

**Balnea**

# Medical Hydrology and Balneology: Environmental Aspects



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**38<sup>th</sup> World Congress of the International  
Society of Medical Hydrology and Climatology  
Lanjarón – Granada 2012  
“Medical Hydrology and Balneology:  
Environmental Aspects”  
June 20<sup>th</sup> to 23<sup>th</sup> 2012**

**Message of the President of the organising committee**

Prof. Francisco Maraver

Dear Colleagues and Friends

On behalf of the Organizing and Scientific Committees, Congress Sponsors and Executive Secretariat, we would like to extend a warm welcome to Spain for our 38th Int'l congress.

For the participants of Spanish medical hydrology and balneology, 2012 is a very special year. We are celebrating the 100th anniversary of the Chair of Medical Hydrology of the School of Medicine at the Complutense University of Madrid, as well as the 135th anniversary of the creation of the Spanish Society of Medical Hydrology.

Just thirty minutes from Granada, with its UNESCO declared World Heritage monuments since 1984 and where part of the social program was developed, is Lanjarón "land of healthy fountains", the venue of the congress. This historic thermal station, one of the most important in Spain, has lent its services since 1765 and is situated in privileged surroundings such as "The Sierra Nevada National Park", declared Biosphere Reserve by UNESCO. It is an example of respect for the environment that makes possible the long-term development of generating wealth.

We are sure your presence and active participation will help to guarantee the success of the endeavour, as this is a unique opportunity to meet and share knowledge with colleagues from all over the world.

Yours very sincerely

**38<sup>th</sup> World Congress of the International  
Society of Medical Hydrology and Climatology  
Lanjarón – Granada 2012  
“Medical Hydrology and Balneology:  
Environmental Aspects”  
June 20<sup>th</sup> to 23<sup>th</sup> 2012**

**Message from ISMH President**  
Prof. Müfit Zeki Karagulle

Dear ISMH Members and Colleagues

I am delighted to announce that 38th World Congress of ISMH, the international scientific meeting of medical hydrology balneology and climatology will be taken place in Lanjaron-Granada Spain, 20-23 June 201. This will be again the only biennial global gathering of the prominent scientists and medical professionals from the medical and related sectors of balneology and representatives of organizations and institutions based on the domains of medical hydrology and climatology. I think you all will agree that being a unique traditional spa town Lanjaron is the perfect choice for ISMH Congress venue and Spain being a traditional scientific balneological country is the right place.

The motto of the congress, «Medical Hydrology and Balneology: Environmental Aspects» reflects the importance of the preservation of the natural balneotherapeutic factors; water, mud and climate in general and the “healing environment” of the traditional spa resorts in particular. Of course the main topics of the congress will cover all aspects of our common field and will be comprehensively presented as the up-to-date lectures by the invited expert speakers. Nevertheless submitted communications from a diversity of research agenda from all over world will be highly appreciated.

As our host Spanish colleagues and Professor Maraver, the president of the congress, I am really excited about our traditional meeting; the 38th one and already looking forward to meeting you all in June 2012 in Lanjaron-Granada.

# Honorary Committee

## Honorary Presidency

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Juan Carlos I

## Honour Members

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**Mrs. Ana Mato Adrover**

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**Mr. Müfit Zeki Karagülle**

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# **PROGRAMME**



**38th ISMH World Congress**  
**Lanjarón – Granada 2012 June 20-23**  
*Medical Hydrology and Balneology: Environmental Aspects*

**PROGRAMME**

**WEDNESDAY JUNE 20**

**OPENING SESSION**

18:30 TO 20:30

**Presidential Addresses**

The ISMH President - Pr Mz. Karagülle  
The ISMH Scientific Committee President – Pr S. Sukenik  
The ISMH General Secretary – Pr CF. Roques  
The Organising Committee President – Pr F. Maraver

**Scientific Session**

**THURSDAY JUNE 21**

**08:00 Registration**

**THE STATE OF ART**

Room 01  
09:00 - 11:00

**CLIMATOTHERAPY - THALASSOYHERAPY - DERMATOLOGY**

Room 02  
09:00 - 11:00

**11:00 - 11:30 Coffee Break**

**HEALTH BENEFIT**

Room 01  
11:30 - 13:30

**CLIMATOTHERAPY - DEAD SEA**

**Room 02  
11:30 - 13:30**

**13:30 - 15:00 Lunch**

**METHODOLOGY OF SCIENTIFIC INVESTIGATION - NEW TRENDS 1**

**Room 01  
15:00 - 16:50**

**NEW TRENDS 2**

**Room 02  
15:00 - 16:50**

**19:00 Visit to the Alhambra - Granada**

**FRIDAY JUNE 22**

**SOCIÉTÉ FRANÇAISE DE MÉDECINE THERMALE**

**Room 01  
09:00 - 11:00**

**DRINKING CURES**

**Room 02  
09:00 - 11:00**

**11:00 - 11:30 Coffee Break**

**MUD THERAPY**

**Room 01  
11:30 - 13:30**

**HEALTH TOURISM SUSTAINABLE - ENVIRONMENTAL ASPECT**

**Room 02  
11:30 - 13:30**

**13:30 - 15:00 Lunch**

**BIOLOGY**

**Room 01  
15:00 - 17:00**

**NEW TRENDS 3**

**Room 02  
15:00 - 17:00**

**POSTER PRESENTATIONS 1**

**Room 03  
15:00 - 17:00**

**17:00 - 17:30 Coffee Break**

**NEW TRENDS 4 - DERMO-COSMETOLOGICAL ISSUES**

**Room 02**

**17:30 - 19:00**

**POSTER PRESENTATIONS 2**

**Room 03**

**17:30 - 19:00**

**21:00 Gala dinner**

**SATURDAY JUNE 23**

**MISCELLANEOUS 1**

**Room 01**

**10:00 - 11:30**

**SOCIEDAD ESPAÑOLA DE HIDROLOGÍA MÉDICA**

**Room 02**

**09:15 - 10:15**

**MISCELLANEOUS - 2**

**Room 02**

**10:15 - 11:30**

**11:30 - 12:00 Coffee Break**

**SOCIAL SESSION**

**Room 01**

**12:00 - 13:00**

ISMH General Assembly

Presentation of the Venue of the next Congress

**GENERAL CONCLUSION**

# **SCIENTIFIC SESSIONS**

# Opening Session - Scientific Session

## Lectures

What's new in Balneology?

*MZ KARAGÜLLE*

Balneology in Europe: results of a new survey

*P CANTISTA*

The Research of Balneology in Hungary

*T BENDER, G BÁLINT, Z PROHÁSZKA, P GÉHER, I TEFNER*

Balneology Research in Germany

*C GUTENBRUNNER*

Balneology Research in Italy: research products and research funding

*M VITALE, M VACCAREZZA*

Balneology Research in France

*CF ROQUES*

# What's new in Balneology?

Karagülle MZ<sup>(1)</sup>

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The new developments and events in Balneology and Medical Hydrology and Climatology since the 37th ISMH Congress we held in Paris in 2010 may be summarized as follows;

**1. Growing number of published studies (in humans and experimental animals) on the mechanisms of action of balneological agents and interventions;** in recent years, there is an increase in the number of published articles of the studies carried out by various disciplines and centers evaluating the mechanisms of action of balneological agents and treatments. Most of these publications are conducted in cell cultures and experimental animals and shed more light on the specific biological effects of various balneological agents (in particular hydrogen sulfide and carbon dioxide).

**2. Recognition of Medical Balneology as a medical specialty in Europe:** Medical Balneology and Hydro-climatology is either a main or a subspecialty in many European countries. However, it was not represented within the European Union of Medical Specialists (UEMS) since very recently. At the Board Meeting of UEMS Section of Physical and Rehabilitation Medicine held in Istanbul in 5 March 2011, UEMS Balneology Permanent Working Group was established in accordance with the decision approved by the board. This group held its first meeting later in September 9th 2011 in Belgrade and has planned a series of activities including to conduct a survey on current status of balneology in European countries, to set-up an Evidence Based Database in balneology to promote scientific balneology in Europe to organize balneological courses in the European countries in frame of UEMS and ISMH to plan balneological studies in Europe and to prepare educational standards and specialist training curricula in Balneology

**3. Increasing international participation at the national balneology congresses and strengthening of the ties between balneological associations of various countries:** In general balneology congresses that are being held at the national level by local balneological associations now having international participants and contributors with more comprehensive programs. Especially balneological associations in Hungary, Poland, France and Turkey were the pioneers of this development. In addition, Italy, Austria, Spain, Serbia, Czech and Tunisia hosted various meetings of balneology which were planned internationally participations

and last two years. This is a growing trend, recent Romanian and Japanese balneology congresses are planned to have guest speakers. Here, ISMH is playing an important role. With its increasing popularity ISMH is building up firm contacts and vivid network among the balneology circumstances and associations such as FEMTEC and ESPA.

**4. Increasing recognition of Balneology and Thermal Medicine within scientific medical community:** Balneology and thermal medicine is gaining more recognition and acceptance in the medical circles of North European and North American countries. The interest in non-pharmacological and complementary and alternative methods in these countries is growing not only in public but in the medical communities as well. Increase in quantity and quality of scientific balneological publications in English and increase in scientific evidence accordingly are the most important driving factors here. Those old fashioned balneological centers in these countries are reopening for use and the forgotten balneological resources are being re-discovered as a result of increased attention and recognition of balneology.

**5. Evaluating the effects of drinking cures (hydropinic treatments) and balneological inhalation and irrigations;** Balneological publications in international scientific journals still mostly focus on the effects of balneotherapy (bathing in thermal mineral water) but in recent years, we are gladly witnessing the appearance of studies evaluating the therapeutic effects of the two other traditional balneological methods; drinking cures and inhalation and irrigations applied in Pulmonology and ENT. We still need more scientific work in this area but reviewing the recent studies carried out in these "neglected" areas is encouraging.

**6. Climatotherapy and Talassotherapy upsurge:** In many countries, besides medical hydrological and balneological interventions, climatotherapeutic and thalassotherapeutic methods are used depending on geographic location and natural features. In particular the Dead Sea, the Mediterranean basin, the Black Sea (Bulgaria, Ukraine, Russia), Ocean coast (France, Brazil) and the North Sea and Baltic coast (Germany, Estonia) have become more prominent in thalassotherapy. In Europe, high and mid mountain climatotherapy (Oroterapi), and in Japan forest climatotherapy (Shinrin Yoku) are used as unique climatic therapy methods and new evidence is supporting their therapeutic value in certain conditions.

# Balneology in Europe: results of a new survey

Cantista P<sup>(1-2)</sup>

<sup>(1)</sup>Invited Professor of the University of Porto - ICBAS School of Medicine, Porto, Portugal

<sup>(2)</sup>President of the Portuguese Society of Medical Hydrology  
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Balneology or Medical Hydrology has been an important modality in the area of Medicine with a wide scope of interventions which include prevention, treatment and rehabilitation of a large number of health conditions.

Nevertheless there are relevant differences from country to country regarding Balneology recognition, clinical practice, reimbursement, education or research.

In the last months of 2007 a survey was conducted by the Balneology Group of the Professional Practice Committee of the UEMS PRM Section concluding by the relevance of this discipline in the majority of the European countries.

Those results encouraged us to keep working for building a subdivision of Balneology as the natural evolution of this Group of the UEMS PRM Section.

With this goal already achieved we decided to update the 2007 data with a new survey, now that five years have passed.

In order to collect this information we designed a new questionnaire that was sent to a delegate in each European country.

In our lecture we present these results, we analyze them and we point the main aspects that may lead to an effective strategy for the desired development of Balneology in Europe.

**Key words:** Balneology, Medical Hydrology, Europe, Survey



# The Research of Balneology in Hungary

Bender T<sup>(1)</sup>, Bálint G<sup>(2)</sup>, Prohászka Z<sup>(3)</sup>, Géher P<sup>(1)</sup>, Tefner I<sup>(4)</sup>

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## Introduction and Objectives

Hungary is rich in mineral water, it has more than 1300 mineral springs (800 are in function). In the past years 30 articles were published in the PUBMED, Scopus or Web of Science about the role of balneotherapy in Hungary.

## Materials and Methods

In our present work we analyzed the data of 18 Hungarian clinical balneotherapy studies. The outcomes parameters were clinical improvements and the change of quality of life.

## Results

According to our present data different mineral waters has beneficial effect on knee osteoarthritis, low back pain and interestingly mineral waters are beneficial on the antioxidant parameters as well.

## Conclusions

Our review proved by EBM dates that balneotherapy has promising effects in these conditions.

**Keywords:** Balneotherapy Hungary review

# Balneology Research in Germany

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**Text not received in time**

# Research in Italy: research products and research funding

Vitale M<sup>(1-3)</sup>, Vaccarezza M<sup>(2)</sup>

<sup>(1)</sup>Dept. of Anatomy, Pharmacology & Forensic Medicine, University of Parma, Italy

<sup>(2)</sup>Dept. of Human, Social and Health Sciences, University of Cassino, Italy

<sup>(3)</sup>FoRST Scientific coordinator, Rome, Italy

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Balneology has a long standing tradition in the Italian territory. This old tradition stems from the natural spring locations and resorts that Italy has since centuries: the entire Italian history witnesses this remarkable journey. To foster a modern basic and clinical research activity in balneology, the Italian Federation since January 2003 has implemented FoRST (Foundation for the Spa Scientific Research) that collects and grants money for scientific and clinical research in balneology. The almost 380 spa centers in Italy allocate a percentage of their income directly to ForST which launches research calls on topics of medical spa therapy. The management of the scientific projects and the consequent money allocation is based on a rigorous international peer-reviewed system, that encompass all the required parameters of integrity and quality at the base of a reliable and solid scientific process. Overall, ForST granted between 2003 and 2011 almost 5 million euro to research activities, with 6 grant calls, 65 research projects implemented, 40 project co-financed. 25 projects have been concluded and publications have been generated in internationally peer-reviewed scientific journals. All the most important fields of interest in spa therapy are involved: Rheumatology, Otorhinolaryngology, Pneumology, Skin diseases, Gastroenterology, Urology, Cardiovascular diseases, Hygiene and Preventive Medicine, Rehabilitation, Health economics. This methodological approach - in common with the main research-granting agencies - is the scaffold for the indispensable spreading of a non-episodic strong scientific research production.

# Balneology Research in France

Roques CF<sup>(1)</sup>

<sup>(1)</sup>AFRETH Scientific Committee President. Paris. France  
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## Introduction and Objectives

In France, several public and or private scientific investigation organisms are involved in medical balneology scientific investigation (academic or university-linked institutes in Paris, Nancy, Bordeaux, Grenoble, Clermont-Ferrand; private organisations in Paris, Aix les Bains, Saujon). However, these last years, the important development in medical balneology investigation could be related to the French Association for Balneotherapy Research (AFRETH). The Afreth has been created in 2004 by the French Union of SPA Contractors, the Union of the mayors of spa resorts and the French branch of the FEMTEC. The AFRETH has agreed to provide every year a budget of 1.2 M€ for scientific investigation in balneology. The founders' representatives, who constitute the association's administrative committee, take the decision of supporting financially the scientifically validated projects. The scientific validity is pronounced by the scientific committee (12 independent and acknowledged doctors and scientists) on the basis of external independent experts' advices (methodological, clinical and biological sciences from French academic institutions).

7 calls for projects have been launched and fully implemented. They concerned mainly the actual medical benefit . A global budget of 7 M€ has been engaged.

## Materials and Methods

101 pre-projects have been sent to the AFRETH.74 were eligible. 41 were validated by the scientific committee (35 concerning medical benefit). 28 received a financial support (25 concerning medical benefit)

## Results

Regarding the medical benefit, 2 RCT have been implemented and published: STOP-TAG (treatment of generalised anxiety, 237 patients); Thermarthrose (knee osteo-arthritis, 462 patients); these two studies have demonstrated significant results in favour of balneotherapy.

Publication is in progress for 2 RCT: Maathermes (overweight and obesity, 257 patients) and Rotatherm (shoulder cuff tendinitis, 186 patients).

Scientific data treatment is in progress for two RCT (breast cancer: Pacthe; chronic venous insufficiency: Therm & Veines).

Are in progress a RCT on COPD (BPCeaux, 337 patients to enrol), a RCT on subacute lumbar pain (ITILO, 700 patients to enrol), a RCT on post-DVT patients' education (stage-post-thrombose, 240 patients to enrol).

Pilot investigations have been implemented or are in progress concerning the metabolic syndrome, Alzheimer's disease, psychotropic drugs withdrawal, therapeutic education of patients with chronic venous insufficiency.

So scientific investigation has to come with usual balneotherapy but also with the development of new trends which have to be scientifically assessed from their initiation.

The AFRETH provided also

- a) an experts agreement on the methodology of thermal scientific investigation (2006)
- b) an unpublished meta-analysis of the existing clinical randomized controlled trials (Pr JP Boissel, cric@t, Laennec School of Medicine, Lyon, France)(2006).

### **Conclusions**

From our experience, we have to emphasize the difficulties related to the patients' enrolment and the need of new methodological designs, alternative to usual RCT to investigate such a complex therapeutic intervention. France has engaged a significant endeavor in the field of balneology investigation, but now a large and international cooperation in balneology investigation would be necessary.

**Keywords:** Balneotherapy, Research, Actual Medical Benefit, Meta-Analysis, Expert Consensus

# The State of art – Session 01

## Lectures

The State of the art, Health Resort Medicine in Japan

*Y OHTSUKA*

State of the art: Spa Resort Medicine in France

*P CARPENTIER*

Health resort therapy (spa therapy) in Israel – State of the art

*S SUKENIK, M HARARI*

State of the art; Medical Balneology in Turkey

*M KARAGÜLLE*

The State of art, Health Resort Medicine in Serbia

*A JOKIĆ*

Current State of Balneotherapy/Thermalisme in Romania: Main actors, reglementation and problems to solve

*O SURDU, V RUSU, V MARIN, TV SURDU, EV IONESCU, D PROFIR, S DEMIRGIAN*

The State of the art, Health Resort Medicine in Spain

*I CORVILLO, A CERRADA, L AGUILERA, A MARTÍN*

The State of the art, Health Resort Medicine in Portugal

*F TEIXEIRA*

# The State of the art, Health Resort Medicine in Japan

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The area of Japan is about 378,000 km<sup>2</sup>, which is smaller than that of Spain and a little larger than that of German. There are 27,671 hot spring resources and 3,185 hot spring regions providing accommodations. Total numbers of the guests who stayed at hot spring regions were about 12,300,000, which is nearly equal to Japanese population (from April 2010 to March 2011), and most of them visited there just for fun but not for medical cure. Two notable features of hot spring waters in Japan are 1) about 50% are over 42 °C and 2) pH ranges from 1.2 to 11.3.

In Japan, health resort medicine dated back to Edo Era (17-18 century) as so-called “Touji (hot-spring cure)” that was occasionally prescribed by some Kampo (traditional Japanese medicine) doctors. Only this custom has continued to the present days and many patients stay at hot spring regions for a couple of weeks without any prescriptions from doctors. This is because application of medical insurance is limited to the remedies based almost on western medicine and no insurance is available for health resort medicine (i.e. balneotherapy). The Japanese Society of Balneology, Climatology and Physical Medicine certifies the doctors as medical specialists who can perform balneotherapy; however, they just give some advice to the patients but not give them any prescriptions with a few exceptions, because both doctors and patients never get any financial benefits. In some hospitals at hot spring regions, hot spring water is used for rehabilitation of orthopedic patients and those after cerebrovascular accidents by such as thermal therapy and/or underwater exercise. In these cases, medical insurance can be applied based on rehabilitation programs and /or physical medicine techniques.

In Japan, there were 6 main national institutions (or hot spring hospitals) affiliated with national universities where many valuable researches were performed. Nowadays, five of them were closed (reorganized) and the last one became limited to the outpatient clinic only. Under this situation, research work trends toward to health promotion activity using health resort medicine including natural resources such as hot springs, forest environments, mountains, oceans and so on.

At present, unfortunately, health resort medicine is not officially recognized by our government and very small number of medical students has a chance to learn health resort medicine. Nevertheless, Japanese people like to visit hot spring re-

gions and enjoy themselves; furthermore, a lot of patients stay there to treat many kinds of diseases on their own responsibilities (Touji).

**Keywords:** Touji, Medical Insurance, Health Promotion



# State of the art: Spa Resort Medicine in France

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Each year, more than 500 000 patients benefit from spa treatment in about 100 resorts in France, mostly for the treatment of rheumatologic, respiratory, vascular, metabolic and dermatological chronic diseases. They are seeing specialized physicians during their stay, and their expenditures are partly covered by the French National Health System.

For the past few years, three main axes are swiftly developing, which will be illustrated during the presentation:

- The evaluation of the efficacy and safety of spa treatment in various indications are under way, thanks to a common effort of all actors in the field under the banner of the Association Française pour la Recherche Thermale, with already produced decisive results in rheumatology, obesity and phlebology.
- The development of therapeutic education of the patient is very vigorous, facilitated the very suitable setting provided by the spa resorts, and the synergistic effect between the physical therapy and therapeutic education, which reinforce each other.
- The spa physicians are renewing their organizations, adding quality practice and education to the scientific purpose of their national society (formerly the Société Française d'Hydrologie, and now the Société Française de Médecine Thermale), reorganizing their specialization teaching under the leadership of a new Collège des Enseignants de Médecine Thermale, and combining their forces in a Collège National Professionnel de Médecine Thermale, as required for every medical specialty in France.

**Keywords:** Balneotherapy, Patient Education, Professional Organization, Health Care Quality

# Health resort therapy (spa therapy) in Israel – State of the art

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Health resort therapy (spa therapy) is not recognized by the scientific council of Israel Medical Association as a specialty or sub- specialty of rheumatology or physical therapy. This kind of therapy is not included in the national basket of medical services and therefore it is not covered by any of the health insurance companies. There are very few health resort areas in Israel and the most famous and investigated one is the Dead Sea area. 85 original clinical trials and many more reviews has been published in the medical literature proving the efficacy of the Dead Sea region on different diseases such as different skin diseases, inflammatory and non-inflammatory rheumatic diseases, chronic obstructive lung diseases, coronary artery diseases, congestive heart failure, uveitis, Crohn's disease and others. The advantages of this site stems primarily its unique geographic location. It is the lowest spot on the face of earth about 420 meters below sea level. The unique climatic conditions derive mainly from its location and include: the highest barometric pressure in the world, leading also to increased oxygen tension, low relative humidity, high temperatures, low rainfall, reduced radiation with an high UVA/UVB ratio, low pollen and high bromide atmosphere. In addition to this unique geographic location, the salinity of the Dead Sea water is about ten times higher than any other sea or ocean and the many mineral springs and black mud are also rich in minerals and trace elements. It is important to stress that health resort medicine can't cure completely any of the above mentioned diseases but can bring to a complete remission lasting from a few weeks to 8 months. Its major advantage over conservative medicine is the absence of serious side effect that are quite common and sometimes even worth than the disease itself.

# State of the art; Medical Balneology in Turkey

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Health resort medicine or spa medicine has a great tradition in Turkey. This tradition is still vivid and mostly accompanied by empiricism and intuitiveness. We have collected data on the characteristics of traditional and modern balneological and spa therapy forms in Turkey that are widely used in the treatment of rheumatic diseases. Spa and balneotherapy forms differ according to the spa centre; they may be either stationary or ambulatory; and mono balneotherapy or complex spa therapy modalities. The main indication for spa therapy and balneotherapy in Turkey is rheumatic diseases. Unlike other European countries, nearly 90% Turkish patients who undergo balneotherapy or spa therapy courses are suffering from rheumatic disorders, mostly degenerative joint diseases, often soft tissue and rarely inflammatory rheumatic diseases.

The recent balneological research in Turkey that is being carried out mainly in two university units; Department of Medical Ecology and Hydroclimatology of Istanbul Medical Faculty of Istanbul University and Atatürk Balneotherapy and Rehabilitation Center of Uludağ University in Bursa. The other two departments of Medical Ecology and Hydroclimatology in Ankara and Tokat and the Departments of Physical Medicine and Rehabilitation in Afyon and Denizli also appeared with their research activities in recent years. While as the education and training centers the Medical Ecology and Hydroclimatology departments are concentrated in the research on a wide range of scientific topics in balneology such as experimental studies, mechanisms of effect studies, effects of different spa packages, effects of bathing and/or drinking cures and specific effects of Sulfur, CO<sub>2</sub> and NaCl (salty and brine) waters, as a University Balneological research center, Atatürk Balneotherapy and Rehabilitation Center of Uludağ University in Bursa is being conducting the relevant randomized controlled trials evaluating the effects of balneotherapy in majority of rheumatic conditions including rheumatoid arthritis and ankylosing spondylitis. It is interesting to note that balneological trials and research have been increasingly published lately in English. This phenomenon not only reflects the willingness of the authors sharing their evidence in international scientific arena with international experts but also helps to improve the quality of research methodology in medical balneology and hydroclimatology in Turkey which is not an internal challenge, rather an international one.

# The State of art, Health Resort Medicine in Serbia

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Serbia has 300 healing water wells, with 1500 l/sec, but only 3-5% exploited.

There are 24 active rehabilitation centers in Serbian health resorts, where balneoclimatological treatment is exercised. Each of those health resorts is known for the treatment of certain conditions. Patients with orthopaedic, neurological, rheumatological, dermatological, cardiovascular, respiratory, gastrointestinal, metabolic problems are mainly treated, as well as children.

Balneoclimatology is studied at Medical School in Belgrade, as one-year subspecialization at the Cathedra for Balneoclimatology. Nevertheless, there is a lack of scientific studies that would confirm or disaffirm experience of physicians in the application of balneotherapy.

Serbia has long balneological tradition, but it needs educated specialists in balneoclimatology who will confirm the healing properties of natural factors with help from ISMH experts, and persuade relevant institutions in the State that balneoclimatology has significant place in the treatment of patients and that it should be applied as much as possible. Primarily because it is the form of natural treatment, without significant side effects.

**Keywords:** Balneology, Spa, Research

# Current State of Balneotherapy/Thermalism in Romania: Main actors, reglementation and problems to solve

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Present paper work presents in a short form the main natural resources and the key actors involved in this field of activity.

Romanian balneal resources consist in:

- climate (relief, hydrology and vegetation), including salt mines and caves microclimate;
- mineral/thermal waters (for bathing and drinking cure);
- mud/peat and gases,

Key actors in the medical field

- 1.The Ministry of Health (MS) and its decentralized services;
- 2.National Health Insurance House (CNAS) and county health houses;
3. College of physicians from Romania (CMR)

Key actors in tourism activity:

- ✓ Ministry of Regional Development and Tourism (MDRT);
- ✓ Organization of Spa Owners in Romania (OPTBR);
- ✓ National Association of Tourism Agencies (ANAT);

Both actors performing in medical balneal tourism need to work together for a common future. In the medical field is needed more elasticity to offer both medical and wellness programs and more cooperation to the master plan made by tourism actors. The tourism actors must be involved into the opening up of balneal/thermal patrimony because research in balneology and balneal medicine means high costs for discovery, characterize and maintaining in exploitation the resource. The economic and political leaders will help this collaboration and cooperation if the actors make themselves heard in this polyphony of balneal medical tourism.

# State of the art, Health Resort Medicine in Spain

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## Introduction

Changes and developments that have occurred during the last twenty years in the field of Crenotherapy have led to an increasing social demand for spa treatments (balneotherapy) leading to an expansion and development of Spanish spas. We decided to study, first hand, the Sanitary and Socio-Sanitary availability with regards to the installations, professionals and indications from a Crenotherapy and Rehabilitation point of view, focusing on disorders of the musculoskeletal system (MSS), respiratory and ENT (RS-ENT). We also wanted to know the therapeutic activity and application of functional rehabilitation programs conducted, in order to know the treatments given as an alternative Sanitary option, less aggressive with the pathology, mainly in chronic, musculoskeletal, respiratory and ENT.

## Objectives

The aim of this study was to determine the materials and professionals available in Spanish Spas, allowing us to select those which can offer functional rehabilitation programs with full guarantee.

## Materials and Methods

The **material** used for this paper was a specific questionnaire developed by our department. To complete the information we consulted the “Vademecum de aguas mineromedicinales españolas” (Handbook of Spanish mineral medicinal waters) and the Web page of fifty-four spas.

The **method** used has been: organization of the information obtained through the questionnaires answered by personal phone calls to ninety-three Medical Directors, and the development of a database using Microsoft Access and the creation of charts and graphs using Microsoft Excel.

## Results

The following data were obtained with regards to MSS and RS-ENT in our research:

- In addition to the crenotherapy facilities, Spanish Spa Facilities have fitness gyms, electrotherapy, paraffin, Kneipp cure, cryotherapy, reflexotherapy or acupuncture included in their installations or programs...
- All Spas have a Medical Director in charge of which 31 of them have more than one doctor.
- We recorded a total of 434 health sciences professionals, of which 163 are doctor, 132 physiotherapists, 96 quiromassagers, 27 physical education technicians and 16 belong to other diplomas, plus peoples bathroom attendants.
- All the establishments surveyed, except one, work with MSS pathology. In 71 establishments AR-ENT pathology was treated.
- The crenotherapy techniques used in MSS are: simple bath, bubble bath, whirlpool bath, circular shower, Scottish shower, underwater jet ... and in RS-ENT: puffs, spray, wash, shower or nasal and/or pharyngeal spray, or tubotimpanic insufflation.
- The results of functional rehabilitation and the fields are shown in Table 1.

**Table 1** - Centers/Functional Rehabilitation

<b>Program</b>	<b>Nº of Centers</b>	<b>Field</b>	<b>Nº of Centers</b>
RFL	28	Sanitary	89
PRFL	21	Social-sanitary	71
RFR	24	Health Tourism	89
PRFR	14		

RFL:Rehabilitation funcional locomotor. RFR: Rehabilitation funcional respiratory. PRFL: Locomotor funcional rehabilitation program. PRFR: respiratory funcional rehabilitation program

## Conclusions

The spa establishments may have crenotherapy facilities and not crenotherapy

All bathing establishments studied, except one, work in the Sanitary field and all, but one, collaborate in Health Tourism Programs

All have at least one doctor.

The most frequently treated MSS pathologies are: chronic inflammatory rheumatism, degenerative processes, para-articular problems, metabolic, psychogenic, and posttraumatic after effects and postoperative neuralgia. And the AR-ENT are rhinitis, laryngitis, sinusitis, tracheitis, rhinosinusitis, bronchitis, pharyngitis, asthma.

In addition to the centers' crenotherapy treatment, one third of them offered additional functional rehabilitation programs in MSS and a quarter of them offered specific programs in RS-ENT.

**Keywords:** Functional reeducation, Crenotherapy, Musculoskeletal system, Respiratory system, ENT, Spa centers

# The State of the art, Health Resort Medicine in Portugal

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Except for the existence of a Thermal Hospital (Caldas da Rainha), created in Portugal in 1498, the traditional spa organization is the existence of a thermal-medical-bathhouse (named “balneário”), often surrounded by a park. And, even though this park or nearby can be one or more hotels included in the same spa complex (ie, the same owner), only one thermal-bathhouse was included in a hotel.

Around the bathhouse (named “balneário”) and their park (when it exists), develops a "spa village" (officially called "estância termal”), with all the support structures: hotels and guest houses, private residences, restaurants and cafes, leisure facilities. The concept of "health resort" is therefore understood in the social group of spa village/”estância termal”, mentioned above, rather than a narrow concept of an individualized "health resort".

However, there are spas where it remained, renewed or created their own space surrounding the resort with leisure park and sporting activities, with hotel, wellness center (these, designated in Portugal by SPA, even if not in the concept of "medical SPA", but only of recreational activities, aesthetics, etc..) - space and set of structures and activities that have been designated as "Health (or Thermal) Resort. "

Keeping, however, this model, the thermal spas in Portugal have undergone profound transformations over the past 20 years: Of the 34 spas in operation in 2011, 17 resorts are totally new; in 12, the spas were substantially restored or increased in size. They all now have one of the most modern technical equipment there.

The most recent legislation on the operation of the spa is included in the Decree-Law No. 142/2004. Three points must be highlight in this legislation: 1 - All spas operate under the medical responsibility of a clinical director, recognized as an hydrologist by the Medical College; 2 - No one is allowed to a thermal treatment without a previous medical appointment and monitoring; 3 - Hydrological research is fostered for the recognition of the vocations of each therapeutic spa, being created for it a "Technical Evaluation Committee."

For a population of just over 10 million inhabitants, the total number of "termalistas" who annually attend the Portuguese spas is close to 100 000 (ie 1% of total population).



## Health Benefit – Session 02

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*M VITALE*

Study of ciliary motility in patients treated with mineral waters from “Las Termas de Copahue”, Neuquén, Argentina

*AM MONASTERIO, E ZINGONI, L MERINO, F MARAVER*

Assessment of Spa therapy in chronic low back pain. Systematic review of randomized clinical trials

*A FRANÇON, R FORESTIER F BERKOZ*

Crenobalneotherapy in the treatment of chronic venous insufficiency. Preliminary results of a randomized clinical trial

*R FORESTIER, G BRIACON, J MOLLARD, A FRANCON*

### Papers

Sulfurous-arsenical-ferruginous thermal water nasal irrigation and wound healing after endoscopic surgery for chronic rhinosinusitis: a prospective, randomized study

*A STAFFIERI, G OTTAVIANO, C STAFFIERI, M LIONELLO, G MARIONI*

Smoking and chronic rhinitis: effects of nasal irrigations with sulfurous-arsenical-ferruginous thermal water. A prospective, randomized, double-blind study

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Improvement of generalized osteoarthritis after (creno)balneotherapy: an open study with evaluation of different outcomes

*F BERKÖZ, R FORESTIER, N ERDOGAN, M KARAGÜLLE*

The effect of spa therapy in chronic low back pain: a randomized- controlled, single blind, follow-up study

*IK TEFNER, A NÉMETH, A LÁSZLÓFI, T KIS, G GYETVAI, T BENDER T*

# Impact of sulphurous water endotympanic insufflation on audiometric parameters in children with otitis media with effusion

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## Introduction and Objectives

The positive effects of spa therapy on ear, nose and throat pathology are known but robust literature in this field, is still lacking. The aim of this study was to assess through a retrospective analysis, the effects on otitis media with effusion of Politzer endotympanic inhalation of sulphurous waters in children aged 5-9 yrs.

## Materials and Methods

A cohort of 95 patients was treated with endotympanic insufflations of sulphurous water: 58 patients did a cycle consisting of a treatment of 12 days per year for three consecutive years; 37 subjects followed the same procedure for 5 years consecutively. The control population was represented by untreated, age-matched children. A standard audiometric test was used before and after each cycle of treatment.

## Results

One cycle of endotympanic insufflation of sulphur-rich water improved the symptoms. Three cycles definitively stabilized the improvement of hearing function.

## Conclusions

Our results show that otitis media with effusion in children can be resolved by an appropriate non-pharmacological treatment of middle ear with sulphur-rich water.

**Keywords:** Middle Ear, Pediatric Audiology, Sulphur Hydrogen, Spa Therapy, Otitis Media

# Study of ciliary motility in patients treated with mineral waters from “Las Termas de Copahue”, Neuquén, Argentina.

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The respiratory system is a group of organs, its main function is to deliver oxygen to the cells and release the carbon dioxide produced by the cell metabolism.

The primary parts of the respiratory system are the nasal cavities where the inspired air is warmed, humidified and filtered from particles coming from the environment before reaching the delicate lung tissues.

The nasal mucociliary clearance system is a nonspecific defence mechanism in which the impurities are trapped by the mucus layer that covers the epithelium and then the ciliary beat is moved to the nasopharynx and destroyed by the digestive system.

The purpose of this investigation is to evaluate the effects of calcium, bicarbonate and sulphurate waters on the cilia of individuals with respiratory pathology who come to Las Termas de Copahue for minero-medicinal healing treatment in comparison with a group of patients who don't follow any thermal treatment and they live in Copahue.

The study took place in the complex of bath therapy of Copahue during the 2010-2011 thermal season and it was authorized by the bioethics commission of the secretary of health of Neuquén, resolution N° 660.

A quasi experimental prospective and longitudinal design was applied to patients, from Villa Copahue who approved the test in written form, over 18 years with a history of high respiratory pathology, pharyngitis, rhinitis, sinusitis, laryngitis and low respiratory pathology like bronchitis or pneumonia diagnosis, they should complete six days of treatments.

A clinic test with self-control was applied as method, with two groups for experimental and control options, one of the groups formed by patients with respiratory pathology and minero-medicinal treatment, and the other group formed by patients without mineral-medicinal treatment. To evaluate the time of nasal mucociliary

transport was applied the saccharin test, an economic, easy to do and non-invasive method.

Using a rhinoscope, a light source and a front mirror, the saccharin test is based on putting the saccharin on the floor of the inferior turbinate, and evaluates the time in which the patient reports having a sweet taste sensation.

The test result is on direct connection to the ciliary movement and the amount of functional specialized cells at the level of the nasal mucosa.

At the same time that the determinations of saccharin were carried out, different issues were studied related to quality of life of patients, with the application test of high-respiratory disease disability, focused on nasal symptoms and their severity.

The results were analyzed by descriptive statistical techniques, showing significant changes in ciliary motility.

**Keywords:** Sulphurate Waters, Ciliary Motility, Termas of Copahue

# Assessment of Spa therapy in chronic low back pain. Systematic review of randomized clinical trials

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## Background

Chronic low back pain (CLBP) is the main disability seen in spa centers in France,. Six randomized clinical trials (RCT) in the ninety's and a meta-analysis in 2006 were in favor of an efficacy of spa therapy in CLBP. Since this publication, five new RCT have been published.

Aim: update of systematic review on efficacy of spa therapy or mineral water in CLBP.

## Method

Bibliographic research of randomized clinical trial (RCT) was realized with the following keywords "low back pain", "balneotherapy", "balneology", "crenoba-neotherapy", "spa therapy", "mud therapy", "mineral water", "clinical trial" . Then we studied the internal and the external validity of the RCT.

## Results

We identified 11 RCT's. None of them carried out a sample size calculation but statistical power of trials seems to be large enough (number of included patients between 50 and 224). Two RCT's didn't perform a between group difference calculation and didn't allow a conclusion about the potential superiority of the treatment group versus the control group. In four of the RCT's in which investigator and patients were not blinded and ITT analysis were not performed, spa therapy was better than a waiting list for improving pain, function, drug consumption and quality of life. In one RCT without blinding of the patient and without ITT analysis, exercises + education + balneotherapy in a spa center improved function and paracetamol consumption more than exercises + education + physical treatment (TENS, US, IR) in a rehabilitation center. In one RCT without blinding of patients, and investigation and with lack of assessment at middle and long-term, physiotherapy (TENS,US,hotpack) + balneotherapy was better than physiotherapy alone in pain, stiffness and function. In three of the RCT's a better improvement was observed in mineral water bathing than in tap water bathing; but in the 1st of these 3 RCT's there was no clear assessment of between-group difference and no ITT

analysis. In the second RCT, 28% of patients didn't complete the study and in the third RCT there is no blinding of patients and 33% didn't complete the study.

**Conclusions**

There is a low to middle evidence that spa therapy and/or mineral water improve patients with CLBP at middle or long-term. New RCT's are needed, which should be built according to the current methodological requirements.

**Keywords:** Chronic Low Back Pain, Spa Therapy, Systematic Review, Randomized Clinical Trial

# **Crenobalneotherapy in the treatment of chronic venous insufficiency. Preliminary results of a randomized clinical trial**

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## **Introduction and Objectives**

This study evaluates the effect of spa therapy on quality of life for patients with chronic venous insufficiency.

Trial design.

Randomized clinical trial comparing spa therapy + usual care versus waiting list + usual care.

## **Materials and Methods**

Participants

Participants Patients between 18 - 80, with chronic venous insufficiency stage 3 or 4 in the Clinical Etiology Anatomic Pathophysiology (CEAP) classification. Patients were recruited by press announcement.

Intervention

Spa therapy group received 18 days of treatment in Aix-Les-Bains spa center and continued their usual care. Control group continued their usual care during the therapy and received spa treatment after the end of the study. Spa treatment was Kneipp therapy, walking 10' in a special pool at 28°C with underwater jets, massage & bath in tub at 30°C.

Objective

The spa treatment + usual care is superior to usual care alone.

Outcome

Main judgment criteria is the number of patient with 20% improvement of the Chronic Venous Insufficiency Questionnaire (CIVIC2) at 3 months.

Secondary outcomes are: quality of life CIVIC2, improvement in Rutherford score, associated treatment, patients acceptable symptom state (PASS), opinion of patient and practitioner (senior specialist of chronic venous insufficiency), side effects.

Randomisation

By blocks of random size (6, 8 or 10 patients). Allocation concealment was performed.

**Blinding**

None of the participants were blinded to the intervention

**Results**

**Numbers randomized**

91 patients were randomized.

**Recruitment**

Recruitment is still continuing in order to reach 174 patients (87 in each group)

**Numbers analyzed**

69 patients will be analyzed in this preliminary report.

**Outcomes**

There were no significant differences between groups at inclusion.

Main criteria: at third month, while 24 patients improved and 13 patients did not improve in spa treatment group; 14 improved and 18 did not in the control group ( $p=0,06$ ).

It was observed that the improvement in Quality of life (CIVIC2) was more in favor of spa group at first month (43 vs 53,  $p=0.02$ ) and third month follow-up (41 vs 51;  $p=0.004$ ).

There is also a better improvement in the spa group for patient's opinion but not in patient's acceptable symptom state and Rutherford classification

**Harms**

There were no serious side effects.

**Conclusions**

Spa therapy seems to improve quality of life in patients with chronic venous insufficiency but statistical power is not sufficient to detect a clinically relevant improvement.

**Funding**

Aix-Les-Bains spa center.

**Keywords:** Spa Therapy, Chronic Venous Insufficiency, Quality Of Life



# **Sulfurous-arsenical-ferruginous thermal water nasal irrigation and wound healing after endoscopic surgery for chronic rhinosinusitis: a prospective, randomized study**

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## **Introduction and Objectives**

Although several publications reported the benefits of nasal irrigation in the management of chronic rhinosinusitis and in sinonasal postoperative care, the available investigations are often small and poorly controlled, and unsupported conclusions are sometimes drawn. The aim of this prospective randomized study was to compare the effects of sulfurous-arsenical-ferruginous thermal water from Levico Spa (Levico Terme, Trento, Italy) nasal irrigation vs isotonic sodium chloride solution nasal irrigation after functional endoscopic sinus surgery (FESS) for chronic sinonasal disease. The histological characteristics of wound healing and the roles played by inflammatory cells in mucosal repair after sinus surgery were investigated.

## **Materials and Methods**

Eighty patients who consecutively underwent FESS were randomly assigned (1:1) to postoperative nasal irrigation with sulfurous-arsenical-ferruginous thermal water or isotonic sodium chloride solution for 6 months. Intraoperative and postoperative (1, 3, and 6 months) mean counts of lymphocytes, neutrophils, eosinophils, plasma cells, histiocytes, and mast cells in ethmoid biopsies were blindly determined by a pathologist.

## **Results**

A statistically significant reduction of eosinophil count was disclosed 6 months postoperatively only after sulfurous-arsenical-ferruginous solution nasal irrigation ( $P = .04$ ). After isotonic sodium chloride solution nasal irrigation, the mean eosinophil count in 6-month postoperative biopsies did not decrease. After both irrigation modalities, the mean mast cell counts in 6-month postoperative biopsies were significantly lower than in intraoperative biopsies ( $P < .05$ ). Neutrophils, lymphocytes, histiocytes, and plasma cell counts were not significantly different between intraoperative vs 6-month postoperative biopsies independently from irrigation modality.

## **Conclusions**

Locally reducing the eosinophil number, sulfurous-arsenical-ferruginous solution nasal irrigation may limit eosinophil-mediated production of cytokines and inflammatory molecules, which damage nasal mucosa, leading to edema and sinonasal inflammation. Considering that eosinophils play a particularly important role in allergic response through the release of mediators as eosinophilic cationic protein, major basic protein, and leukotriene C4, which cause extracellular matrix deposition, epithelial denudation, and basement membrane disruption, sulfurous-arsenical-ferruginous solution nasal irrigation significantly reducing the local eosinophil count should be suggested in particular for allergic patients after FESS for chronic rhinosinusitis.

**Keywords:** Chronic Rhinosinusitis, Functional Endoscopic Sinus Surgery, Nasal Irrigation, Sulfurous-Arsenical-Ferruginous Thermal Water, Wound Healing

# Smoking and chronic rhinitis: effects of nasal irrigations with sulfurous-arsenical-ferruginous thermal water. A prospective, randomized, double-blind study

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## Introduction and Objectives

Smoking is a self-destructive behavior<sup>1</sup> that is known to induce remodeling of the lower airways, leading to squamous metaplasia, but little is known about its effects on the nose and paranasal sinuses<sup>2</sup>. Smoking is a strong independent risk factor of olfactory impairment<sup>3</sup> probably as consequence of anatomical changes that occur in the olfactory mucosa, such as squamous metaplasia<sup>4</sup> and a reduction in the number and size of the olfactory vessels and cilia<sup>5</sup>. Nasal irrigations are often mentioned as measures for treating sinonasal inflammations. Unfortunately, studies conducted on the benefits of nasal irrigations have often been small and poorly controlled, and their conclusions have not always been evidence-based<sup>6</sup>. The purpose of our study was to compare the effects of nasal irrigations with sulfurous-arsenical-ferruginous thermal water or isotonic sodium chloride solution in smokers with non-allergic chronic rhinosinusitis, based on clinical and olfactory evidences.

## Materials and Methods

The present was a prospective, randomized, double-blind study performed in a tertiary academic referral center. Seventy smokers with non-allergic chronic rhinitis were enrolled. Nasal endoscopy, rhinomanometry, nasal cytology and odor threshold measurements were performed in subjects randomized to daily nasal irrigations with either thermal water or isotonic sodium chloride solution for 1 month.

## Results

Immediately after the treatment, the thermal water irrigations revealed a positive pharmacological action, judging from a tendency towards lower nasal resistances ( $p=0.07$ ), and larger numbers of ciliated cells in the patients treated ( $p=0.003$ ). Endoscopic findings in the thermal water group were still better than in the control group a further two months later ( $p=0.03$ ).

## Conclusions

Our results indicate that nasal irrigations with thermal water had a good effect on endoscopic objective signs, nasal resistances and epithelial trophism.

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**Keywords:** Chronic Rhinitis in Smokers; Thermal Water Nasal Washing; Rhinomanometry; Nasal Cytology; Olfactory Threshold

# Rheumatoid arthritis and crenotherapy – preliminary results

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## Introduction

Rheumatoid arthritis (RA) is a chronic systemic autoimmune disease characterized by persistent inflammation of synovial joints with pain, often leading to joint destruction and disability.

Balneotherapy is used a very long time ago and is recognized as an important tool for treatment of rheumatologic diseases.

Among the Portuguese sulphur mineral waters, the hydromineral occurrence of Caldas de São Jorge is a chloride-rich water with sodium prevailing in the cation composition. In spite of its major chemistry, therapeutic benefits of this water are probably related to the presence of reduced chemical species, such as HS<sup>-</sup> and H<sub>2</sub>S, the former being dominating in the pH conditions. In the emergence, the water shows the following main characteristics: electrical conductivity = 934 microS/cm, temperature = 23,5 °C, pH = 8,6 and Eh = -300 mV. Negative value of redox potential determines, in equilibrium conditions, the coexistence of both reduced and oxidized species, favouring the reduced ones in some redox species, such as sulphur and selenium, whose hydrogeochemistry is quite similar.

## Objective

The aim of the actual study is to evaluate the effects of sulphur water in rheumatoid arthritis patients in complement of their pharmacological treatment.

## Materials and Methods

This prospective randomized controlled study included 43 patients (20 were eliminated for different reasons, namely during a formation and some losers during the study). All of them are from the Center Hospital of Porto- Santo António Hospital. After randomization, 19 participated in thermal group and 24 only in control group. The selection obey to specific inclusion and exclusion criteria, and after ethics committee approbation and informed consent of patients.

Their evaluation was made at day 0 (D0) first day of thermal treatment, day 21 (D21) last day of thermal treatment and after 3 months (M3), according to number of pain and swollen joints (CDAI), DAS 28, morning stiffness, analyses, echogra-

phy (same joints in the same patient and along the time by the same echographer), visual analogue scale (VAS) for pain, fatigue, quality of life (QoL), appreciation of medical doctor, and finally the health assessment questionnaire (HAQ), always at the same periods of the follow-up (D0, D21 and M3) and simultaneously for the two groups. The thermal group had a special mini-bus to go and return from spa thermal (S. Jorge Spa) about twenty minutes from Porto. Those who work continue their journey in labor activity. Every day, a medical hydrologist was present in thermal treatments. These treatments were always the same: different types of baths predefined.

### **Results**

Of the preliminary results we found a better statistically difference between groups, at D0 and M3, in delta CDAI ( $p < 0,0001$ ), delta EVA QoL ( $p < 0,014$ ) and delta HAQ ( $p < 0,012$ ) among all the variables studied.

### **Conclusions**

In a population whose pain (body and psychological) predominate, every complementary gain is beneficial, simultaneously contributing to reduce costs, namely corticotherapy and AINE.

**Keywords:** Spa Therapy; Rheumatoid Arthritis; Drug Versus Non-Drug Treatments; Physiological Effects of Sulphur Water; Quality of Life

# Improvement of generalized osteoarthritis after (creno)balneotherapy: an open study with evaluation of different outcomes

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## Materials and Methods

Trial design : open prospective study

Participants: patients diagnosed as generalized osteoarthritis according to Kellgren, American College of Rheumatology and/or Dougados criteria, attending a spa treatment in Aix Les Bains.

Interventions: 18 days of treatment in 3 weeks (6 days/week). 6 different treatment modalities in 2 days; combining 15' mineral mud pack application (45°C), 3 or 7' showers of 38°C mineral water, 10' underwater massage (38°C), 10' swimming pool underwater hydromassages, 10' mineral cloud (37-45°C Berthollet's technique), 25' supervised pool exercises in 35°C mineral water, 20' bath tub with hydrojets (38°C).

Objective: evaluate the change in clinical outcomes of patient with generalized osteoarthritis after a spa treatment.

Outcomes:

Primary outcomes : improvement at least 50% of patient at the end of therapy (patient's opinion on 5 points Likert's scale).

Secondary outcomes: patient's acceptable symptom state (PASS), MHAQ, RAPID3, WOMAC, OSWESTRY DISABILITY INDEX, EuroQol 5D descriptive system, EuroQol Visual Analog Scale, change in drug consumption.

Sensitivity to change was measured by Standardized response mean.

There was no control group. The therapists were blinded.

## Results

245 patients were screened. 99 had generalized osteoarthritis and were analyzed for the primary outcome,

Outcome 61% of patients were improved at the end of therapy, 68% at 8th month.

At the end of therapy there was significant improvement in all outcome measures ( $p < 0.05$ ). At 8th month a significant improvement continued for OSWESTRY,

WOMAC pain, and WOMAC stiffness subscales. PASS was 33% at the end of the treatment and 75% at 8th month.

For drug consumption: at the end of the treatment, 39% of patient said they were not taking any drugs before and after the treatment, 11% said they were using more, 30% said it was unchanged, 20% said it decreased.

Standardized response mean was higher and similar for WOMAC TOTAL (0.57), OSWESTRY (0.57) and RAPID3 (0.53). It was lower for EQ5D (0.28), EQ VAS (0.26), MHAQ (0.24).

Harms There was no serious side effect. We observed some minor side effects: 5 patients had asthenia, 5 had increase in low back pain, 5 had cutaneous reaction (2 erythema), 1 had hypotension.

### **Conclusions**

We observed a significant improvement versus baseline, in clinical status of patients with generalized osteoarthritis, after a spa treatment. WOMAC TOTAL, OSWESTRY and RAPID3 were the most sensitive outcome measures in generalized osteoarthritis.

### **Funding**

None

**Keywords:** Generalized Osteoarthritis, Balneotherapy, Crenobalneotherapy



# The effect of spa therapy in chronic low back pain: a randomized- controlled, single blind, follow-up study

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## Introduction and Objectives

Effect of thermal water with high mineral content on clinical parameters and quality of life of patients with chronic low back pain was studied.

## Materials and Methods

In this randomized-controlled, single blind, follow-up study, 60 patients with chronic low back pain were randomized into two groups. The treatment group received balneotherapy with thermal mineral water, the control group bathed in tap water. Changes of the followings were evaluated: visual analogue scale (VAS) for pain, range of motion for the lumbar spine, Oswestry index, EuroQol-5D and Short Form-36 questionnaires.

## Results

In the treatment group the mobility of the lumbar spine, the Oswestry index, the VAS scores and the EuroQoL-5D index improved significantly. SF-36 items improved significantly in the treated group compared with baseline except for two parameters.

## Conclusions

Our study demonstrated the beneficial effect of balneotherapy with thermal mineral versus tap water on clinical parameters, along with improvements in quality of life.

**Keywords:** Balneotherapy, Low Back Pain, Spa Therapy, High Mineral Content Water, Mátraderecske

# Methodology of Scientific Investigation - New Trends 1 – Session 03

## Lectures

Methodological comments on balneotherapy actual medical benefit assessment  
*CF ROQUES*

How to build a clinical trial?  
*R FORESTIER, A FRANCON, FB BERKŐZ*

Making an Impact on World Health: Focusing Aquatic Research Toward the Big Issues  
*B BECKER*

Evidence of hypocholesterolemic effect of calcic magnesian sulphated bicarbonated mineral water (Bonneval) in cholesterol-rich diet fed rat  
*J CAMBAR, J VINDIGNI, K DUBOURG*

## Papers

Combining balneotherapy and education for the prevention of the post-thrombotic syndrome  
*P CARPENTIER, B SATGER, MT BARRELLIER, C MENEZ, JM KUBINA, B SANDRIN-BERTHON*

Evaluation of the clinical efficiency of the thermal mineral water of Harkány on patients with primary knee osteoarthritis  
*N NUSSER, K HORVÁTH*

Effectiveness of the treatments with natural mineral water in low back pain for spondylarthrosis  
*M FERREIRA, A SILVA, A ALMEIDA*

Building a preventive medicine model based on a thermal approach for certain environment-sensitive diseases  
*M GESTRO, V CONDEMI, U SOLIMENE, R MECO*

# Methodological comments on balneotherapy actual medical benefit assessment

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## Introduction and Objectives

Balneotherapy is a complex, non-pharmacological intervention, whose actual medical benefit has to be established by the Evidence Based Medicine's processes. EBM needs conclusive clinical trials: well designed clinical trials statistically significant for the main endpoint.

## Materials and Methods

A "clinical trial" must have a clinical main endpoint (= directly perceptible by the patient). The number of patients to enroll (usually a difficult issue) has to be previously calculated according to the main endpoint modification score. An Intention To Treat statistical analysis will be performed using appropriate statistical tests. The criteria of importance are crucial to establish the relevance of the main endpoint modifications. Criteria of importance as Minimum Clinically Important Improvement, Minimum Detectable Change, Responder (or non responder) scores, Patient Acceptable State, critical values etc. have to be used whenever existing.

## Results

Randomisation, well appropriated for drugs assessment, can be a controversial issue for complex interventions assessment. Peculiar randomisation designs can be useful (Zelen, cluster randomisation, ...), preference trials but also alternative designs to randomization have to be discussed such as observational studies of cohorts matched using propensity scores. Blind assessment of the patients is also an important issue. The duration of the follow-up must be appropriate to the condition treated but also acceptable for the patient. The different interventions (treatment tested and control treatment) have to be defined and standardised. The patients' follow-up needs to give information about lost patients, changes of study arm, patients' withdrawals, ... . The adverse events have to be reported and described in the paper. Whenever possible and necessary, the trial would be a multicentre one, testing the different waters used for the investigated condition. A preliminary feasibility study can be useful to approach the effect size of the treatment ; its usefulness to predict capacity to enroll the patients is more controversial.

## Conclusions

The conformity to ethical national regulations has to be validated by an ethic committee; the trial will be registered before the beginning of the patients' inclu-

sion. In all situations, a clinical scientific committee, an experienced methodological support and operative structure are needed. Good legal conventions between the different partners have to be issued before the beginning of the investigation; the journals aimed, the names and ranks of the different co-authors have to be previously established.

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**Keywords:** Actual Medical Benefit, Clinical Trial, Randomisation, Judgement Criteria

# How to build a clinical trial?

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## Introduction and Objectives

Practical building of a clinical trial.

## Materials and Methods

Financial support

The first step is to find a financial support. You need to calculate the cost of trial which directly depends on the number of included patients (it will be described below).

Writing the protocol

Introduction

Background of the article should be written at this moment. The author must have detailed knowledge about the subject which will be provided by an extensive bibliography search.

Eligibility criteria

They are, if possible, validated classification criteria obtained from the literature. The author should think about all possible restrictions that could introduce a bias during collection of the data.

Intervention

Interventions should be standardized and precisely described in the protocol. It is better to meet the therapists to learn exactly how the treatment will be applied.

Outcomes

Choice of the primary outcome. The researcher must analyze the literature to know what the recommended outcomes for the pathology are. If it is not available or relevant, it is better to choose a qualitative outcome.

Sample size

Sample size calculation is very important to minimize the risk of negative result by lack of statistical power. The financial cost of the study is proportional to sample size. The author must estimate or evaluate the proportion of improved patient in the treatment and the control group and apply the Casagrande & Pike formula. An example of research financial calculation will be given.

Randomization

Sequence generation must be really random. We will give some example of real random and not real random procedures. We will give some method to implement the allocation concealment.

### Blinding

The method of blinding for all participants (patients, therapist, investigator, statistician) must be planned and managed all along the trial. For non drug trial, it is important to find a control treatment which is similar to the active treatment (in order to equalize the placebo effect).

### Statistical analysis

Must be planned precisely in the protocol and shouldn't be modified after registration. Between group comparison of the main criteria is the only important result of the trial.

### Registration of the protocol and legal dispositions

Protocol must be registered on [www.clinicaltrial.gov](http://www.clinicaltrial.gov) before starting the recruitment.

It must be accepted by an ethic committee. In some countries, it must also be declared to the health authorities and national committee of computerized databases.

### Results

Health authorities and national committee of computerized databases.

### Management of the trial

An appropriate management needs monitoring and secretariat to collect the data, to call patients and investigators when necessary. The finality of management is to limit the loss of data.

### Recruitment

Recruitment methods are one of the main keys of the success of a trial. Most of the trials are unsuccessful due to a lack of recruitment which leads to lack of statistical power.

### Data management

The data management of the trial must be realized precisely all along the trial.

### Implementation of the intervention:

It is important to control if the active treatment and the comparator are delivered as planned in the protocol.

### Conclusions

#### Writing the article

Must follow the consort statement as close as possible.

**Keywords:** Protocole, Methodology, Clinical Trial

# Making an Impact on World Health: Focusing Aquatic Research Toward the Big Issues

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## Introduction and Objectives

Aquatic immersion and activity has tremendous potential to make a positive impact on the health status of the world, yet remains underutilized and insufficiently researched. Given the current limited state of international research funding, it is essential to focus upon those areas that may have the greatest public health benefit for aquatic immersion and activity. This discussion will explore those areas having the most important research potential for public health benefits, in hopes of facilitating a coordinated approach to improving awareness and utilization of aquatics.

## Materials and Methods

In the talk, I will review the current aquatic research literature, which reveals support for major health benefits for cardiovascular health, osteoarthritis, and chronic pain syndromes. In addition, there is some basic science support for aquatic benefits in the following:

- a. Cardiac Function
  - i. Cardiac Rehabilitation including Post-Myocardial Infarction and Congestive Heart Failure management
  - ii. Vascular elasticity, vascular responsiveness
- b. Metabolic Syndrome and Diabetes
  - i. Blood glucose and insulin management
  - ii. Cytokine effects on inflammation
- iii. Cardiorespiratory function during training
- iv. Autonomic function during immersion
- v. Weight loss / lean muscle mass gain
- c. Affective Disorders
  - i. Depression and anxiety disorders
  - ii. Post-traumatic stress disorder
  - iii. Attention Deficit Disorder
- d. Respiratory Disease
  - i. Asthma management
  - ii. Chronic Obstructive Pulmonary Disease rehabilitation
  - iii. Neurologic disorders (spinal cord injury, dystrophies)
  - iv. Athletic cross-training

- e. Arthritis, Fibromyalgia and Bone Healing
  - i. Osteoarthritis and abnormal joint function
  - ii. Fibromyalgia symptoms and function
  - iii. Juvenile Rheumatoid Arthritis and acute arthritis management
  - iv. Stress fracture management

### **Results**

Specific research approaches to these areas will be outlined to facilitate the most efficient use of limited research funding achieving the maximum impact upon human health through aquatics.

### **Conclusions**

Given the probable long-term international limitations of research funding, it is critical to focus available funding toward those areas with the greatest potential for health benefit impact. This talk will hopefully facilitate discussion of the best ways to coordinate international research efforts.

**Keywords:** Aquatics, Aquatic Therapy, Balneology, Medical Hydrology, Health Benefit Research, Aquatic Immersion, Human Health



# Evidence of hypocholesterolemic effect of calcic magnesian sulphated bicarbonate mineral water (Bonneval) in cholesterol-rich diet fed rat

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## Introduction and Objectives

The purpose of this study was to evaluate the ability of a calcic magnesian sulphated mineral water (CMSMW) issued from Bonneval Edelweiss spring to reduce plasma triglycerides and cholesterol in rats fed a cholesterol-rich diet.

## Materials and Methods

40 male Wistar rats are distributed in 4 lots of 10 each: lot 1 (1% cholesterol-rich diet with tap water drinking), lot 2 (1% cholesterol-rich diet with Bonneval water drinking), lot 3 (2% cholesterol-rich diet with tap water drinking) and lot 4 (2% cholesterol-rich diet with Bonneval water drinking). Rats were fed with two cholesterol diets UAR- 214B (1 and 2% cholesterol). Plasma samples were assessed at J0 and every week (D7, D14 and D21) for triglycerides, total cholesterol, HDL and VLDL cholesterol determination. Weight estimation was realized every week. At D21, animals were sacrificed and total liver weight estimated.

## Results

Cholesterol-rich diet shows well a dramatic increase in plasma cholesterol in all lots with a large difference between 1 and 2% cholesterol rich diets. For example, for lot 1 (1% diet), at D0: 0,96 g/l and at D21: 2,99; for lot 3 (2% diet), at D0: 0,97 g/l and at D21: and 4,70 g/l. No significant differences in total animal weight changes can be noted between lots 1 and 2 and between lots 3 and 4 during the experiment and at D21. Macroscopic aspect and total weight are similar in all 4 lots. Significant results of Bonneval water efficacy can be observed only in lot 2 (vs lot 1) with a 1% cholesterol diet. The liver induced damages and plasma lipids level are too severe in lot 3 and 4 with 2% cholesterol rich diet. After 7 days of treatment with Bonneval water, a highly significant decrease in plasma triglycerides (2.19 g/l vs. 1.53 g/l,  $p < 0.001$ ) and VLDL cholesterol (0.44 g/l vs. 0.31 g/l,  $p < 0.001$ ) was observed for lots 1 and 2 respectively.

## Conclusions

These results are in accordance with previous studies focused on plasma cholesterol and lipoproteins changes induced by Bonneval water in cholesterol fed rats.

Likewise, a recent paper demonstrated significant corrections in cholesterol diet induced total and erythrocyte plasma membrane cholesterol perturbations in rats drinking a similar CMSMW. Treatment with Bonneval-Edelweiss spring MW demonstrates a large decrease in rat plasma triglycerides and VLDL cholesterol. Bonneval spring could act thanks to its high calcium content, calcium supplementation leading to a significant decrease in plasma LDL in rats and to increased bile acids excretion in humans. Moreover, magnesium would have a synergistic cholagogue effect. Further investigations will be necessary to confirm these hypotheses. Clinical studies are in progress to confirm in humans these experimental results.

**Keywords:** Natural Mineral Water, Calcium, Magnesium, Sulphate, Plasma Triglycerides, Plasma Cholesterol

# Combining balneotherapy and education for the prevention of the post-thrombotic syndrome

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## Introduction and Objectives

**Background.** The post-thrombotic syndrome accounts for approximately one half of advanced chronic insufficiency, and its incidence is related to the severity of the thrombotic event and the quality of the treatment in the acute phase, but also influenced by the behaviors and lifestyle of the patient (physical activity, weight control and compliance to elastic stockings...). The aim of therapeutic education is to help the patient to achieve the required changes in lifestyle and health related behaviors by improving his knowledge, skills and motivation, which seems appropriate in patients with high risk of post-thrombotic syndrome. We developed and performed a preliminary evaluation of a structured therapeutic education program combined with specific balneotherapeutic sessions dedicated to the patients with a recent episode of proximal deep vein thrombosis.

## Materials and Methods

**Methods.** The education program is organized as a six days training course for small groups of 6 to 10 patients who benefit from, one individual educative consultation, four group education workshops and six sessions of active balneotherapy, also aiming at educational objectives. As a preliminary experiment, three such courses were carried out in three different spa resorts specifically dedicated to the care of patients with venous diseases (La Léchère, Rochefort et Bagnoles de l'Orne). Main inclusion criteria were a recent (<2 years) proximal DVT of the lower limbs remaining symptomatic but with no skin changes (CEAP C Classes: C0s-C3), availability for the course and written consent. An evaluation of CIVIQ2 vein specific quality of life scale (autoevaluation), Euroqol 5D generic quality of life tool, Venous Clinical Severity Score and Villalta score was performed by an independent observer at inclusion before the course, and after 2 and 6 months of follow-up.

## **Results**

Results. Twelve women and nine men (median age 58 years; 20-89) were enrolled. No dropout was observed during follow-up. All participant declared a high level of satisfaction level, and achieved at least one behavioral change objective at two months. Two and six months follow-up showed a significant improvement of the CIVIQ2 and Euroqol 5D quality of life scales ( $P<0.01$ ), the VCSS ( $P<0.05$ ) and the Villalta score ( $P<0.01$ ).

## **Conclusions**

Conclusion. This promising results have to be confirmed in a larger scale randomized controlled study with longer follow-up, which has just started.

*Work supported by a grant of the Association Française pour la Recherche Thermale (#2009-02)*

**Keywords:** Balneotherapy; Patient Education; Post-Thrombotic Syndrome

# Evaluation of the clinical efficiency of the thermal mineral water of Harkány on patients with primary knee osteoarthritis

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## Introduction and Objectives

The aim of this study was to evaluate the efficacy of the thermal mineral water of Harkány, Hungary, in the treatment of patients with primary knee osteoarthritis. The study also aimed to compare the effectiveness of the thermal mineral water of Harkány with the heated tap water.

## Materials and Methods

This randomized, double-blind, controlled, follow-up study examined 53 patients, diagnosed according to the American College of Rheumatology (ACR) criteria for knee osteoarthritis. The patients were randomly divided into two groups. All patients of both groups received TENS (Transcutaneous Electrical Nerve Stimulation) therapy on their knees for 3 days a week and standard physiotherapy for 3 days a week. Beside these therapies the treatment group (group I, n= 33) received thermal mineral water therapy of Harkány, while the control group (group II, n= 20) received heated tap water therapy in form of tub bathing, for 20 minutes a day, 5 days a week, for a period of 3 consecutive weeks. The water temperature was 36°C in both groups. The outcome measures were visual analogue scale scores (VAS), Western Ontario and McMaster Universities Arthritis Index (WOMAC) and Nottingham Health Profile (NHP). The study parameters were administered at baseline, immediately after the treatment and after a 12-week follow-up period.

## Results

We observed statistically significant improvement in the parameters of the thermal mineral water treated group at the end of the treatment as well as at the 12-week follow-up assessment. No significant alterations in the evaluation indices were found in the control group.

## Conclusions

The results of our study confirm that spa therapy has positive effects on patients with knee osteoarthritis, further that thermal mineral water is more effective than heated tap water in the treatment of knee osteoarthritis, including positive effects on the patients' quality of life, pain and functional capacities.

**Keywords:** Knee Osteoarthritis, Balneotherapy, Quality Of Life

# Effectiveness the treatments with natural mineral water in low back pain for spondylarthrosis

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## Introduction and Objectives

Objective: Determine whether treatments with Unhais da Serra natural mineral water, a Portuguese spa, are effective in low back pain for spondylarthrosis.

## Materials and Methods

Methodology: A descriptive, longitudinal, observational, uncontrolled prospective study was conducted. The 51 study participants underwent 14 days of treatment with Unhais da Serra natural mineral water. Assessment criteria were: pain intensity (Visual Analogue Scale), quality of life (SF36v2), disability (ODIv2), absenteeism, acute outbreak/relapse, drug consumption. The evaluation was conducted in four distinct stages: the first day before, 14 days, 3 and 6 months after the thermal treatment.

## Results

Results: The mean age of the sample was 60.53 years, 60.8% were female. The duration of illness was, on average, 7.35 years, 50.9% were retired and 90.2% were from a countryside district. There was a statistically significant improvement ( $p < 0.05$ ) in pain intensity, quality of life, disability, absenteeism and drug consumption, 14 days, 3 and 6 months after thermal treatment compared to baseline. There was no effect on the number of acute outbreak/relapse. Regarding socio-demographic and clinical data, we get no consistent results, only low correlations and some differences in just a few moments of assessment.

## Conclusions

Conclusion: This research showed that 14 days of treatment with natural mineral water of Unhais da Serra spa, reduced pain, disability and drug consumption, improved quality of life, not influencing the number of outbreaks acute/relapse presented by the participants. All the beneficial effects were observed in the short and medium term (six months). No consistent conclusion could be drawn to the possible influence of socio-demographic and clinical variables. Thus, treatment with Unhais da Serra spa shows up as an effective complementary treatment modality in selected patients with lumbar spondylarthrosis. It seems to be justified and useful to famil-

iarize patients and their physicians with this modality of treatment because the socio-economic impact of the pathology.

**Keywords:** Natural Mineral Water, Lumbar Spondylarthrosis, Visual Analogue Scale, SF36, Oswestry Disability Index

# Building a preventive medicine model based on a thermal approach for certain environment-sensitive diseases

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## Introduction and Objectives

The study is aimed at evaluating and confirming exposure to environmental pollutants and weather or climate changes as important risk factors for the breakthrough of certain chronic respiratory, otolaryngological, and urological diseases.

The study is aimed at identifying the risk factors for diseases and the protective factors, while suggesting a preventive medicine model based on a thermal approach.

## Materials and Methods

The work was focused on the ER (Emergency Room) Data Bases of Cuneo, and extended for comparison to the health data contained in the data bases of Milan, Valtellina, and Bergamo, built according to the ICD-9 codification. Case selection was performed according to the diagnosis or set of diagnoses included in the nosological entity under study (Diagnosis1 and Diagnosis2) and based on specific inclusion and exclusion criteria. The selected field of investigation included chronic diseases (chronic bronchitis, chronic otitis, urolithiasis) on which medical hydrology can act as a medium-long term prevention strategy by hampering the onset of breakthroughs and, thus, disease progression. As to chronic otitis and urolithiasis, acute symptoms (reno-urethral colics, acute otitis) were taken as an indirect reflection and a sign of the development and onset of breakthrough as related to weather and climate changes. Weather data was taken from the online Meteorological Data Base of ARPA Piedmont. Data was also requested on the following pollutants: PM10, NO<sub>2</sub> and O<sub>3</sub> in the years 2006-2009 with hourly values for O<sub>3</sub> and NO<sub>2</sub> and average daily values for PM10.

## Results

The analysis of Emergency Room data allowed to infer indirectly (secondary diagnoses) historical data of a past chronic disease underlying the breakthrough and often only in case of clinically significant diseases, except COPD, recorded in the ICD-9 classification with a specific diagnosis (49121), which provides for breakthrough within an ascertained chronic picture, whereas data for breakthrough



chronic bronchitis turned out consistent. The application of the Pearson analysis for otolaryngic diseases has showed a strong negative association ( $r=-0,81$ ) between number of admissions (x) and minimum temperature (y). The analysis on COPD, related specially to PM10 and NO2 according with F Fisher test has showed in accordance worldwide scientific literature. Preliminary statistical analysis on urolithiasis has evidenced a moderate accordance (F Fischer) between maximum temperature and number of admission in ER.

### **Conclusions**

The clinical field experience and the surveys on patients suggest the preventive efficacy of the thermal therapy, with treatment cycles to be performed 20-30 days before the most likely breakthrough period. Such period depends on seasonal weather and climate factors, as well as on the bioclimatological characteristics of the city of residence. The model is built by identifying 1 or 2 optimal periods for thermal treatment during.

**Keywords:** Bioclimatology, Preventive Medicine, Urolithiasis, Chronic Bronchitis, Otitis

# **Climatotherapy – Thalassotherapy - Dermatology – Session 04**

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Benefit of sunshine exposure in man  
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*A LEPORE, L VELA, N GURNICK, J UBOGUI, AM MONASTERIO*

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with the medicinal waters of Harkány  
*A TÓTH*

# Psammotherapy in Porto Santo Island (Madeira archipelago)

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Psammotherapy is a practice that uses sand-baths for therapeutic purposes. Sand-baths in the biogenic carbonate sand from Porto Santo Island, in the archipelago of Madeira, constitutes a good example of the positive interaction of minerals on human health. Recent studies provided much information on relevant physical and chemical properties that could explain this sand's 200-year-long use, although on a much empirical manner, for the treatment of muscular-skeletal (rheumatic and orthopedic) diseases, such as rheumatoid arthritis, gout, osteoporosis, and fibromyalgia.

The biogenic carbonate sand from Porto Santo Island consists mainly of bioclasts of calcareous red algae (Rhodophyta), sand-bathing traditionally taking place outdoors in the dry and warm sand of the transition zone beach/frontal dune, along the southern coast of the island. However, since 10 years ago, sand-bathing can be carried out indoors, as is the case of the Geomedicine Clinic of Hotel Porto Santo, in conditions that try to replicate the outdoors sand-bathing conditions.

The biogenic carbonate sand is essentially composed of calcium carbonate in the forms of calcite, Mg-calcite and aragonite. The amount of grains derived from volcanic rocks, as a rule, is less than 10%.

Analysis of chemical data shows that Ca, Mg and Sr are the major elements of the biogenic carbonate sand from Porto Santo, elements which are bio-essential for human health. P, S, Si, Al, I, Br, F, B, V, Zn, Cu, Fe, and Se are the minor/trace elements identified in the same sand.

The average grain size of this biogenic carbonate sand is estimated at 0.200mm, all sand grain sizes ranging between 0.063mm and 0.500mm: > 0.250mm – 0.5%; 0.250mm-0.125mm – 85.5%; 0.125mm-0.063mm – 13% ; <0.063mm – 1%.

Also, the shape of sand grains is mainly tabular or platy, an essential characteristic for a good adhesion to human skin.

In order to be therapeutically effective, sand-bathing in the biogenic carbonate sand from Porto Santo requires sand temperature to be slightly higher (40-42°C) than body temperature (37°C), so as to promote body sweating, an essential condition for the interaction sand/human body.

The healing properties of sand-bathing in the biogenic carbonate sand of Porto Santo could be explained on the basis of its peculiar mineralogical, morphological,

thermal and geochemical properties. And, the dermal absorption of the bio-essential elements liberated from sand dissolution is an ultimate and essential mechanism.

In short, the sand properties that justify its therapeutic benefits are as follows: 1) Special chemical composition and easy chemical dissolution - bioavailability of bioessential elements, Ca, Mg, Sr, P, S, etc.; 2) High heat storing capacity due to the porosity of most of the biogenic carbonate grains (in sunny days sand temperature in the transition zone beach/frontal dune can reach 65°C; 3) Sand temperature above human body temperature-essential for sweat formation ; 4) Tabular shape of sand grains - essential for their adhesion to the skin; 5) Sand dissolution by the acid sweat.

Due to the excellent characteristics of its maritime mild climate, Porto Santo island gathers all the conditions for the practice of maritime climatotherapy.

The main meteorological data determined in the island are as follows: Air temperature: 16°C is the minimum annual temperature measured in February and 24°C is the maximum measured in August. Mean annual value of thermal amplitude: It is estimated at 7°C. This classifies Porto Santo's climate as maritime. Sea water temperature: 18°C is the minimum mean annual value in February and 24°C is the maximum mean annual value in October; for long periods sea water temperature is higher than air temperature.

**Keywords:** Porto Santo Island; Biogenic Carbonate Sand; Mineralogical, Morphological, Thermal and Geochemical Properties

# Benefit of sunshine exposure in man

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In man, UV-exposure may cause both beneficial and damaging health effects. In recent years possible benefits have gained growing attention, especially in osteology, angiology, cardiology and oncology.

So far, almost all positive effects are considered to result from an improved Vitamin D status, caused by UVB-induced cutaneous production of previtamin D.

After isomerisation of previtamin D in the skin, 25-hydroxylation in the liver and 1 $\alpha$ -hydroxylation in the kidney, the active form 1,25-dihydroxycholecalciferol may exert the beneficial effects in the prevention and treatment of several diseases, namely in rickets, osteomalacia and osteoporosis. Recent epidemiological studies point at benefits in colon-, breast- and prostate-cancer and arterial hypertension. Many more positive effects of UV-exposure and higher vitamin D levels are under discussion, eg. an improved muscle function and a risk reduction of falls, improved fetal brain development and cognitive function in the elderly, risk reduction for metabolic diseases.

All beneficial effects through a sunshine-induced increase of vitamin D can be achieved by exposure to suberythemal doses of UVB-light, which, however, is deficient in northern Europe during wintertime. Humans at risk of vitamin D deficiency may benefit from winter sojourns in countries with abundant sunshine.

# Is Thalassotherapy simply a type of Climatotherapy? no, certainly, it's not

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**Purpose:** The author's compromise to discuss the proposals made on the letter published in 2011 on the International Journal of biometeorology: "Is Talassotherapy simply a type of Climatotherapy?" (Maraver et al. 2011) after the article "A proposal for a worldwide definition of health resort medicine, balneology, medical hydrology and climatology" by Gutenbrunner et al. (2010), focus in Thalassotherapy as a basic component of health resort medicine and not just a type of Climatotherapy, as it concerns to the medical use of seawaters based on their mineral properties, also evokes the use of marine peloids, known as lime muds (Mud Therapy), methodical exposure to the sun (Heliotherapy), partial or full-body warm sand baths (Ammotherapy or Psammothrapy) and (but not only) marine climatotherapy (atmosphere, temperature, humidity, wind, barometric pressure etc.); although MEDLINE/PubMed search of the term "Thalassotherapy" in the Medical Subject Headings (MeSH) database only yields the word under the listing for "Climatotherapy", which as far as we are concerned is insufficient and inexact.

Worldwide there are many health resort medicine centers dedicated to Thalassotherapy, especially in countries with coasts in northern and southern Europe, North Africa, Japan and of course the Dead Sea area (Armijo and San Martín 1994; Bobet 1999; Halevy and Sukenik 1998; Lucchetta et al. 2007). In our country, Spain, Medical Hydrology is recognized as a medical specialty and Thalassotherapy is part of its curriculum.

The aim of this paper is, as it was the paper of Gutenbrunner et al. as "the basis for future discussion: discussion of short descriptions of terms... This task should be done as part of a structured consensus process and is of major importance for the publication of scientific results as well as for systematic reviews and meta-analyses"

For these reasons, we would suggest adding to the basic components (Balneology, Hydrotherapy, Other therapies and Environmental factors) of the field of health resort medicine proposed by Gutenbrunner et al. (2010), the use of seawater and its peloids (Thalassotherapy), including its modalities full-body or local baths, showers, inhalation, irrigations and peloid packs, and its agents seawater, marine peloids and sand, among others.

Examples of Thalassotherapy in Spain:

- Experience in Menor Sea, San Pedro del Pinatar (Murcia)
- Experience in Mediterranean sea, Málaga.

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**Keywords:** Thalassotherapy, Climatotherapy, Medical Hydrology and Climatology, Health Resort Medicine

# Assessment of the impact of weather factors on human health

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## Introduction and Objectives

In recent years interest in studying the influence of environmental factors, including climatic, on human health has been increasing steadily. One of pressing problems is studying the influence of meteorological mode and physical processes going on in atmosphere and development of a monitoring system that warns the "risk factor" for human health.

Prospective global climate change, influence of "heat stress" and sudden changes of air temperature dictates the need to study temporal variability of the most important parameters – temperature, humidity, the oxygen maintenance in air, heliogeophysical characteristics to identify their most biotrophic combinations, capable to make adverse effects on a human body

## Materials and Methods

We carried out a statistical analysis of meteorological parameters for over the 25-year period (1985-2012) to identify the historical averages of weather factors (absolute and relative humidity, air temperature, atmospheric pressure, the oxygen atmospheric in air and heliogeophysical activity). Based on these data work on drawing up medical and meteorological weather forecast with the definition of biotrophic weather types was carried out. Also methods of correction and maintenance of exacerbation of various diseases due to weather.

## Results

Studies have revealed that the formation of the most adverse biotrophic weather types - spastic (39%) and hypoxic (41%) - affects weather-sensitive patients as an additional stress and causes 1-1.5 times growth of ambulance calling.

## Conclusions

Thus, the medical aspects of climate change, high meteosensitivity in many socially significant diseases, which negatively affects on the quality of patients' life dictates the need for research on introducing medical measures to prevent negative



consequences for public health, and the need for improving services of medical meteorological weather forecasting.

**Keywords:** Weather Factors, Global Climate Change, Biotropic Weather Types, Public Health

# **Marine zootherapy as part of thalassotherapy. Medical and psychosocial parameters in 127 children attending a thalassotherapy and dolphin therapy program**

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## **Introduction and Objectives**

According to international definition, thalassotherapy is the use of the benefits of marine elements with a preventive or curative purpose. Some of these elements are the micro and macroorganisms, so assisted therapy with marine mammals could be a part of thalassotherapy.

Benefits of dolphin therapy has been contrasted scientifically with specialized studies.

Dolphin therapy may have an effect comparable to ultrasound therapy in the clinic. Activate basic biological functions and improve overall. Alpha waves with frequency between 8 and 13 Hz are associated with relaxation measured with EEG and directly stimulate the hypothalamus to produce endorphins among other functions.

This statement raises the attention, concentration and ability to learn and memorize. Neutralize distracting elements and increases perception.

Objectives: Conduct a descriptive study to determine the characteristics of children attending a thalassotherapy and dolphin program and the determination of medical-psychological parameters before and after therapy.

## **Materials and Methods**

We proceed to conduct a survey prior o treatment in which we collect the following patient data:

Age.Hometown.Prior dolphintherapy. Main pathology. Concomitant pathology. Number of drugs. Blood pressure. Muscle tone and reflexes. Heart rate. Respiratory rate. Level of anxiety (visual scale of 1 to 10 parents). Mood state.

Increase in communication, improve cognitive, language, attention, concentration, self-esteem, motivation, sleep, appetite, mobility, balance, relaxation, calculation and recognition. Objective evolution.Subjective evolution.

## **Results**

Distribution of the sample:

Origin: 61% Spanish, 39% international (Madrid 31% C.Valenciana 27%)

Mean age: 9.6 years

Diagnosis: Autism spectrum disorders: 27.2%, 19% psychomotor retardation, cerebral palsy 11.6%, Sd.Down to 8.8%.

Experience in previous zootherapy: 62% (Horses, dogs, sea lion)

Systolic blood pressure: 113.2 mmHg systolic blood pressure to 101.5mmHg

Diastolic blood pressure: 78.3mmHg diastolic blood pressure to 70.3 mmHg

Heart rate: 100.56 bpm heart rate to 84 bpm

Respiratory rate: 17.9 rpm Respiration to 15.9 rpm

Anxiety: 5.64 to 2.16

Mood: 7.08 to 8.9

Calculation: 16.86 seconds to 14.44 sec

Recognition: 17.75 sec to 14.7 sec

## **Conclusions**

Thalassotherapy and dolphintherapy treatment in children with physical and psychological symptoms has positive benefits in terms of blood pressure, heart and respiratory rate, anxiety, mood, calculation and recognition.

Hypotony and hyperreflexia had improved, also: Communication. Motivation attention and concentration. Self-esteem. Motricity. Balance and Relaxation.

100% experienced improvement in symptomatology and 2% reduced the number of drugs.

**Keywords:** Thalassotherapy, Dolphintherapy, Down Syndrome, Animal Assisted Therapy, Autism Spectrum Disorders, Psychomotor Retardation, Cerebral Palsy, Zootherapy

# Thalassotherapy and otaridotherapy in patients with rheumatic fibromyalgia, medical and psycho-social parameters

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## Introduction and Objectives

According to international definition of thalassotherapy is the use of the benefits of marine elements with a preventive or curative purpose. Some of these elements are the micro and macroorganisms, so assisted therapy with marine mammals could be a part of thalassotherapy.

There are several therapies to treat psychophysical diseases, although the combination of them could be the most effective way to help symptomatology and/or improve the quality of life.

There are several therapeutic models based on animal encounters that are successful. Therapy with sea lions is fairly new but certainly effective.

This is a therapy that uses thalassotherapy and otariids (sea lions) to improve movement, balance, coordination and psychological aspects.

Objectives: Evaluate characteristics of patients attending a thalassotherapy and otaridotherapy program and the determination of medical and psychological parameters before and after therapy.

## Materials and Methods

Questionary prior to treatment to collect the following patient data:

Age; gender; civil status; origin precedence; Fibromyalgia Impact Questionnaire. (FIQ); geriatric syndromes (incontinence, falls, constipation, sensory deficits, memory, insomnia and emotional condition); previous Zooterapia; main pathology; concomitant pathology; number of drugs; blood pressure; heart rate; respiratory rate; level of anxiety; state of mood; sensation of pain: increased self-esteem, motivation, sleep, mobility, balance, coordination and relaxation; objective evolution; subjective evolution; therapy was developed in several phases; medical consultation: gathering information... .

Habituation: patients familiarize with water, the team of professionals (doctor, physiotherapist, psychologist, special educator, several animal trainers and the co-therapist, the sea lion) and the other participants through various exercises.

Therapeutic phase: Sea lion interaction itself.

Back to baseline: come back to the calm state, then maintaining a consultation with specialists where certain data are collected.

### **Results**

Systolic Blood pressure decreased from 13.5 to 12.3 mmHg. Diastolic BP was reduced from 8.3 to 7.5 mmHg. Decrease in heart rate. Subjective sensation of pain (scale 1 to 10) decreased from 7.5 points before to 4. Anxiety from 7.6 to 2 and mood state from 4.1 to 7.1. Sleep improved from 3.8 hours to 6.1 the last day. Improved the FIQ score.

Motivation was low in 37% of patients before, after had improvement 100% (mild improvement 12.5% and marked improvement 87.5%). Self-esteem was low in 75% before, after had improvement 100% (mild improvement 37.5% and marked improvement 62.5%). Motricity was low in 88% before, after had improvement in 100% (a slight improvement 62.5% and marked improvement 37.5%). The balance was low in 88% before, after had improvement 75% (mild improvement 62.5% and marked improvement 12.5%). Relaxation was low in 75% before, after had improvement in 87.5% (mild improvement 12.5% and marked improvement 75%).

Almost 100% reported subjective improvement in terms of general condition and symptoms (33% reported, slight improvement and 66% greater improvement). Objectively therapists found a slight improvement in 30% and a marked improvement in 70%. 100% would repeat the experience.

### **Conclusions**

We found a high incidence of anxiety, insomnia, mood disturbances and pain are reduced with this experience.

The parameters that most improved were motivation and relaxation.

Blood pressure decreased both systolic and diastolic, heart rate and scores on the FIQ.

Thalassotherapy and otaridotherapy treatment in patients with rheumatic fibromyalgia improves physical and psychological symptoms.

**Keywords:** Thalassotherapy, Otaridotherapy, Rheumatic Fibromyalgia, Animal Assisted Therapy

# Thalasso medical centre in the salt pans of Secovlje (Portoroz, Slovenia)

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## Introduction and Objectives

Secovlje salt pans are the northernmost saltworks in the Adriatic Sea and one of the few in the Mediterranean area where salt is still produced in the traditional manual way. Salt is recovered from the sea water by solar evaporation and during this process two side products are produced, salt pan mud (fango) and brine. The healing properties of these products are well known since the Middle Ages and are still used today. The area of Portoroz it's a known Slovenian health resort with more than a century of tradition in the wellness tourism. Because of that the company SOLINE d.o.o., which manages the Salt pans of Secovlje decided to bring thalassotherapy and therapeutic medical treatments directly to the healing source by creating the Thalasso medical centre in the salt pans. This unique centre is currently under construction and planned to open its doors in spring 2012. The complex will be carefully inserted in the natural reserve and designed as a minimal intervention in a protected cultural and natural landscape. The facilities for a variety of therapeutic purposes will cover an area of around 4700 m<sup>2</sup> and will include: sunbathing, swimming, massages, medical gymnastics in the seawater, knaiping, brine baths, brine inhalation, salt peelings and salt pan mud (fango) baths and other therapies. Despite the long-lasting tradition in the use of salt-pan mud there is a lack in the determination of its composition and healing effects. We here present the general chemical composition of selected mud samples and the preliminary results of the pilot study of salt-pan mud maturation.

## Materials and Methods

Mud samples collected in 2009 were freeze-dried and homogenized. FT-IR spectra were obtained using Perkin-Elmer Spectrum One spectrometer. The organic carbon and total nitrogen contents were determined with Elementar VARIO Micro analyzer. Carbohydrates were determined after Dubois, while the proteins were determined using the Bradford reagent. The geochemical analysis included: mineral compositions by XRD, multi-elemental composition by XRF and granulometry. The same approach was used with the monthly collected samples from the pilot study.

## **Results**

The analysis revealed that salt pan mud is composed mainly of inorganic constituents: carbonates, silicates (quartz) and clay minerals. The organic proportion is small (up to 2.3 wt.%). The carbohydrate and protein content range from 6.6 to 3.1 and 3.5 to 0.1 mg/g. Mineralogical analysis confirmed calcite, quartz, halite, muscovite, manganese oxide and clay minerals as the major components. The particle size analysis showed that samples were mostly composed of silt size particles (83%).

## **Conclusions**

The quality of the therapeutic salt-pan mud depends on the composition of the "virgin" substrate and brine characteristics in the process of salt-pan mud maturation. The results indicate the need for carefully planned monitoring of the "ripening" of the original substrate, which would involve the determination of chemical and biological features of the original substrate and temporal transformations. Particular attention should be devoted to research in this quality (swelling rate, heat conductivity, water and ion-exchange capacity) and the usefulness of the resulting peloid.

**Keywords:** Thalassotherapy, Secovlje Salina, Peloid

# Acute atopic dermatitis and balneotherapy

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## Introduction and Objectives

Atopic dermatitis (AD) is a chronic inflammatory skin disease that disrupts the daily work and social lives of patients. AD is a pruritic chronic or localized inflammatory disease that results from barrier defects combined with modified immune responses of the innate and the adaptive immune system to exogenous and endogenous factors, so that these patients demonstrate compromised skin barrier. Treatment of atopic dermatitis makes use of a variety of therapies. Modern management consists of anti-inflammatory, occasionally antiseptic, as well as antipruritic therapies to address the epidermal barrier as well as immunomodulation or infection. Mild forms of atopic dermatitis may be controlled with topical therapies, but moderate-to-severe forms often require a combination of systemic treatments consisting of antipruritic and immunosuppressive drugs, phototherapy, topical compounds and complementary therapies.

Objective: This review of cases is focused on examining improvement the itching and the quality of life of these patients with balneotherapy.

## Materials and Methods

This is an observational and descriptive study of three cases of atopic dermatitis.

In Copahue Spa treatment of patients with atopic dermatitis is performed using the following protocol is evaluated by the dermatologist doctor or the Hydrologist doctor who evaluates the patient and indicates the application of algae for 20 minutes, then a bath with sulfurated water for 15 minutes, this is combined with a natural sulfur steam bath.

## Results

In all three cases the improvement is evident in the decrease of the skin lesions and pruritus. In laboratory tests there is evidence of decrease in allergic markers.

## Conclusions

There is documentary evidence that the relief of patients with atopic dermatitis is due to chemical elements, thermal effects, mechanical and immunomodulatory effects. Sulfur waters, specifically, have an anti-inflammatory, keratoplastic and antipruriginous effects. Sulfur may also interact with oxygen radicals, producing sulfur and disulfur hydrogen, which may be transformed into pentathionic acid



(H<sub>2</sub>S<sub>5</sub>O<sub>6</sub>) and this may be the source of the antibacterial and antifungal activity of sulfur water. This could be the explanation of the improvement found in these three cases and we think that more investigation should be made in this field in the future.

# Change of the psoriasis area and severity index score after an antipsoriatic treatment with the medicinal waters of Harkány

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## Introduction and Objectives

The water of Harkány is the unique representative of the sulfurated medicinal waters in Europe. It contains a biologically very active, absorbable gaseous compound, the carbonyl sulfide (COS) which transforms into hydrogen sulfide. In 2007, we began a study in our hospital to prove the beneficial effect up till then based only on empirical evidence of the century-old balneotherapy. The same year the antipsoriatic effect of the water of Harkány had been verified.

## Materials and Methods

Between September 2010 and September 2011, we have been studying the changes of the PASI (Psoriasis Area and Severity Index) score in the case of our ward's patients suffering from psoriasis who underwent our complex dermatological treatment. This treatment applied in our institute consists of a balneotherapy with the medicinal water and, depending on the severity of the dermatological symptoms, a local non-steroidal ointment treatment (Dithranol) and a narrowband (311 nm) UVB phototherapy. During the retrospective processing of the data of our ward's psoriasis affected patients who were treated in the above mentioned period, we took as a principal aspect of the assessment the local effect of the applied treatment to the dermatological symptoms. We document the improvement of the psoriasis at our ward by the change of the PASI score. The Psoriasis Area and Severity Index shows the extension of the surface of the skin afflicted of psoriasis and the severity of the dermatological symptoms; it is used to rate the severity of the illness. It helps to choose the proper therapeutic strategy and to assess the efficiency of the therapy.

## Results

At the end of our three-week complex dermatological therapy the calculated values showed a significant improvement. No patient's treatment had to be suspended for side effects, and during the studied period we achieved at all our patients at least an improvement of PASI 50.

### **Conclusions**

In our hospital the local treatment of the mild and moderate plaque psoriasis is well managed and successful, and it is completed with a systemic treatment in the case of severe psoriasis. The results of our retrospective study statistically confirm also the benign effect of the medicinal water of Harkány to the psoriasis that had been verified earlier.

**Keywords:** Psoriasis, PASI score

# Climatotherapy - Dead Sea – Session 05

## Papers

Health effects of dead sea climatotherapy on patients with heart and lung diseases  
*SW MOSES*

Ultra-violet (UV) radiation properties at the Dead Sea  
*AI KUDISH*

Climatotherapy of skin diseases at the Dead Sea – an update  
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Multidisciplinary Rehabilitation and Climatotherapy for Chronic Diseases at the Dead Sea  
*E. DRAMSDAHL*

Changes in serum vitamin d levels following dead-sea climatotherapy  
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Influence of single immersion in Dead Sea water on glucose, insulin, cortisol and C-peptide levels in type 2 diabetes mellitus patients  
*S SUKENIK M HARARI*

Quality of life at the Dead Sea region: the lower the better? An observational study  
*S SUKENIK A AVRIEL, M HARARI*

# Health Effects of Dead Sea Climatotherapy on Patients with Heart and Lung Diseases

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## Introduction and Objectives

The Dead Sea (Sea of Salt in Hebrew), the lowest saline lake on earth, contains high concentrations of salts and is a reservoir of minerals with a unique evaporation regime. The magnesium salts and the sulfur-containing mud in addition to the unique ultra-violet (UV) radiation reaching this area are the main factors used for treating skin disorders and arthritis, as well as respiratory diseases. High and stable temperatures are the main characteristic of this dry region, located at 420 meters below sea level, benefiting also from high barometric pressure (800 mm Hg), and therefore from a higher oxygen partial pressure.

## Materials and Methods

The influence of a sojourn in these exceptional climatic conditions was studied on patients suffering from heart and from lung diseases. Stress test and cardiac ultra-sound imaging, as well as lung function tests were obtained before and after a sojourn at the Dead Sea area.

## Results

In their conclusions, the authors emphasized the positive changes in the condition of the patients, as well as the safety and the possible beneficial effects of such a stay. Even if natural climatotherapy at the Dead Sea for skin and joint diseases has been proven both highly effective and almost without side effects, more studies are necessary for defining and delimiting optimal protocols to be followed by patients suffering from heart and lung diseases.

## Conclusions

In their conclusions, the authors emphasized the positive changes in the condition of the patients, as well as the safety and the possible beneficial effects of such a stay. Even if natural climatotherapy at the Dead Sea for skin and joint diseases has been proven both highly effective and almost without side effects, more studies are necessary for defining and delimiting optimal protocols to be followed by patients suffering from heart and lung diseases.

**Keywords:** Cardiac disease, Chronic Obstructive Lung Disease, Low altitude, Dead Sea

# Ultra-violet (UV) radiation properties at the Dead Sea

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## Introduction and Objectives

The Dead Sea, a salt lake located between the Judean Mountains in Israel and Moab mountains in Jordan, is one of the saltiest bodies of water known, containing 345 g mineral salts per liter. It is situated at the lowest terrestrial point on earth, approximately 400 m below mean sea level. The Dead Sea area is recognized as a natural treatment facility for patients with psoriasis, atopic dermatitis, vitiligo and other skin and rheumatic diseases.

## Materials and Methods

A research project was initiated in 1994 to determine if the Dead Sea basin is indeed characterized by a unique ultraviolet radiation spectrum, which contributes to the success of photoclimate therapy of psoriasis and other skin diseases. A meteorological station was established at the Dead Sea basin (Neve Zohar) to continuously monitor solar global, UVB and UVA radiation, measure spectral selectivity within the ultraviolet spectrum and investigate other relevant bio-climatological parameters. The same parameters were also monitored continuously at a second meteorological station in Beer Sheva, which is located in the southern Negev region of Israel at a distance of approximately 65 km west of the Dead Sea and an altitude of ~315 m above mean sea level, i.e., about a 700 m altitude differential between the two sites.

## Results

The UVB and UVA solar radiation intensities at the Dead Sea are both attenuated relative to Beer Sheva; the UVB to much a greater extent than the UVA. The degree of attenuation is inversely proportional to the wavelength. The erythema wavelength range (ca. 300 nm) is attenuated to greatest extent, whereas the degree of attenuation is lower in the therapeutic wavelength range (ca. 311 nm) with regard to psoriasis. Consequently, the incident solar UVB has a higher ratio of therapeutic to erythema radiation relative to other sites. The ratio of the therapeutic to erythema radiation has a minimum value at solar noon (diurnal minimum optical path length).

**Conclusions**

These findings have been applied to revise the psoriasis treatment protocol at the Dead Sea with the goal of reducing the cumulative sun-exposure time without affecting treatment efficacy.

**Keywords:** Dead Sea; Beer Sheva; Israel; UVB; UVA; solar global radiation; relative attenuation of solar radiation

# **Climatotherapy of skin diseases at the Dead Sea – an update**

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## **Introduction and Objectives**

The Dead Sea area attracts yearly thousands of patients suffering from chronic skin diseases and Climatotherapy protocols and treatments are now well developed and scientifically proven. Sun exposure is the most effective component for the treatment of skin diseases at the Dead Sea, and was recognized as such long ago. This region benefits from a specific reduction of ultraviolet (UV) radiation predominant for the UV-B rays with a wavelength shorter than 300 nm. Dead Sea baths exert an additional proven beneficial effect on Psoriasis and Psoriatic Arthritis, but also on Atopic Eczema and Vitiligo

## **Materials and Methods**

The latest studies dealing with the influence of Dead Sea Climatotherapy on skin diseases were reviewed and analyzed

## **Results**

Numerous studies in vivo and in vitro demonstrated the success of this method, but it seems important to distinguish the beneficial effects of the natural balneo-phototherapy practiced in unique psychological ambiance and exceptional bioclimatic conditions from those obtained by artificial balneo-phototherapy

## **Conclusions**

More than 4 decades after being studied, Dead Sea Climatotherapy can be considered now as a natural and simple dermatological treatment, highly effective and free of side effects, that requires, in order to obtain optimal results, a medical and individualized follow-up for each patient.

**Keywords:** Dead Sea, Climatotherapy, Psoriasis, Atopic Dermatitis, Vitiligo



# Multidisciplinary Rehabilitation and Climatotherapy for Chronic Diseases at the Dead Sea

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## Introduction and Objectives

Since 2004, the DMZ Medical Center and the Norwegian Rehabilitation Center are providing multidisciplinary and comprehensive program for patients suffering from various chronic conditions, mostly musculoskeletal diseases and Chronic Fatigue Syndrome (CFS). The Center has developed a unique concept, based on a multidisciplinary rehabilitation model associated to the intense use of climatic factors present in this area, offering so a good alternative for Norwegian patients. The multidisciplinary rehabilitation Climatotherapy (MDR-C) at the Dead Sea fit the needs of a true MDR program, while introducing a new dimension in this field.

## Materials and Methods

This 3-week long multidimensional rehabilitation at the Dead Sea is a full-time behavioral medical program administered in a cognitive out-patient setting which follows the evidence-based guidelines for therapeutic interventions. At the Dead Sea, medical and psychiatric co-morbidities are carefully taken into account when tailoring the therapeutic plan for each patient. As well the nature and severity of symptoms, together with the individual's level of function and psychosocial stressors of each participant are initially evaluated, before and during the treatment. Several psychological, cognitive and psychosocial interventions are included in this MDR-C program, resulting in a very compact and powerful multi-modal cognitive behavioral agenda.

## Results

Of more of thousand patients treated, a huge amount of them showed significant improvement in their condition and quality of life parameters after treatment at the Dead Sea, describing their stay as a turning point in their disease history and in their life. In a large proportion, they were able to resume work, education or studies. Norwegian physicians are now referring in increasing numbers chronically ill patients to this intensive rehabilitation program.

**Conclusions**

Of more of thousand patients treated, a huge amount of them showed significant improvement in their condition and quality of life parameters after treatment at the Dead Sea, describing their stay as a turning point in their disease history and in their life. In a large proportion, they were able to resume work, education or studies. Norwegian physicians are now referring in increasing numbers chronically ill patients to this intensive rehabilitation program.

**Keywords:** Multidisciplinary Rehabilitation, Climatotherapy, Musculoskeletal Diseases, Cognitive Behavioral Therapy, Dead Sea

# Changes in serum vitamin D levels following Dead Sea climatotherapy

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## Introduction and Objectives

The Dead Sea region in Israel is the deepest spot on earth, 422 meter beneath sea level. The atmosphere layer overhanging this region is larger than in any other place on earth, allowing a filtration effect on sunshine beams and leading to their moderate attenuation in the Ultraviolet B (UVB) spectrum. The question was raised whether exposure to this sunshine may increase serum Vitamin D levels of patients treated at the Dead Sea.

**OBJECTIVES:** To assess, in Norwegian patients suffering from joint disease and chronic pain syndromes, the magnitude of change in 25-Hydroxyvitamin D levels (25-OH-D) after Dead Sea Climatotherapy (DSC).

## Materials and Methods

117 Norwegian patients received regular DSC procedures during their 3 weeks visit, which includes sun exposure (60 to 90 minutes), Dead Sea bath and outdoor physical activities. The cumulative solar UVB exposure was calculated in Minimal Erythema Doses ( $38.3 \pm 12.8$  MEDs). Blood sampling for measurements of 25-OH-D levels were performed upon arrival and on the last day of their stay. Data were evaluated by statistical analysis using paired t test.

## Results

Following the DSC serum 25 OH Vitamin D levels were increased from  $51.9 \pm 2.7$  nano mol per liter (nM), to  $64.2 \pm 3.1$  nM ( $p < 0.001$ , 23.8% increase). The rate of increase in serum 25-OH-D was found to be age related with the highest increase in the youngest group. Variations in response were found between patients with different diseases). The highest increase in serum 25-OH-D was obtained in patients with Post Polio Syndrome (36.7%) and only 16.5% increase was measured in Fibromyalgia patients.

## Conclusions

Even in the attenuated sunshine existing in the Dead Sea region, a daily sun exposure for 3 weeks induces significant increases in serum 25-OH-D levels by Caucasian patients suffering from musculoskeletal and joint diseases. Changes in 25-OH-D after sun exposure were found to be related to initial value of serum 25-OH-D, to age, and disease.

**Keywords:** Musculoskeletal Diseases, Vitamin D, Dead Sea

# Beauty is not only skin deep: the Dead Sea features and cosmetics

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## Introduction

The Dead Sea area possesses extraordinary geo-climatic factors and represents a natural health resort known worldwide for its success treating skin and rheumatic diseases. Dead Sea cosmetics – or cosmetics arguing being from this place and containing Dead Sea water or minerals – are also known worldwide but still controversies take place in the medical milieu regarding their true effect on the skin.

## Materials and Methods

All relevant articles cited in Medline were reviewed, including studies on minerals and mud from the Dead Sea.

## Results

In vivo and in vitro studies demonstrated clearly the high potential of the Dead Sea minerals for cosmetic purposes. Magnesium and Sulfur appear to be the prominent actors in rheumatology and dermatology, when incorporated to cream or mud.

## Conclusions

Even if only few studies are able to elucidate the real effect of the Dead Sea minerals in cosmetics preparations, there is enough evidence for encouraging such investigations and developing more products. These will enable a better use of the extraordinary reservoir of minerals represented by the deepest and most saline lake in the world

**Keywords:** Dead Sea, Minerals, Mud, Cosmetics

# **Influence of single immersion in Dead Sea water on glucose, insulin, cortisol and C-peptide levels in type 2 diabetes mellitus patients**

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Bathing in sweet or mineral water can induce significant physiological changes in several body systems including the endocrine system. To date there are only a small number of reports that balneotherapy can reduce blood sugar levels in diabetes mellitus (DM) type 2 patients.

The objective of the present study was to compare the effects of a single immersion in sweet or mineral water on blood glucose, insulin, cortisol and c-peptide levels on patients with type 2 DM.

14 patients with type 2 DM and 6 healthy volunteers were immersed in water twice, with an interval of two weeks in between immersions. The first immersion was in Dead Sea and the second in sweet water. In both cases the water was warmed to a temperature of 35 degree C and the duration of bath was 20 minutes. The blood samples were taken from each of the participants at every immersion. The first sample was taken just prior to the start of immersion, the second sample was taken at the end of immersion, and the third sample one hour later. In each sample the blood was tested for glucose, insulin, cortisol, and c-peptide levels. A significant reduction was seen in blood glucose levels among DM patients who were immersed in Dead Sea water. The glucose levels dropped from a base level of  $163 \pm 32.4$  mg/dl prior to immersion to  $151 \pm 28.8$  mg/ml at the end of immersion and to  $141 \pm 34.6$  mg/dl an hour later. All the differences were statistically significant: baseline to end of immersion ( $p=0.006$ ) end of immersion to one hour later ( $p=0.005$ ). The difference in blood glucose was much less following immersion in sweet water and did not reach statistical difference except between the end of immersion and one hour later. No significant differences were found for insulin, cortisol, and c-peptide levels between DM patient and healthy volunteers following immersion. The mechanism of the reduction of blood glucose may be due to increased diuresis following bathing in mineral water.

# **Influence of single immersion in Dead Sea water on glucose, insulin, cortisol and C-peptide levels in type 2 diabetes mellitus patients**

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The Dead Sea region, the lowest in the world at 420 meters below sea level is considered a potent climate –balneotherapy center for the treatment of different chronic diseases

The objective of the present study was to assess the prevalence of chronic diseases and the quality of life of residents of the Dead Sea region compared with residents of the Ramat- Negev region which has a similar climate but is situated 600 meters above sea level

The study was an observational study based on a self- administrated questionnaire. Data were collected from kibbutz (community settlement) members in both regions. Residents of the Dead Sea were the study group and of Ramat Negev were the control group. We compared demographic characteristics, the prevalence of different chronic diseases and health related quality of life (OROQL) using the SF-36 questionnaire.

The results of this study showed an higher prevalence of skin nevi and non-inflammatory rheumatic diseases (NIRD) among Dead Sea residents but they had significantly higher HRQOL mean score in general health ( $68.7 \pm 21$  vs.  $64.4 \pm 22$ ,  $p=0.023$ ) and vitality ( $64.7 \pm 17.9$  vs.  $59.6 \pm 17.3$ ,  $p=0.001$ ), as well as significantly higher summary scores ; physical component score ( $80.7 \pm 18.2$  vs.  $78 \pm 18.6$ ,  $p=0.042$ ) and mental component score ( $79 \pm 16.4$  vs.  $77.2 \pm 15$ ,  $p=0.02$ ). This results did not change after adjusting for social –demographic characteristics health – related habits, and chronic diseases.

In conclusion: No significant differences between the groups was found in the prevalence of most chronic diseases, except for higher rates of skin nevi and NIRD among Dead Sea residents. HRQOL was significantly higher among Dead Sea residents, both healthy or with chronic diseases.

## New Trends 2 – Session 06

### Lectures

Which option; Balneotherapy or Spa Therapy for treating osteoarthritis?

*MZ KARAGÜLLE, M KARAGÜLLE*

Significance of balneotherapy in psychiatry: elements of evidence in 2012

*O DUBOIS*

### Papers

Implementing comprehensive care clinic for cancer survivors

*S RAMOS, L FIBLA, I CASÁS, M GONZÁLEZ, N FREIRE, L VÁZQUEZ*

Hydrogalvanic bath in treatment of patients with diabetic angiopathy of lower extremities

*NG BADALOV, AA MUHINA, NV LVOVA, MT EFENDIEVA, AI TRUHANOV,*

*NB LUFEROVA A UYANAEVA, Y TUPITSYNA*

Techirghiol balneal and rehabilitation sanatorium - statistical analysis of pathology types on admitted patients

*D PROFIR, V MARIN, O SURDU, S DEMIRGIAN, EV IONESCU*

Techirghiol balneal and rehabilitation sanatorium - analysis of epidemiological data

*EV IONESCU, D PROFIR, O SURDU, V MARIN, S DEMIRGIAN*

Improvement of clinical features in CRPS after mud therapy

*S DEMIRGIAN, O SURDU, V MARIN, D PROFIR*

Variation of the instrumental texture of peloids as a function of the water content

*F ARMIJO, I CORVILLO, I VAZQUEZ, MI CARRETERO, M POZO, F MARAVER*

Thermophysical study of peat from the Iberian Peninsula for thermotherapeutic applications

*E MÍGUEZ, CP GÓMEZ, A SOTO, ML MOURELLE, JL LEGIDO*



# Which option; Balneotherapy or Spa Therapy for treating osteoarthritis?

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Balneotherapy and spa therapy are the oldest forms of therapy that have been used for centuries in the management of musculoskeletal disorders. “Balneo” comes from the Latin word for bath; “balneum”. It refers simply to bathing in thermal or mineral waters. Balneotherapy of modern times may be defined as “the therapeutic use of mineral and thermal waters, usually through water immersion of part or all of the body, but also through drinking certain amount of water and inhaling the vaporized or dispersed water. The word “spa” comes from the name of a Belgian town where a thermal spring was discovered in the fourteenth century. Throughout the medical literature, it is common to come across the terminology spa therapy or “complex spa therapy” which essentially means that the patient is receiving balneotherapy (principal component) combined with mud therapy, hydrotherapy, exercise, massage and possibly other natural therapy modalities. To what extent do other modalities rather than balneotherapy contribute to the overall favorable effect of spa therapy remains an enigma, considering the widespread use of spa therapy in Europe? Additionally, it has to be stated that there is no scientific proof that balneotherapy is only effective within the setting of a health resort.

Recently there are growing efforts to establish a scientific basis for balneotherapy and spa therapy especially in Europe. The problem in assessing the value of spa therapy is its complexity. Many factors may contribute positively to the therapeutic effects of spa therapy, such as change of environment, the “spa-scenery”, the absence of (house) work duties, physical and mental relaxation, the non-competitive atmosphere with similarly suffering companions, combined therapies, etc. Furthermore, to date it has not been clearly defined as to how many procedures and/or what procedures when combined with balneotherapy constitute spa therapy and as a result, these two terminologies have been used arbitrarily. Despite semantic, there is an important question that it not yet answered satisfactorily- is spa therapy more efficacious than balneotherapy? On the other hand balneotherapy alone is also difficult to study, since it is usually part of total spa therapy. However, it has been possible to compare the effects of balneotherapy with those of warm tap water in double-blind trials in osteoarthritis of the knees. In other controlled trials, ambula-

tory balneotherapy was tried in local patients for osteoarthritis. In this way, the effect of a “spa atmosphere” was excluded.

# Significance of balneotherapy in psychiatry: elements of evidence in 2012

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## **Introduction and Objectives**

Spa medicine in its psychiatric positioning is still not acknowledged enough in psychiatry. Yet, over the last few years, numerous studies have shown the importance of its therapeutic approach in this indication

## **Materials and Methods**

Here, we propose to update the main works concerning taking care of anxiety disorder, depressive disorders, somatoform disorders and withdrawal from benzodiazepines, which has become of problematic extent, especially in Europe.

Every studies are selected from International bibliographical review

## **Results**

The most significative studies are the subject of a presentation and results analysis

## **Conclusions**

Balneotherapy and treatment in spa resort allow a particularly interesting approach, namely for their socio-therapeutic and holistic (or globally humane) approach, enabling to achieve taking care of the psycho-educative type particularly recommended in this special field

**Keywords:** Balneotherapy, Psychiatry, Anxiety

# Implementing comprehensive care clinic for cancer survivors

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## Introduction and Objectives

The high incidence of cancer, the introduction of screening programs and the best results obtained with new therapeutic strategies, bring one increasing number of people living after having passed a cancer.

These patients present new healthcare challenges, as they are - among others - the required continuous care to deal with the aftermath of his illness or demand information and advice to adopt healthier lifestyles.

The attention and care of patients with cancer psychosocial needs is a fundamental component of a good cancer care. The importance of these care and effort in this field should not be lower than those who are just in other areas of assistance. We believe that the Spa was an optimal environment for the recuperation of the health of people affected by cancer.

### GOALS

To reduce the severity of side effects due to cancer and cancer treatments.

To improve the quality of life of patients under cancer treatment and those who have overcome it.

To offer support services and activities that cover the specific needs and demands of these patients.

To offer behavioral interventions to develop healthy lifestyles.

## Materials and Methods

1/ Initial consultation evaluation:

- Clinical history and examination.
- Evaluation of physical exercise routine: frequency, intensity, duration.
- Alimentary test using the Food Frequency Questionnaire.
- Quality of Life Questionnaire (EORTC QLQC30).

2/ Evaluation by a multidisciplinary team to identify possible long-term and side effects derived from cancer treatment.

3/ Physiotherapy interventions to reduce impact on the functional capacity and wellbeing:

- Rehabilitation after surgery. Massage and techniques to prevent scar adhesions. Joint mobilization.

- Relaxing massage to eliminate spasms, muscle aches and fatigue caused by treatments.

- Baths with medicinal mineral water.

- Lymphedema Prevention and Management Workshop.-

- Small group sessions:

- Early detection of patients at risk for lymphedema..

- Instruction about skin and affected member care.

- Exercises and mobilizations with directions about postural hygiene and attitudes.

Individual attention:

- Manual lymphatic drainage. Multi-layers bandages.

- Pressotherapy and Hydrotherapy. Hydrokinesiotherapy

- Fatigue Prevention and Management Workshop.-

Massotherapy and stretches. Stress control.

Hydrokinesiotherapy. Watsu.

Plan for moderate, regular and progressive exercise

4/ Healthy life style promotion:

- Diet, Food and Nutritional Education:

Study and evaluation of diet patterns rough a 7days diet registry.

Eating habits modification.

Weight control.

Consultation, follow-up and control to maintain new acquired habits.

- Physical activity:

Individual evaluation and physical exercise personalized program in order to improve muscle mass, avoiding an increase on body fat.

Hydrokinesiotherapy in dynamic swimming pool with medicinal mineral water at 34- 35° C

Water-gym.

5/ Resilience Area:

- Stress Reduction: Massotherapy and Hydrotherapy.

- Mindfulness Based Stress Reduction Program (MBSR)

- Individual or small groups Coaching sessions.

6/ School of Healthcare:

- Self-care workshops.

- “Expert patient” advice.

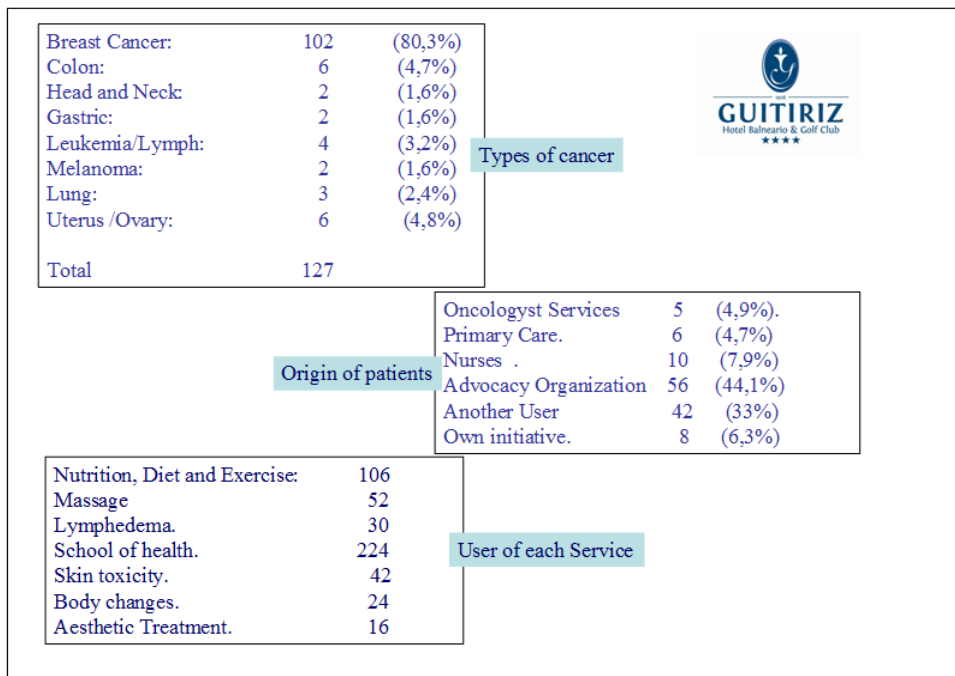
- Residential workshops to gather health professionals, patients, and patient associations.

- Care of caretakers.

- Health Coaching for patients and relatives.

## Results

Graphic 1



# Hydrogalvanic bath in treatment of patients with diabetic angiopathy of lower extremities

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## Introduction and Objectives

Problem of diabetes mellitus is of high medical and social importance primarily because of its vascular complications that often cause early invalidisation and mortality. It's very important to search new possibilities of prevention of such complication.

Combination of hydrotherapy together with different mode of current may be very promising by enhancement of therapeutic effect. There is lack of information about use of this method.

The aim of our study was evaluation of efficiency of hydrogalvanic bath in treatment of patients with diabetic angiopathy of low extremities.

## Materials and Methods

32 patients (23 women and 9 men), mean age  $56 \pm 2,14$  years, with diabetes mellitus with angiopathy of lower extremities were included in the study. Duration of diabetes was  $13 \pm 3,22$  years.

Patients were divided into two groups: First group received drug therapy and a course of galvanic baths ( $n=20$ ) and Control group received drug therapy and tap water bath where galvanic component was switched off ( $n=12$ ). Hydrogalvanic bath was done according to following methodology: galvanic current were applied from tree pairs of electrodes (positive at hip area, negative at the tibia and foot level) in tub filled with tap water of 36-37°C temperature for 10-12 min daily with 8-10 procedures for a course

Students t-test for continuous variables was performed. The difference with  $p < 0,05$  was considered to be statistically significant.

## **Results**

After 2-weeks of treatment clinical symptoms of diabetic angiopathy significantly improved in First group. A reduction in pain score assessed by visual analog scale (VAS) was observed in 90% of patients (from  $4,63 \pm 0,21$  to  $2,13 \pm 0,16$ ;  $p < 0,05$ ), decrease of frequency of seizures were found in 75% patients, in 46,7% more then two times. Coefficient of atherogenicity decreased non significantly ( $p < 0,07$ ) from  $3,86 \pm 0,14$  to  $3,04 \pm 0,16$ . Index of efficiency of microcirculation as well as indices of myogenic and neurogenic vascular tone increased non significantly in 55% of patients of First group.

## **Conclusions**

After 2-weeks of treatment clinical symptoms of diabetic angiopathy significantly improved in First group. A reduction in pain score assessed by visual analog scale (VAS) was observed in 90% of patients (from  $4,63 \pm 0,21$  to  $2,13 \pm 0,16$ ;  $p < 0,05$ ), decrease of frequency of seizures were found in 75% patients, in 46,7% more then two times. Coefficient of atherogenicity decreased non significantly ( $p < 0,07$ ) from  $3,86 \pm 0,14$  to  $3,04 \pm 0,16$ . Index of efficiency of microcirculation as well as indices of myogenic and neurogenic vascular tone increased non significantly in 55% of patients of First group.

**Keywords:** Hydrogalvanic Bath, Diabetic Angiopathy, Microcirculation, Lipid Metabolism



# Techirghiol balneal and rehabilitation sanatorium - statistical analysis of pathology types on admitted patients

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## Introduction and Objectives

Balneal and Rehabilitation Sanatorium is situated on the shore of Techirghiol Lake, 3 km away from the Black Sea. The sanatorium gained its fame over the years, due to the great number of Romanian and foreign patients treated here with natural cure factors – salted water of the lake and sapropelic mud extracted from the lake. Most of the inpatients are admitted in the sanatorium on a basis of state medical insurance system, only a small number come by direct payment.

Aim: to analyze the type of pathology; to determine addressability degree of patients with different diseases; to evaluate periodic return of patients.

## Materials and Methods

The study is still ongoing up to 30th of April 2012. Until now over 6000 patients were registered. The patients were admitted for a period of 12 days up to 30 days and received complex rehabilitation treatment: hydro-kinetic-therapy in the salted water of the pool, alternative with warm mud baths or hot mud wrapping, massage, electrotherapy, kinetotherapy. All patients underwent an initial clinical examination and then the physician filled up a questionnaire, which includes some personal data, information about the disease requiring admission (predominant symptom, main symptom location, stress level, physical activity at home, person who recommended balneal cure), if the patient has in the medical history balneal treatment and what were the results, and finally the group of affections in which fit the existing symptoms. Data from the questionnaires were statistically processed and plotted. The used questionnaire was conceived by a group of physicians from the sanatorium.

## Results

Among all pathology types the most frequent is osteoarthritis, followed closely by neurological diseases (mainly lumbar and cervical slipped disc associated with radiculitis). The most affected segment by degenerative rheumatic process is the spine, followed by weight bearing joints (knees). Age of onset in patients with osteoarthritis is decreasing continuously.

### **Conclusions**

Preliminary data obtained for the time being after partial processing of the questionnaires suggest that osteoarthritis is predominant, nearly equally with neurological pathology. Also, it seems that age of onset for each group of diseases changed, as a consequence of actual social and economic context. Balneal cure with specific natural factors used in sanatorium is efficient for most of the treated affections, fact evidenced by periodic return of patients in this medical unit.

**Keywords:** Sapropelic Mud; Statistical Analysis; Osteoarthritis; Balneal Cure

# Techirghiol balneal and rehabilitation sanatorium - analysis of epidemiological data

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## Introduction and Objectives

Balneal and Rehabilitation Sanatorium is situated on the shore of Techirghiol Lake, near the Black Sea and was established over one century. The sanatorium gained its fame over the years, due to the great number of Romanian and foreign patients treated here with natural cure factors – salted water of the lake and sapropelic mud extracted from the lake. Most of the inpatients are admitted in the sanatorium on a basis of state medical insurance system, only a small number come by direct payment.

Aims: analysis of epidemiological data (gender, age, somatic features), in order to establish the characteristics of population that benefits from treatment with natural specific factors; to participate in a comprehensive comparative international study, in order to compare the groups of patients that address to balneal establishments from other countries with tradition in this field; to contribute to a common background for research in this field.

## Materials and Methods

The study is still ongoing up to 30th of April 2012. Until now over 6000 patients were registered. The patients were admitted for a period of 12 days up to 30 days and received complex rehabilitation treatment: hydro-kinetic-therapy in the salted water of the pool, alternative with warm mud baths or hot mud wrapping, massage, electrotherapy, kinetotherapy. All patients underwent an initial clinical examination and then the physician filled up a questionnaire, which includes personal data (name, gender, age, profession, place of residence, weight, height, being smoker or nonsmoker, associated diseases, values of blood pressure and pulse at admission, stress level induced by the main symptom), data about the disease requiring admission and, finally, the group of affections in which fit the existing symptoms. Data from the questionnaires were statistically processed and plotted. The used questionnaire was conceived by a group of doctors from the sanatorium.

## Results

It seems that feminine population is predominant among all admitted patients. Mean age of inpatients is between 40 and 50 years.

**Conclusions**

As it can be seen from preliminary results, feminine population is predominant among inpatients in the sanatorium. Also, it seems that age of onset for each group of diseases decreased, as a consequence of actual social and economic context.

**Keywords:** Sapropelic Mud; Epidemiological Analysis; Questionnaire

# Improvement of clinical features in CRPS after mud therapy

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## Introduction and Objectives

Complex regional pain syndrome (CRPS) is a disorder of the extremities that is characterized by pain, swelling, limited range of motion, vasomotor instability, trophic skin changes, and patchy bone demineralization. Alternative names for CRPS in the literature include reflex sympathetic dystrophy, algodystrophy, causalgia, Sudeck's atrophy. Two types of CRPS have been recognized:

- type I corresponds to patients with CRPS without a definable nerve lesion and represents about 90% of clinical presentations;
- type II was formerly termed causalgia and refers to cases where a definable nerve lesion is present.

**OBJECTIVE:** The purpose of this study was to assess the incidence of specific clinical features in CRPS I (pain, edema, loss of function, skin temperature), and to evaluate the benefits of complex treatment,

## Materials and Methods

### MATERIALS:

1. sapropelic mud, mineral water from Techirghiol Lake, all facilities for treatment of the sanatorium;
2. visual analog scale for pain, centimeter, goniometer, thermograph; .

**METHODS:** Study batch was composed of 35 patients with posttraumatic CRPS I of upper and lower limbs (10 located at upper limb, 25 located at lower limb). Pain was assessed using visual analogue scale (VAS). Circumference of the affected limb (sign of edema) was measured by centimeter. Range of motion was evaluated using goniometer. Skin temperature was measured with an infrared camera. All the parameters were evaluated before the beginning of treatment and to the end of balneal cure (12 days or 18 days).

Complex treatment consists in thermotherapy (mud bath at 38 C for 20 minutes), electrotherapy (reflex, resorbative, analgesic), massage and kinethotherapy (in the gym room and in swimming pool with salt water of Techirghiol Lake).

## **Results**

- pain perception, edema, skin temperature decreased statistically significant ( $p < 0.05$ ),
- range of motion increased.

## **Conclusions**

1. correct diagnose of CRPS using clinical characteristics measured in this paperwork allow to apply peloidotherapy in patients with CRPS I
2. at the end of balneal cure we obtained the diminution of specific clinical features of CRPS
3. mud therapy is efficient in alleviate the symptoms of CRPS.

**Keywords:** Sapropelic Mud; Epidemiological Analysis; Questionnaire

# Variation of the instrumental texture of peloids as a function of the water content

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## Introduction

During the I Congress on Iberoamerican Peloids, peloids were defined from a physicochemical standpoint, as a *"heterogeneous systems, with a solid phase comprising a mixture of organic and / or inorganic solids suspended or wetted by a liquid phase formed by a solution of ions and molecules, organic and inorganic, with water as the solvent that can be used in therapy or as a topical cosmetic"*<sup>1</sup>. In practice it is a mixture of a solid, usually a clay, with water.

In 1991 we began to study the instrumental texture of peloids to know their rheological behavior and its acceptance, using equipment that provides physical parameters avoiding subjectivity of these measurements. The instrumental texture provides parameters related to the rheological behavior of the sample obtained by penetrometry and compression. The parameters used were: hardness, cohesiveness, and adhesiveness<sup>2-3-4</sup>.

## Materials and Methods

The samples consist of mixtures prepared in the laboratory with three solid materials normally used for the preparation of peloids with deionized distilled water, Synergy Millipore quality. The samples were prepared by adding water to the solids, allowing the mixture to naturally moisturize and then were manually homogenized.

Water and solid content was determined in these mixtures. The assay was performed with the Brookfield texturimeter LRFA. The sample was placed in a non-deformable container of inverted troncoconical shape of a polymeric material. The TPA method with two consecutive cycles<sup>5</sup> and a ball probe were used.

Instrumental "hardness" is defined as the necessary force to achieve a given deformity measured at the peak compression force during the first cycle (TPA), which can be a real peak or a plateau. The unit of measurement in this equipment is the gram (g).

The instrumental parameter called "cohesiveness" is obtained from the ratio of the area under the curve of the second cycle between the first. It has no dimension and the larger numerical values indicate greater cohesion.

"Adhesiveness" is instrumentally defined as the area under the negative part of the curve during the first cycle and represents the work needed to remove the probe from the sample. It is measured in grams per second (g.s)<sup>6-7</sup>.

### Results

With the information on the water content and the hardness, cohesiveness and adhesiveness, graphics have been designed obtaining the mathematical equations that best fit the experimental curves.

The adhesiveness and hardness graphics compared to the water content can be expressed by exponential equations with e base, extremely important in mathematical applications to physical and chemical sciences such as:

$$Y = A_1 e^{-\left[ \frac{x_0 - x}{t_1} \right]}$$

Where Y is the hardness or adhesiveness and x is the percentage of water in the peloid. The value of the constants A1, x0 and t1 shown in the equation are summarized in Table 1. The relationship between cohesiveness and the water content is almost constant over the concentration range studied.

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**Table 1**

<b>Material</b>	<b>Parameter</b>	<b><math>x_0</math></b>	<b><math>A_1</math></b>	<b><math>t_1</math></b>
Bentonita Al	Hardness	50.1	827.7	5.5
	Adhesiveness	50.1	9455.3	6.0
Bentonita Mg	Hardness	57.6	615.1	3.9
	Adhesiveness	57.6	7055.4	4.2
Kerolita	Hardness	48.8	734.1	2.3
	Adhesiveness	48.8	7040.0	2.2

**Keywords:** Peloids, Mud Therapy, Instrumental Texture, Hardness, Cohesiveness, Adhesiveness

# Thermophysical study of peat from the Iberian Peninsula for thermotherapeutic applications

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## Introduction and Objectives

Peat consists of hyper-thermalised peloids which are made up of a peaty solid component and a liquid component, mainly mineral waters but which can sometimes be seawater. The solid component is made up mostly of an organic plant decaying part, and is the most abundant part, while the inorganic component, which can reach up to 40%, varies according to the composition at its place of origin. The therapeutic use of peloids is called pelotherapy and is focused on treating different pathologies. An analysis of their physico-chemical properties is of great importance to ascertain whether such products are ideal for thermotherapeutic applications.

Peat has hydrotherapeutic value because of its organic content and is used in treating rheumatisms, sports injuries, metabolic disorders, skin problems, gynaecology, allergies, and for cosmetic treatments.

This study looks into the thermophysical properties of several peat samples collected from the Iberian peninsula to assess whether they are suitable for use in thermotherapy.

## Materials and Methods

The peat used comes from the Iberian peninsula.

The following physico-chemical characteristics are studied: density and specific heat. Both are important to the ideal application of peat.

The density measurement has been analyzing for pycnometry. The technique is described in Deeds and Van Olphen (1961) using hexane and tridistilled water as reference liquids. The specific heat has been measured in a Calvet microcalorimeter.

## Results

The obtained density values in the studied temperature range are between 1000 and 1200 kg/m<sup>3</sup> for organic phase and the mixtures of peat + waters. The specific heat increases with increasing concentration of the waters. Thus, the more concentrated samples exhibit also higher increase in specific heat values with the temperature

## Conclusions

For the preparation of a peloid is important to take into account the thermophysical properties (density and specific heat). The results of this study can

be used in the spas or thermal centres to determine the suitability and quality of the peats for pelotherapy

**Keywords:** Peloid, Peat, Thermophysical Properties

# Société Française de Médecine Thermale

## Session 07

### Papers

The paradigm of therapeutic education of the patient

*P CARPENTIER, B SANDRIN-BERTHON*

Therapeutic education programs for the patients with chronic venous disease in the setting of spa resorts

*P CARPENTIER*

Metabolic Syndrome: education programmes to improve the health of the patients with metabolic syndrome in spa environment

*P JEAMBRUN*

Development of a therapeutic program for patients with fibromyalgia in spa resorts

*A FRANCON*

Therapeutic education for patients with low back pain. implementation of a program in a spa center and monitoring the quality

*R FORESTIER, A FRANCON, M ESTEVE, G BRIACON*

Withdrawal from benzodiazepines in Spa Treatment

*O DUBOIS*

# The paradigm of therapeutic education of the patient

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The health of patients with chronic diseases cannot be improved substantially on the long run by the treatment of their lesions or even of their disease alone. They need in addition a patient-based approach, involving their ability to participate in the management of their disease. Therapeutic education fall within the scope of patient-based treatment approach. Its purpose is to help the patient with chronic disease to achieve the changes in lifestyle and health related behaviors required by his health condition and to cope with the everyday limitations he encounters. This is carried out through structured programs involving both group workshops and face to face interviews conducted by specially trained health professionals, aiming at improving his knowledge, skills and motivation. Although at first restricted to diabetes mellitus and asthma, the field of therapeutic education of the patient now widened to almost any chronic disease, and spa resorts have proven to provide a suitable setting for the development of such therapeutic education programs.

This presentation will review the concepts, the practical requirements and some examples of therapeutic education programs.

**Keywords:** Therapeutic Education; Patient Education; Chronic Diseases

# Therapeutic education programs for the patients with chronic venous disease in the setting of spa resorts

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## Background

Severe chronic venous disease (CVD), with a high risk of leg ulcer, is found in more than 5% of the adult population of industrialized countries. Each year, in France, such 30 000 to 40 000 patients benefit from a spa treatment in one of the 13 resorts accredited for this disease, and we wanted to take this opportunity to develop therapeutic education programs dedicated to these patients, aiming at improving their knowledge, skills and motivation for their treatment, and to improve their health related behaviors and lifestyle (physical activity, weight control, compliance to elastic stockings, etc...). Two programs were developed: the first one to be organized in a regular 3 weeks spa treatment for CVD, and the second one with a specifically designed intensive spa treatment of six days for patients with severe deep vein thrombosis.

## Methods

The first program was developed by a pluri-professional working group of 15 health professionals developed for patients with advanced CVI, with the help of a group of patients. This program includes for each patient: an individual educational diagnosis, three interactive groups workshops, and an educational personalized follow up by phone interview. The second program was developed in the same way, and organized as a six days training course for small groups of 6 to 10 patients who benefit from one individual educative consultation, four group education workshops and six sessions of active balneotherapy, also aiming at educational objectives. These two programs were experimented in five different venous spa resorts.

## Results

During experimentation, one hundred forty eight patients with advanced venous insufficiency (CEAP classes C4 to C6) were enrolled in the first program. After a 3 months follow-up, the evaluation by phone interview (1% drop-out) showed that 61% of the health behavior objectives were fully achieved, 21% partially obtained and 18% unreached; 83% of the patients fully achieved at least one objective. In the mean time, the CIVIQ score decreased in 69% of the patients ( $p < 0.01$ ).

The second program was experimented in twelve women and nine men (median age 58 years; 20-89) with a recent severe proximal deep vein thrombosis. No drop-out was observed during follow-up. Every participant declared a high satisfaction level and achieved at least one behavioral change objective at two months. Two and six months follow-up showed a significant improvement of the CIVIQ2 and Euroqol 5D quality of life scales ( $P<0.01$ ), the VCSS ( $P<0.05$ ) and the Villalta score ( $P<0.01$ ).

**Conclusion.**

On the basis of these results, the first program obtained a national accreditation by the French National Health System for patients with advanced chronic venous insufficiency. The second program is presently applied in a randomized controlled trial which has just started.

*Works supported by grants from the Association Française pour la Recherche Thermale (#2008-07 and 2009-02)*

**Keywords:** Balneotherapy; Patient Education; Venous Insufficiency; Post-Thrombotic Syndrome

# Metabolic Syndrome: education programmes to improve the health of the patients with metabolic syndrome in spa environment

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## Introduction and Objectives

The association between abdominal obesity, insulin-resistance, type 2 diabetes, dyslipidemia and arterial hypertension has been known for many years. Metabolic syndrome represents an adverse metabolic state since it confers an increased risk for both type 2 diabetes and cardiovascular disease. Targeting physical inactivity and obesity with lifestyle changes is the cornerstone of the prevention and treatment of the metabolic syndrome.

This programme is for persons with metabolic syndrome according to the definition of NCEP-ATPIII.

## Materials and Methods

Quality criteria for educational interventions

- Processes centred on the patient with individual discussion
- Tracing with an educational file
- Team work multi-occupational (physicians, dieticians, sports teachers) and inter-sectors (spa-resort, family physicians, specialists, patients' associations)
- Formation of contributors
- Coordination procedures between contributors

Methodology

Workshop with persons from different horizons : specialist of medical education and public health, physicians, directors of spa-resorts, associations of patients, nutritionists.

## Results

Framework of the program

- Course of the patient which allows to determine the activities in which he will take part during the cure: diet, workshops, conferences, personalized physical activities with coaching
  - At the end of the cure: results and plan of action when return at home and following during a year
  - Propositions are given to the family physician
- Course of the cure



D1 • Medical consultation

- Evaluate patient's situation, its practices as physical activity and diet
- Agree upon activities which the patient will follow during the cure

D1-D21

- Participation in different workshops or activities which are obligatory or optional

systematic during the first week

- understand what is the metabolic syndrome
- improve his feeding habits
- have an adapted physical activity

optional

- food and stress
- food and social life
- learn cooking
- learn reading labels
- physical activities with coach

D21 • Medical consultation

- Assessments of the cure and plan of action for the following year
- Letter for the family physician

**Conclusions**

One year later

Evaluate if aim of the cure is reached in physical activities and food habits.

**Keywords:** Metabolic Syndrome, Balneocrenotherapy, Therapeutic Education

# Development of a therapeutic program for patients with fibromyalgia in spa resorts

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## Background

Fibromyalgia syndrome (FS) is characterized by chronic pain, sleeps disturbance, fatigue and often psychological distress and has a negative impact on family, professional and social life of patients. According to recent guidelines, the optimal treatment of FS requires a multidisciplinary approach with a combination of pharmacological and non-pharmacological (exercise programs, heated pool treatments, cognitive behavioral therapy, relaxation, rehabilitation, physiotherapy and psychological support ...) treatments. Therapeutic education programs could be also beneficial but today none of them have been yet validated.

## Therapeutic program for patients with fibromyalgia in a spa resort

Spa resorts can offer many non pharmacological treatments for FS. They also could be interesting places to introduce therapeutic education programs.

On initiative of Conseil National des Exploitants Thermaux (CNETh), a workshop has been conducted by a therapeutic education program specialist, spa resort's physicians, spa resort's directors and patients association's representatives. The aim of this workshop was to build a project of specific therapeutic program to manage patients with fibromyalgia during a stay of three weeks in spa resorts; combining specific spa treatments with a therapeutic education program.

### 1°) Spa treatments especially adapted for FS patients

Spa treatments are composed of "essential" treatments (bath and pool of mineral water with exercises, massages) and optional treatments (mud, low pressure showers, underwater showers). These treatments should be applied progressively. The tolerance and particularly the fatigability of the patients should be monitored.

### 2°) Therapeutic education program

The aim of this program is to improve the activities and to maintain participation to family, social and professional life.

### Course of the therapeutic education program:

.at D1 .First medical consultation and first shared educational assessment (carried out by a health professional trained to the therapeutic education program: physician, nurse, physiotherapist ...)

.from D1 to D21: participation in different workshops or activities (led by professionals trained to the therapeutic education) which are obligatory or optional.

Obligatory workshops: “understand what is FS”, “manage pain and stress”, “well sleeping”, “perform an appropriate physical activity” (individual interview with a medico-sportive teacher, participation to the physical activities according to a customized program). Optional workshops: “using medical treatment as advised”, “live with my FS”

.at D21: Second shared educational assessment realized by the assessment of the program and agreement on a future customized action plan and second medical consultation with validation of the customized action plan, addressing a medical report to the usual physician.

Three months later the stay in the spa, by phone, third shared educational assessment: update of the implementation of the customized action plan, assessment of the achievements on the general aim (activities and participation to the family, social and professional life).

This program will be proposed for French spa resorts with the medical orientations “Rheumatology” and “Psychiatry”. Currently therapeutic education programs don’t get reimbursed by the French National Health Assurances.

# Therapeutic education for patients with low back pain. Implementation of a program in a Spa Center and monitoring the quality

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## Introduction and Objectives

Low back pain is a public health problem resulting in a significant disability for patients and high costs for the social insurance system.

Many studies show that sedentary lifestyle and apprehension in activity promote transition to the chronic stage.

Spa centers, in which thousands of patients with low back pain are treated every year, could be an ideal location to conduct patient education program, aiming to restore the confidence of patients in physical activity.

The implementation and quality monitoring of a therapeutic education program focused on chronic low back pain in the spa center of Aix-les-Bains is presented.

## Materials and Methods

### Implementation of the education program

The program is delivered by a physiotherapist, a gym teacher and a psychologist. It is intended for patients admitted to 5 days spa treatment. The education program is delivered in addition to the usual spa treatment.

It begins with a personal interview, conducted by the physiotherapist, who seeks the patient's needs, expectations, and responsiveness to education. It assesses the patient's personal resources and leads to a personalized education program that defines the skills to be acquired. Patients complete two self-administered questionnaire during this initial evaluation: the OSWESTRY (which assesses the impact of low back pain on daily activities) and FABQ (which assesses fears and beliefs of the patient about the back pain).

With the guidance of physiotherapist, patient chooses the personal program, in a panel of workshops that include aerobic exercises, water exercises, relaxation and sophrology, information on low back pain and a session based on the back book. The physiotherapist completes the initial interview by giving the patient a booklet of therapeutic education that includes information about chronic low back pain inspired from the Back Book, an illustrated reminder of movements that will be

taught during the program and a tracking sheet that the patient is supposed to fill throughout the year to assess his physical activity.

The 5 days program ends with an interview with the therapist who will make the follow up by phone during the year. The telephone follow-up is performed at 3rd, 6th and 9th month. It is intended to maintain physical activity habits that have been taught in the education program of patients. It also allows monitoring patient's clinical evaluation by OSWESTRY disability questionnaire.

### **Results**

Quality control

The clinical outcomes of the first 89 patients included in the program will be presented.

### **Conclusions**

A patient education program for low back pain have been developed in a french spa center

**Keywords:** Patient Education, Low Back Pain, Crenobalneotherapy

# Withdrawal from benzodiazepines in Spa Treatment

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## Introduction and Objectives

The recent results stemming from the STOP-TAG study have shown the way to demonstrating the considerable efficacy of psychiatric spa therapy compared to a reference treatment (Paroxetine) in generalized anxiety disorders. The study carried out on 237 patients has clearly indicated the impact of balneotherapy in this indication with indisputable evidence.

The questionable problem of withdrawal from benzodiazepines is a well-known issue throughout European countries, particularly in France. For instance, 11.2% of the French are regular benzodiazepine consumers and 70% of the prescriptions are made out to them for as long as 5 years!

No therapy has ever actually shown a satisfactory efficacy to treat the problem. The given elements converge to propose programmes of a psycho-educative kind.

## Materials and Methods

As a result, this has led us to the conclusion that a protocol, which would be set up and supervised by university academics, ensured by trained psychologists with medical withdrawal follow-up to be carried out within the spa therapy, could well allow withdrawal from this medication. The spa therapy, through its proven anxiolytic activity, is able to favour the substituting of treatment by benzodiazepine, and as a result would make withdrawal easier.

## Results

We propose here to set out the psycho-educative protocol with the support of an experiment on 73 patients, carried out in 2010 and 2011 in France together with the first results of our study.

**Keywords:** Balneotherapy, Patient Education, Withdrawal, Benzodiazepines

# Mud Therapy - Session 08

## Lectures

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# A proposal for a glossary of peloids and pelotherapy

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It has been recognized, in what health promotion, prevention, therapy, rehabilitation and skin care is concerned, that *water*, *mud* and *peloid* are commonly applied for healing purposes. However, it has been recognized too, due to the existence of serious inconsistencies related with cultural differences from country to country, the increasing demand for internationally accepted terms, such as: *health resort*, *health resort medicine*, *balneology*, *crenobalneology*, *crenotherapy*, *balneotherapy*, *thalassotherapy*, *hydrotherapy*, *natural mineral water*, *thermal water*, *climatology*, *climatotherapy*, *medical hydrology and climatology*, *fangotherapy*, *mud*, *mud therapy*, *peloid*, *pelotherapy*, *spa*, *spa therapy*, *cosmetology*, *cosmetics*, *spa*, *skin care*, *wellness*, *natural sediment* (such as, *clay*, *mud*, *mire*, *slime*, *ooze*, *loam*, *silt*, *sapropel*, *turf*, *moor*, *peat*, *biofilm* or *bioglea*, *sulfuretum* and *gyttja*, and eventual equivalent terms used in other idioms, such as *argila*, *barro*, *ton*, *lodo*, *limo*, *boue*, *schlamm*, *schlick*, *fango*, *glaise*, *barégine*, *muffe*, *torf*, *biogeleia*, *sulfuraria*), *naturally matured mud*, *modified natural mud*, *mud varieties*, *peloid varieties* (such as, *primary peloid*, *secondary peloid*, *natural peloid*, *matured peloid*, *peloid s.s* or *peloid sensu strictu*, *medical peloid*, *cosmetic peloid*, *parapeloid* and *extemporaneous peloid*), *peloid properties* (such as, *adhesiveness*, *heat capacity*, *specific heat*, *thermal conductivity*, *thermal diffusiveness* and *centesimal composition*).

The meaning of many of these terms is different in different countries. For instance the meaning of the term *spa* is different in USA, Canada, as well as in U.K, from the European countries where the term *spa* is equivalent to *Spa Therapy* or *Health Resort Medicine*. Even the international general acceptance of these methods and terms referred to is not fully recognized, in spite of the efforts of several researchers. Also, for instance, does the terms *mud* and *mud therapy* are synonymous of the terms *peloid* and *pelotherapy*?

Unlike the term *mud* the term *peloid* has no geological meaning, but just medical or cosmetic meaning. The terms *mud* and *mud therapy* are currently used in the English idiom. On the other hand, the terms *peloid* and *pelotherapy* are currently used in Latin derived idioms. However, the term *mud* has not a precise geologic meaning, because it does not express the specificity in terms of origin and composition of the water bearing and plastic *natural sediment*. *Mud* solid phase can be soil, weathered rock, sediment or clay, all of diverse origin and composition. *Mud* liquid



phase can be water of diverse composition and origin: rain, spring, river, lake, lagoon, or sea. The distinction of both source and deposition environment could be achieved using, for instance the expressions *volcanic mud*, *thermal spring mud*, *salt lake mud*, *marine mud*, *river mud*, and *peat mud*.

A comprehensive glossary with the terms referred to and with the corresponding technical definitions does not exist. A glossary in English, the idiom worldwide used for science communication is being prepared by an *ad hoc* Working Group<sup>1</sup> constituted of senior researchers from several European countries and with varied scientific backgrounds, in order to respond to the inconsistencies particularly found in the literature regarding the meaning of many terms involved in the use of both mud and peloid for therapeutic and skin care purposes. The terms and definitions which have already deserved consensus are disclosed in our presentation.

<sup>1</sup> Working Group: Celso Gomes (PT); María Isabel Carretero (SP), Manuel Pozo (SP), Francisco Maraver (SP), Pedro Cantista (PT), Francisco Armijo (SP), José Luis Legido (SP), Frederico Teixeira (PT), Michael Rautureau (FR), Fernando Veniale (IT), Rafael Calvo-Flores (SP)

# Biophysical skin effects of peloids according to their maturity time

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## Objectives

This study was designed to assess the skin response to daily use for 10 and 20 days on forearms of 33 healthy volunteers aged between 18 and 40 years ( $23.3 \pm 4.4$ ) when applied 5 peloides with 0 (P0), 3 (P3) and 6 months of maturation (P6). The objective was to determine changes in blood flow, viscoelastic skin properties, pH, dermal density and transepidermal water loss (TEWL) on these areas and compare the results according to the maturity of each peloid.

## Materials

Five peloids were prepared mixing the same magnesium bentonite with 4 mineral waters and sea water in the same proportion (1:2.4), except a sodium chloride mineral water, which was mixed 1:1.6, in order to obtain the same viscosity as above. These peloids were subsequently matured in the same environment.

## Methods

Biological responses were determined using 5 non-invasive techniques: laser Doppler velocimetry, cutometry, pH-metry, reviscometry and tewametry. These determinations were performed on P0, P3 and P6.

## Results

Significant differences were produced as a function of mud aging time.

Skin firmness (Uf) increases after application of matured peloids P3 and P6. Skin elasticity (Ua/Uf) and pH are reversed compared to P0 when applying P3, however, P6 peloid behaves similar to P0.

Cutaneous blood flow values (PU) has a very peculiar behavior, practically unchanged when applying P0, decreases when applying P3 and increases with P6.

Finally, viscoelastic elongation ratio (Uv/Ue), skin fatigue, TEWL and dermal density are not modified by peloid maturation.

**Conclusion**

Our findings indicate that it is possible to modify the biomechanical, pH and cutaneous blood flow behaviour of skin through surface treatment with natural extemporaneous peloids. Furthermore, the effects which occur when applied muds during 20 days are accentuated when compared to the 10 days of application.

# Mud cure in Russia: history, achievements and prospective

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Mud cure in Russia has a long history. From the beginning of XIX century it became one of the basic directions of resort treatment. Mud cure in Crimea became a basis of the Russian school of peloidotherapy. In 1828 first-ever mud resort was Saki officially opened in Saki. During the Crimean War (1853-1856) under N.I.Pirogov's offer mud treatment of the wounded in a backbone and a spinal cord was practiced in Saki

Basic formation of the Russian school of mud cure has occurred in Soviet period. Large researches on studying quantity of mud resources of the country, their genesis, physico-chemical and biological properties, the mechanism of physiological and therapeutic influence were conducted. Optimal methods of treatment were developed taking into account physical and chemical properties of the mud, activity of its environment at different diseases depending on a stage and expressiveness of a clinical picture.

Thus it is proved that the degree of physiological changes at different types of mud is not the same, and muds of various physical and chemical composition at the same temperature and different parameters can cause ambiguous responses of an organism.

Various methodical techniques were developed: baths, applications, abdominal procedures, local baths for hands and feet, combined techniques mud cure (galvano-mud cure, diathermomudtherapy, electro-and phonophoresis of mud solution, magnetic and mud therapy etc.). Balneo-mud economy was put on a new level (extraction, processing and transportation of mud, its storage, regeneration, heating, etc.).

In recent years methods of thin-layer mud therapy, mud baths have been implemented actively. Also new data of the mechanism of mud-cure procedures' action was obtained and indications for their appointment were expanded( at such diseases as chronic obstructive illness of lungs, seronegative spondylitis etc); works on finding of an optimum temperature mode (the application of peloids of low and moderate temperature) and localizations of influence of mud cure were held. Scientific bases of appointment of the mud therapy procedures in the early regenerative period after surgical interventions are developed.

As to prospects of the development of scientific and practical mudtherapy in our opinion it is necessary to continue researches on studying of the mechanism and specificity of biological and therapeutic action peloids of different structure, creation of the unified system of efficiency estimation of mud treatment procedures taking into account principles of evidence-based medicine.

Expansion of indications, optimization and perfection of methods of mud cure, studying questions combined use of mud cure and pharmacotherapy for the purpose of increase of efficiency of treatment, reduction of doses of medicines, overcoming resistance to them – all these issues remain of current interest.

**Keywords:** Mud Cure, Mud Baths, Methodical Techniques

# Clinical effects of mud-bath therapy in patients with psoriatic arthritis treated with TNF-inhibitors

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## Introduction and Objectives

Mud packs and thermal baths have been used since ancient times for the treatment of rheumatic diseases and other musculoskeletal disorders. Many studies have demonstrated the utility of thermal therapy in chronic inflammatory rheumatic diseases, but only a few data have been reported in psoriatic arthritis (PA).

The aim of this work was to evaluate the effects of a cycle of mud-bath treatment, in addition to pharmacological therapy with TNF-inhibitors, on the clinical manifestations of psoriatic arthritis (PA).

## Materials and Methods

After obtaining permission from the local Ethics Committee, 32 patients with PA (24 women and 8 men, mean age 53.2 years and mean disease duration of 11.8 years), in follow-up in the Rheumatology Unit of Padova University were enrolled. All had peripheral joint involvement and were treated with TNF-inhibitors (adalimumab, etanercept or infliximab) for at least six months. Patients were randomized into two groups: 18 were submitted to a cycle of mud-bath treatment maintaining pharmacological therapy (group A), 14 were treated with TNF-inhibitors alone (group B, controls). The mud-bath treatment was performed in a spa resort of Montegrotto, near Padova in North-East Italy, according to the classical schedule used in the Euganean Thermal Area.

Both group of patients were evaluated with clinical indexes and validated questionnaires to measure disease activity and health status perceived by the patient (DAS28, number of swollen and tender joints, GH, VAS pain, BASDAI, PASI, HAQ, SF-36). CPR serum levels were also measured. The evaluations were performed at baseline (T0) and after 45 days (T1). Statistical analysis was performed by Student t-test and Wilcoxon test.

## Results

In patients treated with thermal therapy (group A), all clinical parameters (DAS28, number of swollen joints and tender joints, VAS pain, BASDAI, PASI,

HAQ and SF36)) improved significantly at T1 in comparison to baseline. CPR levels, within the normal range at T0, remained unchanged at T1.

In contrast in patients treated with pharmacological therapy alone (group B), all evaluation parameters showed no significant variations between T0 and T1.

### **Conclusions**

The improvement of DAS28 and of the other clinical indexes in the group of patients treated with mud-bath therapy and their deterioration in the group treated only with TNF-inhibitors demonstrates the favorable effect of thermal treatment in PA. The significant reduction of PASI suggests the beneficial effect also on the extension and severity of skin lesions.

These results are consistent with those of the few controlled studies published in literature and confirm that patients with PA can receive a further clinical improvement from a cycle of mud-bath therapy in addition to TNF-inhibitors.

**Keywords:** Psoriatic Arthritis, Mud-Bath Therapy, Clinical Assessment

# Impact of peloidotherapy on histological structure of dermis and muscles

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## Introduction and Objectives

The physical component of the action of mud on the human body refers to the existing mechanical and thermal conditions during application. Mud thermotherapy is possible due to mud's properties to maintain temperature. This capability of mud allows its application at higher temperatures than body's temperature. There is a slow transfer of heat stored in the mud, allowing the body to take over an amount of this heat. Temperature affects living systems starting with the fundamental biophysics and molecular energy levels up to the most complex systems functionally speaking.

AIM: to evaluate if mud therapy produces histological modifications within dermis and muscle.

## Materials and Methods

### MATERIALS:

- Sapropelic mud and mineral water from Techirghiol lake;
- Glycerinate extract of medicinal plants ;
- biopsy from deltoidian region meaning subcutaneous and muscle proofs, (1,5/0,5 cm);
- Laboratory reactive, fixators, solvents, specific dyestuffs, microtom, research microscope, equipped with automatic expometer and video camera, soft of image analysis LUCIA© G;

### METHODS:

- 30 patients who received mud-therapy (wrapping, bath, ointement) and 5 who received non-peloid bath, during 12 days;
- Including and exclusion criteria were applied upon the four batches;
- The histological proofs were procesed by conventional method and were analysed at fotonic microscope.

## Results

We observed the folowing histological modifications on dermis and muscles.

- Superficial dermis:



1. the increase of the blood vessels caliber.
2. vessels of neoangiogenesis.
3. perivascular inflammatory infiltrate with: lymphocytes, plasmocytes and Rouget cells
  - Deep dermis: slight vascular congestion, and perivascular lymphocyte infiltrate
  - Muscles:
    1. unmodified muscular fibers,
    2. moderate vascular congestion.
  - Lymphocytes:
    1. positive reaction at CD45;
    2. negative reaction at CD20.

### **Conclusions**

- Because at the witness batch we haven't noticed the presence of the neoangiogenesis vessels, we presume that a biochemical component of the mud is responsible for its production. But, we haven't identified the mud factor and mechanism that produces the stimulation of this process.
- Because the increase of the caliber of the blood vessels were found at all batches it might be produced by the heat action;
- The presence of the perivascular inflammatory infiltrate might be linked to the intense antigenic stimulation produced by the application of mud on the entire tegument.
- Absence of B lymphocyte is due to the end of their task and transformation into plasmocyte and Rouget cells and presence of T lymphocyte is due to their implication into the specific immune response, after the antigens are processed by B lymphocyte.
- Neoangiogenesis underline the stimulation of reparatory capacity of the skin.

**Keywords:** Mud Therapy, Histology, Vessels, Muscles

# Impact of Mud Therapy in pathogenesis of osteoarthritis

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## Introduction and Objectives

Pathogenesis of OA is closely linked to pathogenesis of cartilage degradation. Oxidative stress, defined as the imbalance between the production and degradation of ROS, is considered to play an important role in mechanism of cartilage degradation. Peroxidation of lipids, spontaneous or catalyzed by metals (iron, copper), and self-maintained by self-catalysis, generates the production of the reactive species of oxygen (ROS). The ROS are aggressive to cells and to macromolecules of cartilage.

Non-conventional therapies using natural factors (as mineral salted water and peloid /sapropelic mud from Techirghiol Lake) are used on empiric basis from ancient times and have unchallenged benefits in rheumatic pathology, but the intimate biological mechanisms of action are yet not known.

In Techirghiol Balneal and Rehabilitation Sanatorium we used mud from Techirghiol Lake for osteoarthritis treatment. We used the mud in different ways: bath mud and heated mud packing.

The aim of the present study is to evaluate the antioxidant effect of mud therapy in patients with primary osteoarthritis in order to contribute to better understanding of the mechanism of mud treatments in osteoarthritis.

## Materials and Methods

We performed a clinical study on 30 patients with osteoarthritis with different localization. To these patients we determined the values of glutathione-reductase (GR), total antioxidant status (TAS), superoxid-dismutase (SOD), reduced glutathione (G-SH), bicarbonic anion (HCO<sub>3</sub><sup>-</sup>), the oxygen link capacity (O<sub>2</sub>CT), the oxygen contents in hemoglobin (O<sub>2</sub>CAP), blood saturation in oxygen (SO<sub>2</sub>%), partial pressure of oxygen (pO<sub>2</sub>), uric acid, lactate, blood glucose, and pH-plasma in peripheral blood, before and after mud applications.

We took blood samples in first day before and after first mud therapy after 5 days of treatment and in the end of cure (after 12 days). All patients have got physical therapy and exercise.

## Results

The effects of mud bath it seem that it is a decrease of TAS, GR and blood glucose. These results may suggest that mud therapy causes an extra oxidative stress.

On the other hand, increase in SOD, O<sub>2</sub>CT, O<sub>2</sub>CAP, pO<sub>2</sub>, SO<sub>2</sub>%, level after mud therapy may be seen as an indicator of improved antioxidant potential and activity.

**Conclusions**

Evaluation of antioxidant potential of sapropelic mud from Techirghiol in patients with osteoarthritis, through assessment of oxidative stress markers, was confirmed by a significantly statistic increase of SOD level and by a decrease of reduced glutathione level under the action of mud treatment. The increase of SOD level after mud treatment suggests a positive response of the body, considering the positive role of enzyme in ROS neutralization and NO inactivation. The levels of glutathione reductase, uric acid or blood glucose, protective factors in oxidative stress balance, haven't been influenced by mud treatment. This conclusion emphasizes the protective character of mud therapy on oxidative stress, the enzymes with positive effect on this metabolism increasing, as in SOD case. The obtained results, confirm antioxidant action of mud and offers a solution for osteoarthritis treatment.

**Keywords:** Oxidative Stress, Mud Therapy, Superoxid-Dismutase, Glutathione-Reductase

# Effects of mud-bath applications on synovial inflammation evaluated by contrasted-enhanced ultrasound (CEUS) in patients with psoriatic arthritis

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## Introduction and Objectives

The effects of mud packs and thermal baths on inflammation are complex and not yet fully understood. However, a recent basic research has shown favorable results on animal models of chronic arthritis (Cozzi F., et al. Clin Exp Rheumatol 2004; 22:763-6).

The aim of the study was to evaluate the effects of thermal applications on synovial inflammation in psoriatic arthritis (PA), using a new diagnostic method, the contrast-enhanced ultrasound (CEUS), able to a precise detection and quantification of finger joint vascularity (Stramare R, et al. J Clin Ultrasound 2012 Jan 30).

## Materials and Methods

After obtaining permission from the local Ethics Committee, 32 patients with PA (24 women and 8 men, mean age 53.2 years and mean disease duration of 11.8 years), in follow-up in the Rheumatology Unit of Padova University were enrolled. All had peripheral joint involvement and were treated with TNF-inhibitors for at least six months. Patients were randomized into two groups: 18 were submitted to a cycle of mud-bath treatment maintaining pharmacological therapy (group A), 14 were treated with TNF-inhibitors alone (group B, controls). The mud-bath therapy treatment was performed in a spa of the Euganean Area (Italy). Both groups were evaluated at baseline (T0) and after 45 days (T1).

All patients were submitted to CEUS, in order to detect the finger joint vascularity. The films obtained were evaluated by a blinded experienced Radiologist, who used the three-point score (0 – 2) recommended by the IACUS study group (Klauser A, et al. Eur Radiol 2005; 15:2404-10), and were processed with a dedicated software, developed in collaboration with the Department of Information Engineering of Padova University, able to determine a panel of vascularity parameters. Statistical analysis was performed by Student t-test and Wilcoxon test.

## **Results**

The score at T0 demonstrated a low grade of vascularity in both groups. The Radiologist did not detect significant variations at T1 and in particular the score remained unchanged in 12 patients (66.7%), improved in 4 (22.2%) and worsened in 2 (11.1%) in group A, remained unchanged in 10 patients (71.4%), improved in 2 (14.3%) and worsened in 2 (14.3%) in group B. The processing of the films by a dedicated software showed at T1 a favorable variation of vascularity parameters in patients in group A, in comparison to controls.

## **Conclusions**

Our data suggest that patients with PA with low active disease induced by TNF-inhibitors can receive a further improvement from a cycle of mud-bath treatment. CEUS revealed in these patients a slight reduction of vascularity parameters at time T1 compared to baseline, while in those treated with TNF-inhibitors alone showed an opposite trend.

These results are in agreement with the clinical improvement observed in patients with PA submitted to thermal therapy, reported in other studies.

**Keywords:** Psoriatic Arthritis, Mud-Bath Therapy, Contrast-Enhanced Ultrasound (CEUS)

# Chondrogenic effect of the sulphuric peloid from banja koviljaca in remodeling of the femoral head in children with M.Perthes

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## Introduction and Objectives

Perthes disease is characterized by osteonecrosis of the femoral head in a child in development. The disease may affect epiphyseal plate and metaphysis, resulting in the secondary changes of acetabulum. It occurs at the age of 3-12, more often in boys, and the most possible cause is generalized disorder of the skeletal maturity. The objective of this study was to present chondrogenic effect of the sulphuric peloid from Banja Koviljaca in remodeling of the femoral head in children with M.Perthes in during the 22 years time period of observation.

## Materials and Methods

In the time period between 1989 and 2011, at the Children's Department of the Specialized Rehabilitation Hospital, 1136 children were treated after being operated on for Morbus Perthes. There were 892 boys and 244 girls. Most children were operated on for M.Perthes, and 8 children had bilateral M.Perthes, Catterall groups 3 et 4. The sulphuric from Banja Koviljaca was applied in all children admitted for the physical treatment, and paraffin was applied in the control group, where application of peloid was contraindicated (sma, traum. paraplegia, myotonia) 12 in total.

## Results

After physical treatment. Most children (1104) were allowed to gradually lean on the operated leg completely. The motion range was increased in all directions to full. The circumference of the limbs was increased for 2.5 cm on average in comparison to the healthy leg. The muscle strength according to MMT was increased to the score being 4 to 4+ on average. The radiology report indicated remodeling of the femoral head cartilage, and the sites of osteotomy completely healed up.

## Conclusions

Application of the sulphuric peloid in M.Perthes has significant chondrogenic effect in remodeling of the femoral head, being observed empirically, because it is very complicated for proving it »in vivo«. The treatment should be started immediately after the surgical treatment. The treatment has to be long enough in order to achieve remodeling of the femoral head. Remodeling of the femoral head was not

achieved for a longer time period, up to one year, in cases where the sulphuric peloid was not applied on the operated hip. Therefore, the authors plead for using sulphuric peloid in M. Perthes in order to achieve much faster remodeling of the femoral head, and to rehabilitate children for walk and everyday activities as soon as possible. Some scientific research has been initiated in this direction. Therefore, our further studies will be oriented toward this direction on the cellular level.

**Keywords:** Peloid, Perthes, Children

# Balneotherapy and mud-therapy in knee osteoarthritis treatment

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## Introduction and Objectives

Caldes de Boí-Tartera water(temperature 43,2°C; dry residue 110°C:286mg/l; Chloride:54,8 mg/l; Sulphate:51,3 mg/l; sodium:79,6 mg/l; Sulphide:12,7mg/l and Radon: 73 Bq/l) is being used since the XIXth century for rheumatic disease treatment and since 1950 is being used for mud maturation.

Ever since the discovery of Lanjaron-Salado springs (temperature 25,4°C; dry residue 110°C: 4.005mg/l; Chloride: 1.474 mg/l; Bicarbonate: 756 mg/l;Sulphate: 129 mg/l; sodium: 803 mg/l; Calcium: 235 mg/l and iron : 14 mg/l) there is constant evidence of locomotory affections treatments in the thermal center.

Objectives:

The aim of this study is to compare the therapeutic effects of balneotherapy, parafango therapy, not fully matured mud and the use of matured mud in knee osteoarthritis (KOA)

## Materials and Methods

It is a descriptive, controlled, prospective follow-up, multicenter study which includes Caldes de Boi and Lanjaron Thermal Centers.

135 patients from Lanjaron Spa with KOA that fulfill American College of Rheumatology's (ACR) criteria and KOA's radiological criteria were randomized distributed into three groups: 45 patients were treated every day, during 10 days, with parafango and Lanjaron Salado mineral water bath (36-38 °c) and also steam bath; 45 patients followed treatment with not fully matured mud (45-47 °C) together with Lanjaron Salado mineral water bath (36-38 °c) and also steam bath; 45 patients were treated with Lanjaron Salado mineral water bath (36-38 °c) and steam bath only.



80 patients from Caldes de Boí Spa with KOA that fulfill ACR's criteria and KOA's radiological criteria were randomized distributed into two groups: 40 patients were treated every day, during 10 days, with maturated mud and Caldes de Boí- Tartera mineral water bath (36-38 °c) and also steam bath; 40 patients were treated every day, during 10 days, with Caldes de Boí- Tartera mineral water bath (36-38 °c) and steam bath only.

All patients were evaluated before and after 10 days of balneology treatment (functional evaluation, body mass index, muscular and joint balance; VAS pain scale, Lequesne's scale, WOMAC scale and SAR-M scale).

### **Results**

All protocol treatments showed their efficiency by improving both symptomatology and functionality. Better results were obtained when mud or parafango were used.

### **Conclusions**

Osteoarthritis is the most common rheumatic disease in developed countries. Conservatory osteoarthritis treatment is based on pharmacological management. With this study we can conclude that balneotherapy is a good complement to decrease pain and improve functionality in knee osteoarthritis. Better results are achieved when local thermotherapy methods are used, such as: parafango or mud.

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**Keywords:** Balneotherapy, Knee Osteoarthritis, Chlorided-Ferruginous Mineral Water, Sulfured Mineral Water, Mud-Therapy.

# Biology - Session 09

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# Vetriolo's (Trentino, Italy) thermal water modulate the negative effect of interleukin-1 $\beta$ in human osteoarthritic chondrocytes

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## Introduction and Objectives

Spa therapy is one of the most commonly used non-pharmacological approaches for osteoarthritis (OA). The water “Debole di Vetriolo” (VW) is known for its therapeutic properties in the treatment of OA. This is a highly mineralized water, strongly acidic, sulfate, rich in iron, it is also rich in other minerals. The aim of our study was to investigate the possible in vitro effects of the VW in human OA chondrocytes cultivated in the presence or in the absence of Interleukin-1 beta (IL-1 $\beta$ ).

## Materials and Methods

Human OA chondrocytes were detached from the culture flasks by a mild trypsin treatment and then seeded at 4x10<sup>4</sup> cells into wells containing 2.0 ml of either DMEM medium, whose chemical constituents had been dissolved in Deionised Water (DW) (controls in DW-DMEM), or in one four different in VW, in which DW had been totally (100%) or in part (25% or 50%) substituted with VW. All samples were analyzed before and after treatment with IL-1 $\beta$  at a concentration of 5 ng/ml. Cells viability was evaluated by MTT assay, metalloproteinase-3 (MMP-3) by a solid phase Enzyme Amplified Sensitivity Immunoassay (EASIA) and nitrite concentrations by the Griess method. Immunocytochemistry was also performed to localize the inducible nitric oxide synthase (iNOS). The incidence of apoptosis and necrosis were evaluated by Annexin-V-FITC and Propidium Iodide assay and a morphological analysis was performed by transmission electron microscopy (TEM).

## Results

In chondrocyte cultures reconstituted with DW-DMEM or with VW, low levels of MMP-3 and NO were detected at basal conditions, while in the presence of IL-1 $\beta$  the levels of MMP-3 and NO were significantly increased (p <0.001). In cultures stimulated with IL-1 $\beta$  and reconstituted with VW to 25%, 50% a significant decrease in the levels of MMP-3 and NO (p <0.001) was observed in comparison to

chondrocytes cultivated in DW-DMEM controls. The localitation iNOS, the percentage of apoptosis and necrosis and the morphological findings obtained by TEM confirmed biochemical data.

### **Conclusions**

In conclusion, this in vitro study demonstrates that the water "Debole di Vetriolo" counteracts the IL-1-beta induced effects in human OA chondrocyte cultures. Our data seem to suggest a protective role of this water in cartilage metabolism.

**Keywords:** Chondrocyte, Interleukin 1 beta, "Debole di Vetriolo" Water, Osteoarthritis

# Radon: place in Medical Hydrology: a review of literature

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Only a few therapeutic tools have been reported as having both, positive and negative action for human health, such as radon gas. The range of informed actions goes from a mild analgesic effect in patients with rheumatoid arthritis who inhale the gas, to lung cancer in miners (chronic exposition).

European and Japanese communications, favors the radon inhalation therapy, while in the Saxon medical literature the therapeutic value of radon is literally ignored.

In the '90s, begin to appear studies where the focus was proving that the inhalation of radon coming from mineral water, promotes complex systemic changes.

Japanese researchers detected systematically, a number of actions occurring without immersion after a few days of breathing in a radon atmosphere. They confirmed that radon inhalation for few days, have an antioxidant action, modify the joint pain in osteoarthritis and rheumatoid arthritis.

In USA medical literature, the lonely voice of Luckey, defending Hormesis Theory for the last 30 years is only audible.

The paradigm of radiobiological science, has been for years "any radiation is dangerous" and "there is a certain risk at each exposure to radiation"

Hormesis theory describe and explain how in defined situations, an agent usually lethal at high doses produce beneficial stimulation at low doses.

We review the medical literature generated last 30years about radon, concluding that coexist two opposite position;

a) Any inhalation of radon is always dangerous and eventually, responsible for lung cancer

b) Inhalation of small doses of radon produces -through Hormesis phenomenon-, healthy and useful effects in certain clinical setting.

By some reason, nature has arranged that we must coexist in harmony with the natural radiation.

It will be necessary further research and greater rigor to know completely the action of radon gas inhaled from hot springs.

**Keywords:** Radon, Balneology, Hormesis

# Which is better for health promotion activity in a forest, Nordic walking or normal walking?

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## Introduction and Objectives

In Japan, exercise therapy is believed to be one of the essentials for balneotherapy. Since hot spring areas usually have forest environments, walking in a forest is recommended for patients and visitors. It has been reported that walking in forest environments significantly enhances human immune function, reduces the levels of stress hormones such as urinary adrenaline and noradrenaline, and increases the score for vigor and decreased the scores for anxiety, depression, fatigue, confusion and anger on the Profile of Mood States (POMS) test. On the other hand, Nordic walking (walking with poles) activity in obese women allows an increase in exercise intensity and adherence to a training program without increasing the perception of effort leading to enhanced aerobic capacity compared with normal walking, which means Nordic walking is more preferable than normal walking for obese women. Therefore, we hypothesize that performing Nordic walking in a forest has more beneficial effects than those by normal walking.

## Materials and Methods

Twelve university students (7males and 5 females, 22-26 years old) participated in the present study. They walked in a forest for 30 min, twice a week, ten times with or without poles. Changes in mental conditions were determined by Mood Check List-Short Form (MCL-S.1). Peripheral blood circulation was analyzed by accelerated photoplethysmography (APG).

## Results

The pleasant sensation increased significantly ( $p < 0.05$ ) and the anxiety sensation tended to decrease ( $p < 0.1$ ) after the first normal walking and Nordic walking. The relaxation sensation showed no changes. On the last day, the pleasant sensation significantly increased ( $p < 0.05$ ) after Nordic walking but only increasing tendency was observed after normal walking ( $p < 0.1$ ). Elevating tendency of relaxation sensation ( $p < 0.1$ ) was observed only after Nordic walking. The anxiety sensation did not change after both walking. We compared the resting values between the first and the last day and there was no difference between them. To know the effects of habitual exercise on mental states we mixed up the data from normal and Nordic walking together and compared the resting values between the first and the last day. There were significant improvements in pleasant, anxiety and relaxation

sensations. After the first normal walking, there were no significant changes in APG indices. However, after the first Nordic walking, Remained Blood Volume increased and arterial vascular age decreased significantly ( $p < 0.05$ ). On the last day, there was a significant increase in Differential Pulsewave Index ( $p < 0.05$ ) only after Nordic walking.

### **Conclusions**

Repetitive Nordic walking in the forests had more favorable effects on mental states and habitual exercise like a walking has a potential to maintain mental condition at a good level. Nordic walking in a forest seems to have a beneficial effect on peripheral blood flow and it is recommended for health promotion activity.

**Keywords:** Walking, Nordic Walking, Forest, Health Promotion

# Heat-shock protein 70 is affected by thermal treatment

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## Introduction and Objectives

Hormesis is defined as a biphasic dose-response and it may be graphically represented by either an inverted U-shaped dose response or by a J- or U-shaped dose response. Hormesis-stimulating factors initiate an adaptive stress response that renders cells/organisms resistant against high doses of the same agent. Therefore, also the exposure to a mild stressor confers resistance to subsequent conditions of increased stress. Moreover, even though not all mechanisms of hormesis are understood an emerging concept is that the effectiveness of an adaptive (hormetic) response elicits general protective and reparative mechanisms. After heat shock or other metabolic stress, heat-shock proteins (HSPs) are expressed at high levels in all tissues and cells. Abundant evidence shows that these proteins have pro-survival functions that include chaperone, anti-apoptotic and/or anti-inflammatory activity. Noteworthy, HSPs are known as important endogenous cell-protective proteins induced in response to a wide variety of stresses. Taking into account that the correlation between thermal treatment and HSP-70 has not been demonstrated, this study clarified the potential effects of this treatment on HSP-70 levels. In addition to explore whether different thermal treatments such as thermal steam bath in the natural grotta and thermal mud induce changes in individual levels of HSP-70, we have considered and investigated several parameters including C-reactive protein (CRP), adrenocorticotrophic hormone (ACTH), fibrinogen, insuline-like growth factor-1 (IGF-1). Specifically, we assessed the relationship between these parameters and the changes observed for HSP-70.

## Materials and Methods

20 healthy subjects over 45 years of age were enrolled into the study. Blood samples were collected after two hours from the first treatments session and after one week of treatments repeated one time a day. Study parameters including CRP, ACTH, IGF-1, fibrinogen, growth hormone (GH) were determined with methods routinely used in clinical laboratories. A quantitative real-time PCR (qRT-PCR)



protocol was developed to determine HSP-70 levels. Total RNA was isolated and retrotranscribed into cDNA. Relative quantification was performed using an house-keeping gene as reference. Data were analysed using SPSS 16.0.2 software.

### **Results**

The analysis of gene expression data shows a direct correlation between HSP-70 levels and thermal treatment. These results indicate that the variation in HSP70 expression may be dependent at least partially by the thermal treatment. Furthermore, there is a functional relationship between the changes in HSP-70 levels and the biochemical parameters analyzed in this study.

### **Conclusions**

The results provide initial insights to support the relationships between hormetic pathways and thermal treatments.

**Keywords:** Hormesis, Hsp-70, Thermal Treatment

# A possible physiological mechanism of thermal crisis during spa therapy with mud pack and sulphur baths in patients with osteoarthritis

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## Introduction and Objectives

Thermal crisis or bath reaction is an experimentally well known phenomenon which usually appears in the patients during the first week (mostly on 3rd to 5th day) of a spa therapy. It has been estimated that it is experienced as a clinical presentation up to 60% of the patients. Symptoms associated with this reaction include malaise, fever, tachycardia, headache, fatigue, insomnia and pain.

We aimed to investigate the changes in the plasma levels of oxidative system enzymes as possible indicators of bath reaction in the patients with osteoarthritis during a spa therapy course consisting of mud pack and sulfur bath applications.

## Materials and Methods

Thirty patients (20 female and 10 male) with knee and/or hip osteoarthritis (OA) of both sexes who were diagnosed according to the American College of Rheumatology Criteria included in this prospective uncontrolled study. Blood samples were taken by venipuncture before and at the end of spa therapy as well as on the 5th day for the assay of Copper-Zinc superoxide dismutase (CuZnSOD) and catalase (CAT) activity. All patients had native mineral mud pack of 420C on affected joints for 20 minutes and went into individual bath-like pool containing native sulfurous water, where the temperature was adjusted individually according to the patient's wish (32-340C) for 20 minutes a day, 6 consecutive days a week, over 3 weeks.

## Results

The mean blood SOD activity ( $\pm$ SD) before the therapy was found  $1836.47 \pm 738.92$  U/gHb. On day 5 during therapy, it was increased to  $1942.15 \pm 779.35$  U/gHb, but then at the end decreased to the level even lower than before therapy,  $1745.98 \pm 450.89$  U/gHb ( $p=0.530$ , F test). Mean measured CAT activity ( $\pm$ SD) was found  $20.56 \pm 5.86$  kU/gHb at the beginning, on the 5th day, decreased to  $18.92 \pm 4.72$  kU/gHb, and at the end it was lowest,  $16.16 \pm 3.98$  kU/gHb. This change was statistically significant as compared to before the treatment values ( $p=0.002$ , F-test).

Before therapy, mean pain (VAS) scores ( $\pm$ SD) were  $5.88 \pm 1.52$ , on day 5 they increased up to  $6.29 \pm 2.10$ , and at the end of spa treatment dramatically decreased down to  $2.93 \pm 1.70$  ( $p < 0.001$ , t-test).

### **Conclusions**

On the fifth day of the therapy, at the possible thermal crisis time, we observed increase in mean pain scores. Interestingly the same day measured values of anti-oxidative defense enzymes showed a changing pattern in opposite direction; an increase in SOD and a decrease in CAT activities. These clinical and biochemical changes may be seen as the indicators of an increased oxidative activity. At the end of the therapy course, we observed improvement in pain scores and decreases of the both enzymes' levels comparing the before therapy and the 5th day values. In conclusion anti-oxidative defense system might be involved in the development of thermal crisis and the clinical improvement as reflected in the changes of SOD and CAT activities in this study group of OA patients during and after the mud pack and sulfur bath spa therapy course. Future randomized controlled studies should investigate this hypothesis.

**Keywords:** Sulphur Baths, Mud Packs, Thermal Crisis, Superoxiddismutase, Catalase

# Thermal changes of fingers after cold exposure

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## Introduction and Objectives

**INTRODUCTION:** Vasoconstriction or dilatation in response to thermal stimuli is of physiological importance in balneology. An aberrant response different from that of normal individuals might be observed in disease status, as typified by Raynaud phenomenon. To see the response pattern might help a diagnosis, and show a guide for balneotherapy.

**OBJECTIVES:** To elucidate the sequential temperature changes after a cold stimulus to hands and fingers, that could be encountered in daily life, in connective tissue diseases (CTD) patients.

## Methods

The CTD patients who visited to our hospital from June, 2008 to October, 2009, and whose finger temperature changes were measured by thermography before and after cold stimulus, were included. The temperature was determined by infrared thermography (Infra-eye, Fujitsu, Japan). Prior to the test, the patients waited relaxing in a temperature-controlled room (25°C) for 15 minutes. From before to immediately after, and 3, 5, 10, 20 and 30 minutes after bilateral hands immersion into 10°C water for 10 seconds, skin temperature at the site proximal to the nailfold (nailfold) and the dorsum of the metacarpophalangeal joints (MCP) of 10 fingers were measured. The patterns of changing temperature were globally classified based on visual perception how the lowered temperature persisted. The normal reference pattern was adopted from our another study. As for the temperature difference among fingers, standard difference (SD) of measured temperatures of 10 fingers was studied.

## Results-Discussion

A total of 119 CTD patients, 109 females and 10 males aged 55.0±17.8 (21-81), were examined. The changing courses of the temperatures were classified into 5 patterns: (1) normal, (2) rebound, (3) progressive decline, (4) delayed recovery, and (5) persistently low. The patient number in each pattern was listed in the table. The mean and SD of 10 fingers' temperature of each patient was re-summarized as 'the mean temperature', and 'the mean of the SD' in the table.

The highest temperature was observed in normal pattern throughout the measurement, and the lowest was in persistently low pattern. The SD was the smallest in normal pattern, got the largest in delayed recovery pattern, and even lower in persistently low pattern. Totally, the mean temperature at the nailfold was lower than that at the MCP (data not shown) at any measure in patterns other than normal pattern.

This study showed that the response to thermal stimulus of human body got aberrant in disease status. The normal pattern that was classified on the basis of our previous study showed a rapid recovery after the stimuli, and in addition, almost equal temperature among the fingers. In contrast, the major aberrancy was delayed recovery, in that broken equality of temperature among fingers was observed. Rebound and progressive decline patterns were minor in number, and might be transient during the course of vasculature involvement. Persistently low pattern might be an expression of vascular remodeling.

### **Conclusions**

Evaluation of finger temperature change by thermography would be a useful tool to elucidate aberrant response to thermal stimulus.

**Keywords:** Thermal Response, Cold Stimulus, Thermography, Fingers, Connective Tissue Diseases

# Case study: geochemical transformation of saline mud (Secovelje Salina, northern Adriatic)

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## Introduction and Objectives

The Secovlje Salina Nature Park (KPSS)<sup>1</sup>, including Secovlje Salina, is located in south-western Slovenia and is important because of its aesthetic, cultural and natural values. Today, the company Salt Production Co., Ltd<sup>2</sup> protects and preserves the natural and cultural heritage within KPSS and produces salt by using centuries-old methods. Favourable climate conditions (high seasonal temperatures, winds) for the solar evaporation of brine allow the seasonal fractional crystallization leading to the production of NaCl through the evaporation and concentration of seawater in crystallization basins. Beside salt, also thermal mud and brine are important products usually used for aesthetic and therapeutic purposes. Despite the centuries-old tradition of salt-making and thermal tourism, preparation of muds for pelotherapy is mostly based on practical experiences. However, the last few years the intense study of salt production processes and saline mud begun.<sup>3,4</sup> A case study of transformation of saline mud, traditionally characterized as the best peloid material, from crystallization basin is presented.

## Materials and Methods

Mud (uppermost 10-15 cm sediment) samples were taken from the corner of the crystallizer basin monthly (2009: Mar-Sep and 2010: Apr-Oct) by hand using polyethylene sample containers. The freeze-dried samples were used for elemental (organic carbon, total nitrogen) and spectroscopic (FT-IR) analyses. Prior to geochemical analyses, the samples were milled in an agate mortar to a particle size of <50 µm. Bulk mineralogical composition was determined via X-Ray Powder Diffraction (XRD) and geochemical elemental analyses were performed with X-Ray Fluorescence analyser (XRF).

## Results

The FT-IR and XRD results are in accordance with previous studies of saline mud indicating major mineral constituents: carbonates (calcite), silicates (quartz), halite, various Fe/Mg minerals, gypsum and clay minerals. On contrary to samples from 2010 (rainy salt production season), the results from 2009 (favourable weather

condition) indicate a relationship between salinity and mud elemental composition. The organic matter content was low and slightly variable during yearly sampling.

### **Conclusions**

This study showed the time-dependant transformation/changes of organic and inorganic fraction of mud sampled in the crystallization basin. The physico-chemical characteristics of clay, geochemistry of the mineral water, procedure of mixing/remixing each other and lasting time procedure<sup>5</sup> impact the »maturation« processes of peloids so these results are needed and will be used for the establishment of controlled production of peloid muds in Secovlje Salina

**Keywords:** Peloid, Saline Mud, Transformation, Geochemistry, Secovlje Salina

# Hydrogen sulfide as an anti-inflammatory mediator in osteoarthritis

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## Introduction and Objectives

Hydrogen sulfide (H<sub>2</sub>S) has in the past been associated with environmental toxicity; however, balneotherapy has made use of sulfur waters as complementary therapy in the treatment of rheumatic diseases such as osteoarthritis. Hydrogen sulfide, the principal sulfur-containing compound of these medicinal waters has been recently proposed as an endogenous mediator of inflammation and an antioxidant in osteoarthritis (OA). The aim of this work was to study the effects of different concentrations of two sulfur releasing compounds on human articular chondrocytes from osteoarthritic (OA) tissue.

## Materials and Methods

We analyzed the effects of the addition of different concentrations of either a fast or slow release H<sub>2</sub>S donor (NaHS or GYY4137, respectively) on the levels of nitric oxide (NO) production with Griess reagent and the expression of iNOS protein through immunocytochemistry (ICC). We also measured the effects on the production of reactive oxygen species (ROS) by immunofluorescence with the use of dihydrorhodamine 123, and the expression of superoxide dismutase 2 (SOD2) mRNA with qRT-PCR. For all studies cells were seeded with a known density and kept in 5% CO<sub>2</sub> in a humidified atmosphere at 37°C for 48 hours. Prior to the determinations cells were stimulated with 5 ng/ml of IL-1 $\beta$  and the different concentrations of NaHS and GYY4137 (ranging from 50  $\mu$ M to 1000  $\mu$ M).

## Results

None of the concentrations of hydrogen sulfide donors used were seen to cause cell death. Stimulation of cells with IL-1 $\beta$  caused an increase in the production of NO up to about 120 mM when compared with unstimulated cells (approximately 5 mM NO). Addition of GYY4137 led to a concentration-dependent reduction of up to 33 mM for 1000  $\mu$ M, whereas for NaHS the reduction was limited to 96 mM with the highest concentration (1000  $\mu$ M). When quantifying iNOS expression with ICC a 2.5% positivity was detected in the basal conditions; this increased up to 9% when cells were stimulated with IL-1 $\beta$ . Addition of the S-releasing compounds led



to a reduction of iNOS in the cells. This decrease was down to 5% positivity for NaHS (similar for all the concentrations) and down to approximately 1% for all GYY4137 concentrations except for 50  $\mu$ M which did not cause a reduction.

Regarding the production of ROS, basal conditions had approximately 9% positivity. Addition of 50  $\mu$ M and 100  $\mu$ M GYY4137 resulted in a reduction of ROS down to 0.11% and 0.25% positivity, respectively; however, for 1000  $\mu$ M positivity was again increased up to 9.95%. For NaHS, ROS positivity was reduced to 7.54% and 5% for 500 and 1000  $\mu$ M, respectively. We also saw a concentration-dependent increase in the expression of SOD2 mRNA in the IL-1 $\beta$  stimulated cells treated with the S-containing compounds, this may in part account for the observed decrease in ROS.

### **Conclusions**

These results indicate that the hydrogen sulfide, the main component of sulfur waters, may have anti-oxidants and anti-inflammatory properties. Therefore, therapies that make use of these waters may represent promising alternatives to explore for the treatment of rheumatic diseases, such as osteoarthritis

**Keywords:** Sulfur Water; Chondrocytes; Osteoarthritis; Hydrogen Sulphide; Anti-oxidant

# Determination of selenium in mineral and thermal waters in the province of Ourense (Spain): its importance in human biochemistry

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## Introduction and Objectives

Introduction: Galicia is a region with a remarkable shortage of selenium, as shown in a doctoral thesis conducted at the Department of Analytical Chemistry, Nutrition and Food Science, Faculty of Chemistry, University of Santiago de Compostela, in which selenium levels in newborns and their mothers were studied.

That is the reason why searching for new sources of selenium in Galicia must be considered. At present no data are available about the possible levels of selenium in thermal mineral waters in the province of Ourense (Galicia). Therefore the determination of this parameter is extremely important and its existence would add value to the healthy virtues of these waters.

Selenium is important for its antioxidant function, being part of the active site of the glutathione peroxidase enzyme, an enzyme which is necessary for maintaining the integrity of cell membranes and which catalyzes the reduction of a wide variety of organic peroxides and hydrogen peroxide.

These radicals can be formed as a result of the metabolism of toxic substances, ethanol, medicines and chlorinated derivatives; in today's society they are associated with stress experienced by individuals. Considering this starting point, several biochemical mechanisms that involve selenoproteins have been described, being specially important the glutathione peroxidase, forming part of the defense mechanism of antioxidants.

There is evidence that many of the diseases and problems associated with selenium deficiency are caused by reduced levels of this enzyme.

The glutathione peroxidase, vitamin E and other enzymes such as catalase, superoxide dismutase and glutathione transferase, are the essential cellular defense mechanism against hydrogen peroxide and free radicals.

This protection is particularly important in maintaining cell membranes, whose integrity and proper functioning is essential in order to maintain the systems and

biological processes in higher organisms. It seems therefore that the aging of organisms as well as the development of cancerous tumors could be related to the degenerative effects caused by free radicals.

Most existing studies try to see how this element influences cancer prevention and the impact its deficiency causes.

Selenium is also related to other diseases involving tissue damage, such as Keshan disease (heart disease), Kaschin disease (bone disease) and myxedematosus endemic cretinism.

Nowadays medical studies are aimed to investigate the connection between selenium and cancer, as well as with other important diseases in today's society such as AIDS, diabetes, and Alzheimer's disease.

Objective: Determination of Selenium in 33 thermal mineral water springs in the province of Ourense (Galicia), Spain, and establish its relationship with the glutathione peroxidase enzyme.

### Materials and Methods

Standard Methods for the Examination of Water and Wastewater (2009)

### Results

SOURCE	Se+4 mg/L	SOURCE	Se+4 mg/L
Fuente de la Rañoa	0.03	Fuente del Sapo antigua	0.00
Balneario de Carballiño	0.00	Fuente del Sapo nueva	0.04
Fuente de Brués	0.01	Fuente de Villaza	0.03
Fuente de Arcos	0.00	Fuente del Carregal	0.00
Fuente de Ponterriza	0.04	Aguas de Reza	0.00
Fuente de Manzós	0.00	Balneario de Arnoia	works
Antiguos baños Prexigueir	0.02	Balneario de Partovia	works
Baños del Prexigueiro	0.01	Burgas de Arriba	0.02
Balneario de Berán	0.02	Burgas de Abajo caño Izdo.	0.00
Baños del Monte Cortegada	0,02	Burgas de Abajo caño dcho.	0.01
Fuente de Sás de Penelas	0.00	Burgas Jardín	0.01
Fuente de Piñeiroá	0.00	Chabasqueira pública	0.01
Balneario Baños de Molgas	0.01	Chabasqueira pozita	0.03
Fte. exterior Baños de Molga	0.00	Fuente del Tinteiro	0,00
Baños del Porteiro	0.01	Balneario de Laias	0.01
Fuente del Bañiño	0.01	Balneario de Lobios	0.00
Ponte da Y	0.04		

### Conclusions

The determination of selenium ranges between 0.00 mg/L and 0.04 mg/L. These values are a consequence of an acid soil.

Some sources and spas, for their Se+4 concentration, will hydropinic favour an increase of the enzyme glutathione peroxidase.

The cure external (baths) favours the reduction of psoriasis and atopic dermatitis.

Beran Spa has had a longstanding reputation for its effectiveness on psoriasis. However the 41 parameters studied (PhD Dr. Souto Figueroa) could not explain this action, except S-2, Indeed the presence of S+4, (0.02 mg / L) explains it.

The existence of selenium in Antiguos baños del Prexigueiro spring justifies why so many people wash their head there because selenium relieves itching and flaking of the scalp and removes dry particles (dandruff or seborrhea)

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**Keywords:** Selenium, Glutathione-Peroxidase, Aguas-Mineromedicinales, Free-Radicals, Cancer, Alzheimer

# Drinking Cures - Session 10

## Lectures

Scientific Basics of Water and Hydration

*L LE BELLEGO*

Effects of drinking Spa Therapy on oxidative stress

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Drinking mineral waters, preventing osteoporosis

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*R MELJIDE, M LÓPEZ-SILVA, M BLANCO*

The Bahia 2011 Seniors study. patterns of Hydration in the elderly in Spain

*F MARAVER, C MORER, P MIR*

## Papers

Migration assays for the identification of organic compounds in natural mineral water containers

*A BORRELL, A GUART, S LACORTE*

Changes in diuresis after rehydration with mineral waters of different mineralization after a sesión of submaximal exercise in a warm atmosphere

*R MELJIDE, C AGRASAR, M SANTIAGO, M SAAVEDRA, R BARRAL*

Nitrates in spanish waters: natural mineral water and tap water

*F ARMIJO, I CORVILLO, I VAZQUEZ, I VITORIA, F MARAVER*

# Scientific Basics of Water and Hydration

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Over the course of the last few years, food intake has obtained considerable attention because of the importance of dietary nutrient deficiencies and their consequences for public health. It is only more recently that our fluid intake and nutrition have gained attention.

In this context, it is sometimes surprising to discover how the scientific evidence on the importance of drinking enough water on a daily basis and why this so important for our health is overlooked. This is the reason why EFBW's Health Working Group has undertaken the initiative to compile and summarize the relevant scientific evidence related to water and healthy hydration into a toolkit.

The scope of this presentation will be to address the key scientific aspects of water and hydration.

Water is essential for life and is the number one component of our body. Water is essential to every single reaction and function in our body. Without water we wouldn't be able to live. Water intake should at least compensate our body's water losses in order to maintain fluid balance on a daily basis. These losses highly depend on physiological parameters, behaviour, but also climate. Water losses can vary from about one litre up to several litres per day for people exercising and/or living under hot conditions. Therefore, water needs should be evaluated on an individual basis. Low water intake vs. losses will lead to dehydration with its consequences. The importance of drinking enough water and the associated health benefits has been recently recognised by the European Food Safety Agency.

# Effects of drinking Spa Therapy on oxidative stress

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## Objectives

The oxidative stress is produced in cells by oxygen-derived species resulting from cellular metabolism and from interaction with exogenous compounds. It results dangerous when an imbalance in antioxidant status arises. This is the case of chronic inflammation of gastrointestinal tract. For example data of literature have shown the correlation between oxidative stress and some diseases of gastrointestinal and metabolic relevance such as diabetes mellitus, gastric cancer, gastritis etc.. Recent data demonstrated the correlation between oxidative stress and vascular alteration and pancreatic  $\beta$  cells damage in diabetics. The results of the published clinical, experimental in vitro and in vivo studies, suggests that SPA (Salus Per Aquam) Therapy or SPA Medicine provide anti-inflammatory, immunomodulatory and recently antioxidative effects. The aim of our research was to evaluate the effects of a drinking SPA treatment on the oxidative stress conditions in patients with type 2 diabetes mellitus, a chronic disease with a high social and economic impact.

## Materials and Methods

Thirty-five subjects (74% men and 26% women) (Age range: 46-74 years; Mean +/- SE: 64+/-1.1 years) affected by type 2 diabetes mellitus under drug therapy participated in the study. Patients were informed of the purpose of the study and gave their informed consent. After medical examination, subjects were randomly divided into 2 groups: group A (21 subjects with Body Mass Index (BMI) 27.9+/-1.0), who continued hypoglycaemic drug therapy and group B (14 subjects with BMI 27.5+/-1.0), who continued hypoglycaemic drug therapy in association with a drinking treatment with sulphureous-bicarbonate-calcic-magnesian mineral water from Terme of Teleso SpA (Benevento-Italy) for 14 days. After 2 weeks of treatment, the following parameters were measured: fasting blood glycaemia (mg/dL), capillary blood was taken and immediately tested with Glucocard G+meter; oxidative stress indices: 1. d-ROMs test (Diacron International srl-Grosseto, Italy). These

test evaluate plasma ROM (reactive oxygen metabolites) levels. Normal healthy subjects show ROM values in a range between 250 to 300 U.Carr. (1 U Carr.=0.08mg of H<sub>2</sub>O<sub>2</sub>) - 2. Plasma Biological Antioxidant Potential (BAP) measured with the BAP-test (Diacron International srl-Grosseto, Italy). Normal healthy subjects show BAP values higher than 2200 micromol/L of vitamin C; untoward side effects. Statistical analysis was performed with the Student's t-tests for unpaired data. Data are presented as mean +/-SE.

### **Results**

All treatments were well tolerated by all the subjects. The hypoglycaemic drug therapy for regulation of blood glucose levels along and the drinking treatment with sulphureous-bicarbonate-calcic-magnesian mineral water produced significantly lower plasma ROM concentrations in group B, in comparison with group A (treated with hypoglycaemic drug therapy alone) (group A: 331U.Carr. $\pm$ 11; group B: 297U.Carr. $\pm$ 11) ( $p<0.05$ ). Furthermore, in group B we have observed a significant ( $p<0.05$ ) increment of the plasmatic barrier defence against free radical attack, documented by the higher BAP levels after treatments in group B than in group A (group B: 1487 $\mu$ mol/L $\pm$ 61; group A:944 $\mu$ mol/L $\pm$ 71). Simultaneously, a significant ( $p<0.05$ ) reduction of blood glycaemia was observed (group B: 110mg/dL $\pm$ 9 versus group A: 139mg/dL $\pm$ 10).

### **Conclusions**

This investigation suggest that combination the drinking SPA treatment with hypoglycaemic drug therapy may be useful in type 2 diabetes mellitus for the improvement redox state of the organism and thus reduce risks of complication. Therefore, drinking SPA treatment with sulphureous-bicarbonate-calcic-magnesian mineral water could be inserted as an adjunct to other therapeutic and nutritional therapies usually adopt in the treatment of Type 2 Diabetes Mellitus.

**Keywords:** Drinking SPA Therapy, Reactive Oxygen Metabolites (ROM), Type 2 Diabetes Mellitus, BAP



# Drinking mineral waters, preventing osteoporosis

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Osteoporosis is a systemic disease of the skeleton, characterized by reduction of bone mass and increased risk for fractures. Measures to prevent osteoporosis include a healthy lifestyle, with regular physical activity, adequate intake of calcium and vitamin D, and avoidance of cigarette smoking and excess alcohol.

To attain the optimal calcium intake it has been suggested that the frequency of consumption of dairy products and calcium-rich vegetables be increased. In general, it is assumed that any calcium supplementation will lead to an improved calcium metabolism. Mineral waters are recommended in the prevention of osteoporosis because of their calcium content since some mineral waters may contain calcium in high concentrations (150-550mg/L), and regular consumption can give rise to a significant intake of calcium. It has been shown that the calcium contained in these mineral waters is equally well absorbed and utilized as that from milk and calcium supplements. Another study indicated that calcium in mineral water immediately lowers parathyroid hormone (PTH) and bone resorption marker. The long-term effect of calcium in mineral water on bone resorption was also demonstrated by a controlled study in a group of women who were on a low calcium intake. These positive results of drinking high calcium mineral waters on the bone health have been confirmed by following studies.

It is believed in general that mineral waters rich in calcium can influence bone health positively and can help preventing osteoporosis when consumed regularly. On the other hand mineral waters contain other minerals such as sodium, magnesium and fluoride, and anions such as bicarbonate and sulfate. Fluoride can in rare cases be so high that it increases bone density. Since bicarbonate increase the urinary pH and lowers renal calcium excretion hence improves calcium balance, alkali mineral waters rich in bicarbonate have to be tested in terms of their effects on bone and calcium metabolism. Indeed, they lowered renal calcium excretion and bone resorption in short and medium term trials and they could be of particular interest in the prevention of osteoporosis in addition to calcium-rich waters. But the eventual benefit of an alkali load provided by bicarbonate rich mineral water consumption appeared to be an additional factor to be considered. This was assessed by some interventional trials very recently. It has been shown that alkali mineral waters with

a high content of bicarbonate but not calcium can exert an inhibitory effect on bone resorption that exceeds the effect of mineral waters which are only rich in calcium.

Osteoporosis is one of the diseases of our times which can be prevented by a combination of life style and nutrition. Recent evidence indicates that a healthy diet including adequate intake of calcium and nutrients that promote a more alkaline ambience would favor bone metabolism. In this regard mineral water drinking cures deserve to be evaluated in preventive studies of osteoporosis since they may contain high amounts of calcium and/or bicarbonate that would play a role in the optimal protection of bone. Since different mineral waters in the world market have different characteristics from the point of view of ion composition further research is needed to identify the most specific and effective chemical components or compositions for the primary and secondary prevention of osteoporosis.

# Health Effects of Natural Mineral Water Drinking: The sodium bicarbonate mineral waters and Cardiovascular Risk Factors

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## Introduction and Objectives

The effects of the natural mineral water ingestion have been the subject of several studies in recent years. A number of health benefits including improvements in acid/base balance, bone metabolism, and cardiovascular risk factors have been attributed to the intake of sodium rich alkaline mineral water.

The OBJECTIVE of our studies was to assess whether ingestion of sodium bicarbonate mineral water produced changes of blood pressure levels and biochemical parameters in patients with essential hypertension and healthy adults. These studies were designed to investigate the effects of the regular consumption of sodium bicarbonate mineral waters.

## Materials and Methods

We conducted two randomized, controlled trials, one in 132 adult hypertensive subjects, 68,5 years old middle ages, divided into three groups who consumed 1.5 liters daily of Mondariz mineral water with three different concentrations of dry residue of 96.2 (low), 183.2 (mild), and 1200 mg/l (medium), respectively, for 9 weeks. And the other study in 36 adult normotensive (19 treatment, 17 control), mean age 49 years with Cabreiroá natural mineral water intake or water placebo. We assessed the effects on major cardiovascular risk factors, BP blood pressure.

## Results

The results of our studies shown that consumption of natural mineral water with different concentrations of sodium bicarbonate does not increase BP in older hypertensive patients. Systolic and diastolic BP decreased slightly in the three groups at 4 and 9 weeks: control water 6.26/2.0 mmHg, low mineralization 1.14/2.39 mmHg, medium mineralization 2.71/0.96 mmHg ( $p = 0.080$ ). Results of regression analysis showed a negative association between BP increase and degree of mineralization since the water with the highest content in sodium chloride and sodium bicarbonate exerted a protective effect against BP increase at the end of the study (OR = 0.2 [95% CI 0.1–0.6];  $p = 0.008$ ) compared with the control group. These effects were independent of initial BP and mineral urinary excretion concentrations.

In healthy adults SBP in the intervention group descends on average of  $121.9 \pm 9.2$  to  $117.7 \pm 14.5$  ( $p = 0.078$ ). The same phenomenon is objectified in the TAD, which descends from  $76.4 \pm 9.5$  to  $71.6 \pm 9.8$  ( $p = 0.064$ ). There is no objective decrease in the control group in blood pressure values, both systolic and diastolic. After taking into consideration variables such as age, sex, type of water and base-line, the type of water has an independent effect in predicting decline in SBP (OR = 6.49). Patients in the intervention group are 6.5 times more likely to diminish their SBP than the control group

### **Conclusions**

The short term regular ingestion of sodium- bicarbonate mineral water provides a protection against cardiovascular risk factors. Long term clinical studies are required to investigate any health benefits

**Keywords:** Sodium-Bicarbonated Mineral Water; Cardiovascular Risk; Blood Pressure

# The Bahia 2011 Seniors study. patterns of Hydration in the elderly in Spain

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## Background

The aging process is associated with changes that may affect the ability to maintain water balance. The main objective of this study is to analyze the water intake habits and attitudes of hydration in the elderly population.

**Material and methods:** A descriptive and transversal epidemiological study was conducted in 2011 in the Hot Spring Medical Spa of Lanjaron (Granada). Data were collected through a survey that included 1,071 subjects, all of them spa guests. A multiple choice self questionnaire was applied.

## Results

Women had a better rate of hydration than man (44% vs 25%). Water intake decreases with age (43% in subjects 56-54 years vs. 21% in subjects > 75 years). The liquid intake estimated average in the previous day was 1,778 ml (confidence interval [CI] 95% 1741-1836) and the water average intake was 1,498 mL (95% CI 1455-1541). Water is, therefore, the 84% of the ingested liquids. Only 45% affirmed that they use to drink the same amount of liquid than when they were younger, while 55% reported drinking less. Highlights that the main reason for not drinking water are lack of appetency (42.61%) and lack of thirst (41.01%). Almost half of respondents (45%) do not carry liquids while walking. Of those respondents who tend to carry liquids, 58.6% carry mineral water and 40% tap water. Only a small percentage trends to carry infusions (4.5%) or soda (3.21%). A very high percentage (93%) has liquids at home. Tap water represents the 51.9% and mineral water, 48.1%. 4.0% said other liquids. 4 every 10 respondents do not drink water when they wake up in the morning and 1 every 5 does not drink before sleeping.

## Conclusions

Water intake in the elderly is insufficient. There is no knowledge about hydration needs. The mineral composition is not a reason for increased consumption of mineral water. Taste and safety aspects are the main reasons. Health education on

water intake in the elderly population is an important aspect in which health workers, the media and relatives should be involved.

**Keywords:** Hydration. Water Consumption. Mineral Water. Elderly

# Migration assays for the identification of organic compounds in natural mineral water containers

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## Introduction and Objectives

Natural Mineral Waters are natural products, which have to maintain their original purity of the source. The protection perimeter has to be adequate to avoid a possible source contamination.

Once the water has been bottled, the container has to be as inert as possible. European Regulation 10/2011 establishes the migration conditions for polymeric materials which have to be in contact with food.

Previously, we have investigated the presence of different organic compounds, such as Bisphenol A (BPA) or Nonylphenol in plastics in contact with water (Guart et al., 2011). We have demonstrated the migration of BPA from polycarbonate containers.

BPA has been banned recently in material in contact to baby food. And a possible future French Decree could ban the use of BPA for materials in contact with food. So companies are studying possible polycarbonate substitutes.

## Materials and Methods

Migration assays have been performed according to the Regulation 10/2011 and Spanish Royal Decree 866/2008, using solid phase extraction (SPE) followed by gas chromatography coupled to mass spectrometry (GC-MS).

## Results

In this work, we show the possible migration of organic compounds of a substitute free BPA container, made in the copolyester Tritan. Tritan was introduced in 2007 as a polymer produced from dimethyl terephthalate, 1,4-cyclohexanedimethanol and 2,2,4,4-tetramethyl-1,3-cyclobutanediol.

## Conclusions

The results obtained after incubating the plastic at 40°C during 10 days show that Tritan is a polymeric material with low migration potential of plasticisers and additives.

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**Keywords:** Migration, Polymeric Materials, Bisphenol A, Polycarbonate, Tritan.



# Changes in diuresis after rehydration with mineral waters of different mineralization after a sesión of submaximal exercise in a warm atmosphere

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## Introduction and Objectives

The exercise involves fluid and electrolyte loss that is increased in warm and humid conditions. Athletes have to recover those losses through proper hydration to help them compete or develop subsequent training sessions with optimal performance. Studies suggest that hydration with sodium bicarbonate waters with high mineralization reduce diuresis and increase the hydration of the body after anaerobic exercise decreasing the time of fatigue. Magma mineral water® (Spain) is an alkaline bicarbonate water, characterized by a relatively high content of bicarbonate, sodium, carbon dioxide, silicon in addition to calcium, magnesium, lithium and fluoride ions. The aim of this study is to determine the changes in hydration and diuresis after administration of two mineral waters, a weak and a strong mineralization (WMW and SMW) after a 90 minutes submaximal exercise with high temperature and humidity

## Materials and Methods

We performed a crossover trial with 8 subjects, cyclists with high degree of training, which was previously done ergospirometry to determine maximal oxygen consumption (VO<sub>2</sub> max). 90 minutes underwent cycle ergometer exercise, the first 30 minutes at 70% VO<sub>2</sub> max. The next 30 minutes at 60% and the last 30 minutes at 50%, temperature 28° C and a humidity of 50%. Following the exercise were given an amount of a type of drink 150% of lost weight (initial weight-final weight): 1/3 in the first 30 minutes and 1/6 at intervals of 30 minutes, with a rehydration along 5 hours. After that period were allowed to drink ad libitum. The test was repeated under the same conditions with the second type of drinking water for two weeks.

The variables studied were initial and final weight, fluid intake during the five hours of recovery and then at home, diuresis during the five hours of recovery and subsequent diuresis of each athlete at home (at 12 hours). Statistical analysis: Quan-

titative variables were expressed as mean  $\pm$  SD. The comparison of means was performed using the Student t-test or the U test of Mann-Whitney as appropriate after verification of normality with the Kolmogorov-Smirnov with a significance level less than 5% ( $p < 0.05$ )

### **Results**

The process of rehydration after exercise shows clear differences in urine output between the two types of beverage ingested rehydration being much more effective when athletes are hydrated with water Magma strong mineralization. Thus, the cumulative urine output has an average value of 68.75 ml (Magma), 180.63 ml (WMW)  $p < 0.006$  after first hour; 190.63 ml (Magma) to 424.38 ml (WMW)  $p < 0.003$  after two hours; 409.38 ml (Magma) to 850 ml (WMW)  $p < 0.001$  after three hours; 837.50 ml (Magma) to 1306.25 ml (WMW)  $p < 0,001$  after the fourth hour; 1321.88 ml (Magma) and 1734.38 ml (WMW) at the end of the fifth hour ( $p < 0.002$ ).

### **Conclusions**

Rehydration in the first five hours after exercise is greater when performed with sodium bicarbonate mineral water of high mineralization, providing better conditions for the recovery of the athlete to perform a new training session or competition.

**Keywords:** Hydration, Sodium Bicarbonate Water, Mineral Water, Diuresis

# Nitrates in spanish waters: natural mineral water and tap water

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For over three decades, the Chair of Medical Hydrology, Faculty of Medicine, Universidad Complutense de Madrid has studied the waters of Spanish spas<sup>1</sup>, bottled waters<sup>2</sup> and the spring water of several Spanish areas<sup>3</sup>.

In this paper we have done the full analysis, from the Medical Hydrology point of view, of 97 bottles of mineral water and of 117 samples of tap water from towns with a population over 50,000, paying special attention to the nitrate concentration.

In recent years, the level of nitrogen in soils is much higher than necessary so the excess nitrate easily filters and reaches the aquifer; plants absorb more nitrates than necessary accumulating larger amounts of nitrates than usual. This can determine serious implications for health and for the environment.

Nitrates are natural constituents of vegetables and can be found in very high concentrations. Natural spinach or celery can contain as much as 2 g/kg of nitrate. Nitrates may also be present in other vegetables, such as beets or chard, as well as in the drinking water.

The World Health Organization (WHO) establishes the maximum value of 50 mg/L of "nitrate ion" in the drinking water. This limit was chosen to prevent a serious problem due to toxic nitrates / nitrites levels in children under four months<sup>4</sup>.

The toxic effects of nitrates are due to its reduction to nitrite. Excessive amounts of nitrates in water can have lethal effects because of methemoglobin formation in infants, and nitrosamines (carcinogenic) formation, due to a reaction between the nitrates with amines and amino acids, in adults<sup>5</sup>.

In pregnant women, some studies have suggested a relation between exposure to nitrates in water and spontaneous abortions, intrauterine growth retardation and multiple congenital defects. However, epidemiological evidence has not yet been sufficiently demonstrated<sup>6-7-8</sup>.

**Analytical Method:**

The method indicated in "Vademecum II of Spanish mineral medicinal waters" was used. Physicochemical parameters used for water classification and study of water quality were performed<sup>1</sup>.

**Results:**

**Table 1**

	<b>Tap Waters</b>	<b>Natural Mineral Waters</b>
< 1 mg/L	4 (3.4%)	8 (8.2%)
1 to 10 mg/L	94 (80.3%)	64 (66.0%)
10 to 20 mg/L	14 (12.0%)	20 (20.6%)
>20 mg/L	5 (4.3%)	5 (5.2%)
Total	117	97
Mean	6.41	6.80
Standard Deviation	9.20	6.27
Median	3.50	4.50

**Conclusions**

Of the 117 tap water samples tested only one exceeded the limit of 50 mg / l. None of the natural mineral waters tested was above the limit of 50 mg / l.

Only 19 of the samples of tap water and 25 of natural mineral samples had more than 0 mg / L of nitrates. 17 of the tap water samples came from the Mediterranean coast, and of the natural mineral waters, 4 were bottled in Valencia and Zaragoza and 3 in Salamanca.

No statistically significant correlations were found between nitrate concentration and the dry residue, nor with the sodium, calcium and magnesium cations.

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**Keywords:** Nitrates, Natural Mineral Water, Tap Water, Methemoglobinemia, Nitrosamines.

# Health tourism sustainable – Environmental aspect - Session 11

## Lectures

Sustainable Tourism and environmental aspects in the thermal capital Ourense  
*PA ARAUJO, JA VÁZQUEZ-BARQUERO; E GONZÁLEZ-DIÉGUEZ*

Recent contributions of the Geological Survey of Spain (IGME) in mineral water  
*MM CORRAL, C ONTIVEROS, JA LÓPEZ GETA*

## Papers

A geochemical approach to explain germanium origin in potentially medicinal waters of the Bieszczady mountains (the Carpathians, se Poland)  
*D DOBRZYNSKI, E SLABY, A KOSTKA, A METLAK*

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# Sustainable Tourism and environmental aspects in the thermal capital Ourense

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The development model of Ourense as a thermal town and its projection is based on three key players that are driving the exploitation and enhancement of the hydro-thermal resources of the city in a sustainable way: the actions of the Council of Ourense, the International Fair of Thermal Tourism, TERMATALIA and the University of Vigo who created the Water Campus.

Currently there are 10 springs owned by municipalities which are used by locals and tourists on the concept of "Outdoor Thermalism". The area of operation of thermal projects are concentrated in two points: the center of the city with the Spring called "As Burgas", which is particularly renowned for its flow rate of 300 liters per minute of water that emerges at 67 °, and the Thermal Bank of the "Miño" River, where we can find several "Spa" with temperatures ranging from 43 to 69.3 degrees. Approximately 4 million liters of mineral water that arise spontaneously in several enclaves, situate Ourense as the second thermal capital Europe (after the city of Budapest). The water arising in Ourense is mainly sodium bicarbonated water, sulfure water and fluoride water which are coexisting in historical and natural sites, with greenways through which users can access to Spas.

This natural potential has been projected internationally by TERMATALIA, a unique exhibition specialized in Hydrotherapy and Thermalism, which brings together experts from around the world and which has been a driving force of the know-how for the development of various companies related to mineromedicinal water resource.

The latest plan which will strengthen the city of Ourense as a Sustainable Thermal destination will be the creation of the "Water Campus," which is currently made up by 4,595 students, 33 degrees, 49 research groups, 339 researchers and over 120 R & D projects. The project is built on five areas of collaboration that will shape its future R & D clusters: Tourism, Computer Science, Social and Educational Innovation, Environment and Food. This project will be involved in the thermal development of Ourense and growing environmental requirements.

# Recent contributions of the Geological Survey of Spain (IGME) in mineral water

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The Geological Survey of Spain has developed in recent years some projects with the goal of obtaining a deeper knowledge about mineral waters of Spain. At a Regional level it is important to remark those ones that were developed in association with the Spanish regions of Galicia and Castilla y León.

Both projects have been the origin of two publications about mineral waters in those regions, studied in all its complexity: Several mineral waters and other ones with the potential to be declared as so have been identified and analyzed. Some of them have been evaluated as potentially able to be used by new enterprises (Bottled mineral water plants and balnearies). A central aspect of both publications has been the definition of hydromineral sub-domains in Galicia and Castilla y León, based on the hydromineral domains defined in Spain during previous projects developed by the Geological Survey of Spain. Other aspects included have been history and legislation about mineral waters in Spain.



# **A geochemical approach to explain germanium origin in potentially medicinal waters of the Bieszczady mountains (the Carpathians, se Poland)**

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## **Introduction and Objectives**

Germanium (Ge) is an element which usually demonstrates silicon-like geochemistry, and in many natural environments correlates with silicon (Si). In continental crust, mean Ge content is 1.4 ppm and mean Ge:Si molal [ $\mu\text{M}/\text{M}$ ] ratio of 1.7. Silicon provides therapeutic benefits in medicinal waters. Germanium evokes a rousing interest also in biology and medicine. In some countries, Ge-rich mineral waters are successfully applied in balneotherapy, or are accessible as a bottled waters.

In groundwater, the highest Ge contents (up to 300 ppb) are found in silicates-rich geothermal aquifers. Unpolluted, low-mineralized and/or low-enthalpy groundwater usually contain Ge less than 0.1 ppb.

## **Materials and Methods**

Detailed geochemical studies of groundwaters and bedrocks have been performed in Bieszczady Mountains (range of the Carpathians, SE Poland), in the area where mineral waters have been planned to be used for balneotherapy. The studied groundwaters occur in conglomerates, sandstones and shales. Current investigation covered groundwater samples from 15 springs and wells, and 52 rock samples. Chemical data on trace elements of water and rock samples were processed with use of data-mining methods to elucidate processes controlling increased Ge concentrations in groundwaters, and the relationship between Ge and others elements

## **Results**

Low-enthalpy CO<sub>2</sub>-rich mineral waters of HCO<sub>3</sub>-Cl-Na type (with H<sub>2</sub>S, B) occur in the studied area. Groundwater show varied mineralization, and are a mixture of two components: mineral water and fresh water. Specific electrical conductivity (SEC) ranges from 680 to 4970  $\mu\text{S}/\text{cm}$ . Groundwater have Ge and Si concentrations of 0.08 to 35.8 ppb (mean 7.41 ppb), and 2.71 to 6.44 ppm (mean 4.48 ppm), respectively. The maximum Ge content (35.8 ppb) is the highest one that has been

found in groundwater of Poland, and is at the same level as Ge content in thermal waters, e.g. in Iceland, France, Korea. The Ge:Si ratio varies between 11.4 and 2692 (mean 611).

Germanium does not correlate with temperature and pH, but manifests strong correlation with SEC, which confirms that Ge possibly originated from the mineral water component. Germanium also positively correlates with Si, Fe, and As, what indicates various Ge source phases and processes conducive to the emergence of geochemical affinity of these elements. The trace analysis demonstrates Ge enrichment in clay minerals, pyrite, and Fe-(oxyhydr)oxides

### **Conclusions**

Geochemical study revealed high Ge content in potentially medicinal mineral waters (the Carpathians, SE Poland). This enrichment originates from ascending mineral water and (re)mobilization from secondary minerals. Water-rock interactions, and mixing with fresh Ge-free groundwaters bleared primordial geochemistry of mineral water component.

Germanium in minerals reveals distinct affinity to deep crust elements, like Li, Rb, Tl, and Ga, what reinforces hypothesis of deep crust Ge-origin in waters.

Studies indicate that Ge-rich water might be found not only in thermal aquifers, but also in low-enthalpy geological environments, which are enriched in other minerals than silicates, like sulphides or (oxyhydr)oxides.

The studied Ge-rich mineral waters in Poland can be used in balneotherapy, and seem to be promising in the context of Ge health benefits. Germanium geochemistry in medicinal waters is a new research subject worth detailed, multidisciplinary studying.

**Keywords:** Germanium, Groundwater Geochemistry, Medicinal Waters, Carpathians Mountains, Poland

# Water mineralization origin inferred from the rainfall contribution. Relationship between quality of water, soil and lithology

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## Introduction and Objectives

The composition of superficial water depends on its interaction with the rock substrate of the hydrologic basin, the soil (non saturated zone) and its velocity of circulation. Processes involved in soil development and soil composition in a specified zone have a significant impact on water composition too.

The aim of this work is to infer the possible relationship between the quality of water, the soil and the lithology.

## Materials and Methods

This work is about the physical characterization (pH, conductivity, dry residue at 180° C, total hardness and oxidability) and chemical composition (main anions and cations by High Performance Ion Chromatography, HPIC, and elements by Inductively Coupled Plasma –Atomic Emission Spectroscopy, ICP-AES), of waters collected in ten different points of the Jarama river basin and its tributaries.

## Results

Test results show that most of the waters have calcium and/or sodium bicarbonate composition with a very low mineralization level, together with neutral or slightly basic pH values.

Some of the most common ion ratios, such as  $rNa/rK$  or  $rMg/rCa$  were calculated in order to deduce some of the physicochemical reactions affecting the water. These reactions are related to materials that are in contact with the water and/or with modifying phenomena of water composition (organic matter decomposition, mineral precipitation, etc).

From the concentration of a conservative element (chloride ion) in rainwater and groundwater, we calculated the rainfall contribution (Appelo & Postma, 1993) while water quality has been linked to the lithology of the studied zone and soil over the water pass through.

Finally, concentrations of main elements such as As, Ba, Ca, Ce, Co, Fe, K, La, Mg, Mn, Na, Ni, P, Pb, V and Zn in water, soil and rock have been statistically

correlated resulting in positive and very significant correlations between soils and rocks, and between waters and soils.

**Conclusions**

Possible components origin or mineralization has been deduced from original materials after applying the obtained evaporation factor. The most common water composition resulted from the dissolution of limestone while alteration of silicate minerals and rain composition could be seen in other cases.

**Keywords:** Mineralization, Water, Soil, Rock, Origin

# Mineral waters in Azores islands: hydrogeological approach and therapeutical applications

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## Introduction and Objectives

In Azores Islands, located 1,815 km W of Portugal Mainland, in the North Atlantic Ocean and at the Azores triple tectonic junction, occur several mineral and thermal waters related to volcanism and circulation in volcanic formations (e.g., Carvalho et al., 2005; Carvalho et al., 2006; Cruz, 2004; Cruz & França, 2006; Cabeças et al., 2010). Some of them are or were classified as natural mineral water (Nunes et al., 2007) as, i) the Lombadas and Serra do Trigo CO<sub>2</sub>-rich waters, and ii) waters used for balneotherapy and balneology as Furnas, Ferraria and Caldeiras da Ribeira Grande (São Miguel Island), Varadouro ( Faial Island) and Carapacho (Graciosa Island). In the commercial market it is also present the spring water Gloria Patri (low mineralization) at São Miguel Island.

## Materials and Methods

Typology of chemical composition is quite broad, resulting hydrogeological conceptual models of several nature (Cruz, 2007), namely (Figure 1): (i) NaCl thermal springs from the basal aquifer; (ii) thermal springs, boiling pools, fumaroles and cold CO<sub>2</sub>-rich springs associated to hydrothermal systems. To those types must be associated other springs resulting from suspended aquifers, spurring from paleosoils, dykes, lithological contacts or other structures.

Current development projects (Nunes et al., 2007) are being carried out mainly over thermal springs at sea level (e.g. Varadouro, Carapacho, and Ferraria) associated with the basal aquifer and sea water heating.

At those sites several studied and works are in due course and include hydrogeological surveys, isotopic and classical geochemistry, geophysical surveys and evaluation and production drilled wells. The scope is to get resources able to be recognized as natural mineral natural according to European and national law and with the modern hygienical and sanitary standards.

## Results

Those mineral waters have electrical conductivities from 6 to 47 mS/cm and temperatures from 35°C (Varadouro old spring), to 41°C (Carapacho) and 62°C

(Ferraria). At springs occurring in the basal complex the dynamics of tide determines relevant oscillation of total dissolved solids and of the piezometric level.

The NaCl facies of the waters are directly dependent of sea water mixing processes and the CO<sub>2</sub> total content as deep origin. This CO<sub>2</sub>-rich acidizing water, promotes rock leaching contributing to high contents of silica, iron, nickel and manganese, among others dissolved species.

Flow from primitive exploitation works (dug well located inside the Thermal Bath of Carapacho and dug well accessible by a gallery, and destroyed by the 1998 earthquake, at Varadouro)

### **Conclusions**

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Flow from primitive exploitation works (dug well located inside the Thermal Bath of Carapacho and dug well accessible by a gallery, and destroyed by the 1998 earthquake, at Varadouro)

**Keywords:** Azores, Drinking Mineral Waters, Thermal Baths, Therapeutical Applications

## **New Trends 3 - Session 12**

### **Lectures**

Salt rooms and halotherapy in european Health Resorts and Spas: fashionable trend or real therapy?

*A CHERVINSKAYA*

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Threats and opportunities facing French spa therapy

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Importance of the natural factor, thermomineral water “Serbian selters” in rehabilitation treatment (1990-2010)

*O LEKIC*

# Salt rooms and halotherapy in european Health Resorts and Spas: fashionable trend or real therapy?

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In the last decade the usage of therapeutic environment with the modeling of natural factors has become notable in rehabilitation and resort medicine. Physiotherapy and non-medicinal methods have a long history of use in Russia and Eastern Europe.

Salt speleotherapy is one of the methods which have given rise to further development of the whole trend in modern recovering medicine. A study of the atmosphere of the speleoclinic and the mechanics of speleotherapy showed that the main factor, which improves health is the smallest airborne particles of natural rock salt of a certain size and concentration. This fact led us to the idea of creating similar atmospheric conditions, which are more accessible to patients.

Artificial salt caves are being developed since the end of 80s. The first salt room equipped with salt aerosol generator was built in 1990 in the All-Union Institute of Pulmonology in St.Petersburg. The method was called 'halotherapy' ('halite' means 'mineral rock salt'), Halotherapy was being developed as a medical method in which the air environment of dry salt aerosol is reproduced by special equipment.

Since 1995, we have used an innovative medical technology: controlled halotherapy. It allows for differentiated metering and control of the level of salt aerosol when performing the treatment. This is very important, as it allows for objective treatment, which enhances the effectiveness and safety of the procedure and optimizes the length of each session.

Controlled halotherapy is authorized for medical use in Russia and the Baltic countries. The distinctive features of controlled halotherapy are 1) that its effects are scientifically based; 2) it provides the ability to choose and control the levels of salt aerosol, 3) and its clinical effectiveness is proven, as confirmed by numerous studies and practical uses in various medical fields: pulmonology, allergology, paediatrics, otorhinolaryngology, and dermatology. The method was presented in textbooks for students and doctors and was included in the courses for the advanced training of physiotherapists and balneologists. In Russia, controlled salt rooms have been installed in thousands of clinics, nursery schools, schools, sanatoriums, rehabilitation and spa centers.



Salt rooms began appearing outside of Russia and the Baltic countries 10–12 years ago. As opposed to Russia, another path of development can be observed in other countries.

The first salt rooms were constructed by builders and were immediately available for commercial use without any professional supervision. People were attracted to the external imitation of salt caves of various designs. Despite the lack of the most important thing, dry salt aerosol, the owners of such rooms often claimed categorically that it was possible to cure asthma, allergies and many other illnesses in their rooms. The term ‘halotherapy’ came into fashion, but it was being used in the entirely wrong way!

At present, there are many different types of salt therapy, and many are called halotherapy. The fashionable trend and the lack of reliable information about halotherapy have led to the commercial spread of techniques, often based on pseudo-scientific information. Of the hundreds of salt rooms built in Europe, only a few have modern equipment for full, effective, and safe use of the method of controlled halotherapy. This situation hinders the advancement of halotherapy, and arouses distrust in the medical community.

It is my belief that based on already available substantial scientific research and clinical experience, halotherapy has great potential for use in other countries. Of course, it is necessary to gain personal experience and determine the appropriate niche of medicine and rehabilitation, taking into account the traditional features.

Thanks to the possibility of a differentiated approach, controlled halotherapy has the potential to be used in the health resort and SPA industries. This method can become an effective means of respiratory hygiene in the rehabilitative and preventative respiratory care. There is great potential for the use of halotherapy in family, and, especially, in children’s rehabilitation.

There is necessity of accumulation and analysis practice experience of halotherapy in Europe. The specialists are in need of determination of role and place of salt rooms and halotherapy in European Balneology and Spa Resorts.

**Keywords:** Salt Rooms, Halotherapy, Speleotherapy, Dry Sodium Chloride Aerosol

# Meteo-climatic factors influence and balneary-climatic potential studies - Cacica salt-mines, Suceava county

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## Introduction and Objectives

In this paper, an interesting region area with high potential in human health rehabilitation has been investigated and preliminary studies are given. The area is a destination for both tourists and patients that are coming for treatment of respiratory diseases and rehabilitation therapy.

Moreover, systematic studies of medical treatment influences versus physico-chemical properties of daily atmospheric Cacica region and corresponding meteorological data have been taking into account.

In order to make a complete characterization of a special region of medical treatment, the complex analysis of physical, chemical, geological and meteorological factors is described in this paper. The Cacica saline area is well-known as a balneary-climatic region but it is not yet complete analyzed. The Cacica treatment area is located between coordinates: 47°34' – 47°41' north latitude and 25°47' – 25°56' east longitude, respectively. The hilly topography of the Cacica area is guarded to the north-west by the height of 973 m- the peak of Custura and to the south-east by the Ciungi massive- height of 629 m. The lowest point of Cacica depression in the area of interest is in the south-east of the village, having a value of 380 m.

## Materials and Methods

Our case study aims to compare the forecasted data by MAP 3D, meteo-climatic factors and experimental data recorded at the Cacica salt mine (lat: 47.6308, lon: 25.8995), correlated with history medical data. The area in which determinations were made was chosen at approximately 300 m north-northeast of the local salt mine, which is a destination for both tourists and patients that are coming for treatment of respiratory diseases and rehabilitation therapy.

We studied, compared and correlated data concerning the dust particles and the meteorological data. The two observatory stations are situated into the frame region

validated by the Map 3D software (15x15 km). The measured data were obtained using a Dust Trak Aerosol Monitor – model 8520.

### **Results**

The investigated area was chosen at approximately 300 m north-northeast of the local salt mine, which is a destination for both tourists and patients that are coming for treatment of respiratory diseases and rehabilitation therapy.

Knowledge of the climatic factors, in this case the air quality study, allows us to complete the quality approach to the modern medical analysis of a natural area so that the indications of medical cure to be achieved with certainty and scientific evidences.

### **Conclusions**

Because of their importance upon the influences of toxic dusts, irritating pollutants, irritating the lining of the respiratory system and eyes, studies concerning the particularly region and climate changes, pollution and therapeutic treatment involve a complex panel of measurements and research studies for scientists (physics, chemistry, biology, medical infrastructure, etc).

**Keywords:** MAP3D, Aerosol, Health, Salt Mine, Balneo-Therapy

# Carbocrenotherapy and the sclerodermic hand

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## Introduction and Objectives

The sclerodermic hand is a serious problem due to the risk of its developing into sclerodactyly and gangren or cutaneous necroses.

## Materials and Methods

Natural carbon dioxide gas (co<sub>2</sub>) coming from the principal hot spring of royat (france) and is used for four qualities: vasodilatation, antalgia, healing and antiseptis properties.

It is applied every morning for a period of 18 days by means of:

1. sleeves for hands and fore-arms
2. wet showers
3. needle-jet sprays on fingers and toes
4. subcutaneous injections into the extremities carried out by a qualified doctor

## Results

Naturel CO<sub>2</sub> treatment leads to a reduction of the Raynaud's phenomenon (\*), better hand movement and a decrease fingers oedema for patients who having badly swollen fingers. also small and recently formed digital ulcers heal permanently in three weeks.

## Conclusions

It is difficult to make a blind placebo controlled study but it will be necessary To quantify these results in long term trial

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**Keywords:** Carbocrenotherapy-Scleroderma-Royat

# A new thermal treatment center is planning to integrate with a hamam (turkish bath)

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## Introduction and Objectives

The plan for the addition of a hamam to the Izmir-Balcova Thermal Bath Treatment Center was conceived so as to show the result as an integrated complex. The hamam (hammam) is intended to serve both inpatients receiving thermal bath treatment as well as bathing clients from the general public, with enriched spa and wellness facilities.

The entrance section includes the reception, the cafeteria, the shopping facilities and small hamam units on both sides which are available for hourly rental. A central pool is situated in an open air courtyard surrounded by a walkway along which the functional sections such as dressing rooms, relaxation and bathing units are located, with the pool serving as a focal point uniting these parts into an architectural whole. Sliding glass panels can be retracted to allow the interior to be connected to the open air in the appropriate seasons, while in winter the pool may be in use when fed by the warm thermal spring waters.

The treatment section, on the other hand, connects with the existing building and is thus suitable for use by disabled patients. The central courtyard pool is used for therapy purposes, and when desired these two sections can be interconnected.

**Keywords:** Thermal Bath Treatment, Hamam, Hammam, Turkish Bath, Spa

# Legionella infection from spa waters and peloids: a risk assessment study

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## Introduction and Objectives

Czech spas have a long and well-established tradition for hydrotherapy and drinking. Five travel-associated legionella infections have been notified to the European Legionnaires' Disease Surveillance Network to date with two fatalities. The cases were linked to the two largest spas in West Bohemia. A study was conducted to track sources, elucidate the role of thermal waters and carry out a risk assessment in the two complexes. Peloids from five different localities were also included.

## Materials and Methods

Samples were taken, processed and Legionella identified by standardized and accredited methods.

## Results

### 1. Spa No.1.

Thirteen thermal springs for drinking were sampled at client outlets. Eleven were negative, two contained low counts of Legionella pneumophila serogroup (sg) 6 (53°C, 30°C). The hottest spring produces water at 72°C, which is stored and distributed to spa hotels. Although Legionella were not detected in the spring water, hotel storage vessels were highly positive. Cold and hot water from 25 hotels were also examined. Fifteen fully complied with legislation, 5 represented a risk due to presence of the virulent monoclonal antibody (Mab) subgroup Pontiac of L.pneumophila sg1. Two hotels were implicated as a source of infection (Mab Benidorm). There was a high diversity in the Legionella species isolated from hot and thermal waters indicating possible artificial enrichment of the latter with potable water. Two new sequence types (STs) of L. pneumophila and one novel Legionella species were identified.

### 2. Spa No.2.

Two cases of L.pneumophila sg 1, Mab Philadelphia, ST1, were investigated. Two hotels were confirmed as sources of infection. Water isolates matched a clinical strain. These hotels are fed with a mixture of two thermal springs whose tem-

peratures favour the growth of Legionella ( 36-41°C). Four Mab subgroups of *L.pneumophila* sg 1, three other *L.pneumophila* serogroups (sg2,sg5, and sg6) and a further 7 Legionella species were detected in the thermal water distribution network. Both hotels have installed chlorine dioxide generators. Disinfection of thermal waters is not permitted by law.

### 3. Peloids

Raw peat from five different deposits and spas were cultured. Two were positive despite very low pH. *L.sainthelensi* sg1 and a Legionella sp.nov. were identified in one, the second was positive for *L.quateirensis* in concentrations exceeding 102 cfu/g . Although infection by non-*L.pneumophila* species is rare, Legionella *sainthelensi* has been reported to cause outbreaks in Canadian nursing homes. The significance of the novel species has yet to be determined.

### Conclusions

Thermal waters used for medicinal purposes do not appear to demonstrate significantly more risk than hotel hot waters. In all investigated cases virulent Legionella colonized both distribution systems. Given the numbers of clients annually treated there, the risk appears low and is dangerous only for patients with suppressed immunity and other serious underlying diseases. These risk groups should be assessed by spa physicians and prevented from such potential exposure. Tour operators have been also made aware of these risks.

Technical and organisational remedial measures were proposed. Contentious parts of the Czech spa legislation that hamper prevention are presented (Spa Law 164/2001, Decree of Ministry of Health No.423/2001 On Spas and Sources).

**Keywords:** Legionella, Spa Waters, Peloids, Risk Assessment

# Threats and opportunities facing French spa therapy

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## Introduction and Objectives

French thermalism is highly dependent on public regulations and finance. State and public bodies have a major say on cares delivered, in both nature and number, on required qualifications of therapists, on a fixed 3-week's duration, on hygiene and safety. At the same time, public financing of cares is by far more important than the contribution of complementary private health insurances and out-of-pocket payments by the patient. Some 8 years ago, the National Health Insurance openly stated that hypothesized health benefits of spa therapy were no longer good enough to keep the subsidizing of thermal treatments. Clinical research with flawless methodology had to be organized to prove thermalism has a true medical interest. Years later the challenge has been met and fewer opponents question any longer the virtues of hydrotherapy. However, in the wake of spiralling health costs putting a strain on public spending, a new requirement is set on spa center operators. Nowadays, they also have to prove that thermalism is cost-efficient in comparison with other therapies. The yet to be proved economic relevance of spa therapy as well as new expectations are set to bring about a dramatic shake-up by which alongside the traditional treatment of chronic diseases, spa companies will have to address new fields of competences, such as prevention, rehabilitation, quitting of addictions, postponing of age-associated loss of autonomy, etc. This is way out the current framework, but essential to the survival of most thermal establishments.

## Materials and Methods

not relevant

## Results

not relevant

## Conclusions

not relevant

**Keywords:** Health Policy : National Health Insurance: Health Impact Assessment : Prevention



# **Importance of the natural factor, thermomineral water “Serbian selters” in rehabilitation treatment (1990-2010)**

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## **Introduction and Objectives**

The most important natural factor, which is used for therapeutical purposes is thermomineral water.

## **Materials and Methods**

DESIGN: Of the work is to show representation of natural factor, thermomineral water “SERBIAN SELTERS” in treatment and rehabilitation of patients in rehabilitation centre which posses natural factor and want the attention to be paid to its significance.

MATERIAL AND METHODS: Representation of all ways of physical procedures in dispensary treatments has been analysed. From specific procedures thermo mineral water “SERBIAN SELTERS” which due to Quentin’s classification is in the group of alcal muriotic carbon dioxide hyperterms, is used. The temperature of the used water was thermoindifferent 33 -36 degree C° in different ways of application: general, swimming pools-buthtub-tub-bath with

under water massage in the way of pearl bath and local extremities bath. In respiratory rehabilitation and inhalation “STANDARD SELTERS” is used with added medicaments or eterical oils, depending to patient’s illnesses.

## **Results**

Results are analyzed with descriptive statistic method, and due to statistic analyzing of facts. I got for patients, cured for twenty years period, one can see that from the amount of 124.645 patients, 69.411 patients cured with hydrotherapeutical procedures with 55,7% in respiratory rehabilitation thermomineral water “SERBIAN SELTERS” was used for 7.805 patients, 6,3% (62,0% total).

20% of the total amount of cured patients hydrotherapy treatment was contraindicated due to the nature of illness of CNS (hemiplegia-hemiparesis), cardiovascular genesis. Kinesis therapy is used 100%, Electro therapy 95,9 %, work therapy 59,0%

## **Conclusions**

One can conclude, that the significance of the natural factor in modern rehabilitation and treatment is still very important.

**Keywords:** Natural Factor “SERBIAN SELTERS”, Thermomineral Water, Physical Procedures

# New Trends 4 - Dermo-cosmetological issues

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# Balneary Research in Romania – a swot analysis

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## Background

Balneary cure means a complex therapy, using the action of a bunch of natural factors from a resort. These factors action individually, influencing the functioning of a system or an organ, but there is a global unspecific action too, determined by the human body reactivity and adaptation capacity). That's why the scientific research in this area is difficult to conduct. Romania has a complex background into the field of scientific research of the natural therapeutic factors. There are a lot of papers to demonstrate the effects and the efficacy the cure factors have on the human health, but an important part of this scientific work was done more than 20 years ago and it need to be refreshed.

## Purpose

The presentation aims to realize a SWOT analysis of the actual Romanian balneary research, based on a synthesis of over 50 years of medical balneary practice and medical balneary studies.

## Material and methods

The natural factors used in Romania to promote health are various and rich: therapeutic gases, different mineral waters (carbogaseous, sulphurous, salty etc), thermal waters, the complex factors from the seaside of the Black Sea, therapeutic muds, salt mines and caves, and the climacteric factors. The balneary cures can be for preventive, curative and for rehabilitation purposes. We militate for the development of a rehabilitation network in the balneary resorts.

The strengths and the opportunities are represented mainly by our scientific background and by the richness of the cure factors. A baseline of the fundamental research was just establish 5 years ago, in order to study the physiological and immunological effects of these natural factors on the human functioning; now, it is developing, slowly, but quite sure.

There are, of course, a lot of difficulties: to find enthusiastic young physicians to develop a network of clinical studies into the resorts, to find financial resources, to assure the best design for these studies. There are also some threats: many balneary resorts are no more functioning and the sources of therapeutic factors are going to be destroyed or polluted.

## **Conclusion**

The adequate knowledge concerning the mechanisms of action for the natural therapeutic factors allows the correctness of our prescription and avoids mistakes. The balneary research will promote the balneary medicine and a healthy life style; it also could be essential for the preservation of the cure factors sources, for the local environmental protection and for the economic growth of different region of our country.

# Does modern thermal medicine need new standardized terminology?

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## Introduction and Objectives

Thermal medicine is one of the oldest branch of medicine treating patients with chronic diseases. Because of regional differences in natural substances and treatments methods, that part of medicine doesn't have a homogeneous English terminology, methodology of since researches, methods to measure treatment results. Improvement of modern medicine technology also required new English terminology.

Lack of common English terminology make difficulties in compare and analyzing researches from different countries. That fact affect negative on metaanalyzing results in accordance with EBM, where researches has problem to match keywords to searching in data bases.

Taking those problems into account, during last meeting of Polish Association of Balneology and Physical Medicine we discussed about terminology and science's collaboration on Thermal Medicine. In time of debate we settled the only one common definition: "Thermal Medicine", which previes named spa medicine, also declaration about international cooperation ("balneodeclaration") was signed in.

## Materials and Methods

Based on those establishes we created Discussing Work Group, which in time since November 2011 until February 2012 discussed about most important and general definitions from Thermal Medicine.

We obtain a agreement of text in all discussed group of definition. It's only introduction of work In further part of works we will include about 300 – 500 terms.

## Results

Main purpose of the lecture is to present proposition of 23 balneological definitions in English, which were discussed in international experts group and given under discussion to forward action on homogeneous writing.

Definitions include terminology from: balneology, climatotherapy and partly from hydrotherapy. Few of experts whom active taken a part in work of group suggested changes to some definitions.

## **Conclusions**

Definitions settled by Discussing Group will be published and suggested to use like a recommendation by international group of experts if all members of group will joint to work and accept results of this work.

In case of disagreement about sense of further work, cooperation will be determine to “Polish Association of Balneology and Physical Medicine” and also in those associations which will active take part in further work. Finally result of our work will be publishing “Balneological Dictionary”( Balneoencyclopaedia) which include all settled definitions in English.

**Keywords:** Thermal Medicine, Terminology



# Evaluation of the efficacy of exfoliating formulations containing pumice from São Miguel's Island – Azores Archipelago

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## Introduction and Objectives

The skin of humans and, more specifically, facial skin, periodically need a deep cleansing to remove not only the oily particles resulting from secretions, but also dead skin resulting from desquamation of epidermis [1]. Pumice has a recognized application as abrasive agent to promote exfoliation of the skin. Pumice ground into micro-fine grains provide an excellent exfoliating medium to remove dead and rough skin, leaving the skin silky smooth, particularly, facial skin [2, 3]. In this study, the efficacy of two different formulations (a gel and a soap) containing pumice 5% (w/w) with grain size 125-250 µm was evaluated.

## Materials and Methods

Determinations of skin hydration, pH, sebum content and skin relief were performed, before and 30 minutes after application of the gel (EP 125) or soap (SP 125), chosen randomly, on the forehead of male and female volunteers through thirty circular movements. Hydration and pH values as well as the sebum content were determined with MPA®9 equipment (Courage-Khazaka, Köln, Germany), through the probes Corneometer® CM825, Skin-pH-meter® PH905, and Sebumeter® SM815, respectively. The skin surface images were obtained with the Visioscan® VC98 equipment and software SELS (“Surface Evaluation of the Living Skin”), (Courage-Khazaka, Köln, Germany), specially designed to characterize skin's relief by different variables. In this study, the variables analysed were: surface, volume, energy (NRJ), scaliness (SEsc), roughness (SEr), wrinkles (SEw) and smoothness (SEsm). These tests were conducted in laboratory environment, at a temperature around 20°C and mean relative humidity of 60%. All volunteers received oral and written information about the study modalities, including the experimental protocol, and written informed consent was obtained from each volunteer.

## **Results**

The results obtained showed that after the skin exfoliation with the EP125 gel there was a significant improvement in several biometric parameters, such as sebum, surface, SEsm and energy (NRJ). As expected, a decrease in the sebum content was obtained because the exfoliation allows the removing of the lipid content of the stratum corneum. A reduction of surface was also indicative of skin renewal. SEsm decreases as a consequence of cell desquamation promoted by exfoliation. After the exfoliation with the soap SP 125 there was no significant improvement in any of the biometric parameters evaluated, which means that gel EP 125 showed better exfoliating efficacy. This EP 125 gel allows the removal of dirt, sweat, sebum and dead cells without damaging the facial skin.

## **Conclusions**

This formulation could be of effective and interesting application as a exfoliating product for oily and combination skin. The results obtained in this study showed that Visioscan® VC 98 and MPA®9 are suitable equipments for evaluation of efficacy of the exfoliating formulations.

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**Keywords:** Pumice, Exfoliation, Gel, Soap, Skin Biometric Test

# Development and characterization of formulations containing pumice from São Miguel's Island – Azores Archipelago

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## Introduction and Objectives

Pumice is a volcanic rock formed during explosive volcanic eruptions of acidic and highly viscous magma; it is an extremely vesicular (vesicles are bubble-shaped openings formed by the expansion of entrapped gases), frothy, natural glass having a high (60-75%) silica content and very low density that in some cases float on water; it consists of fragile acicular glass and minerals (in particular, feldspars). Pumice stone has been used for centuries to remove rough and hardened skin, and it is particularly effective when used to remove hard and rough skin on the feet, in order to leave the feet feeling silky, smooth and velvety soft [1,2].

In this study, different particle size fractions of pumice sampled in several geologic occurrences in São Miguel's Island, the Azores Archipelago, were used in the preparation of cosmetic formulations.

## Materials and Methods

PFC 0.5% (w/w) gels were prepared incorporating pumice (5%, w/w) having the following particle sizes: 250-500  $\mu\text{m}$  (EP 250), 125-250  $\mu\text{m}$  (EP 125) and < 63  $\mu\text{m}$  (EP 63). Soaps obtained by saponification of stearic acid with sodium hydroxide (38%, w/v) were also prepared incorporating pumice having particle sizes within the range 125-250  $\mu\text{m}$  (SP 125). In stability tests, usually conducted at constant temperature, the samples are periodically checked for changes in important features [3]. In this work, texture (firmness and adhesiveness) and rheological studies, were carried out 48 hours, 15 and 30 days after samples preparation. These formulations were maintained at 20°C throughout the test period. The evaluation of pH of gels and soaps were also evaluated. Texture analysis is used to determine mechanical characteristics of cosmetics since they must exhibit acceptable mechanical characteristics e.g. ease of application and low firmness. Firmness is related to the ease of application onto a substrate, whereas adhesiveness, a property related with bioadhesion, describes the relative adhesive properties of a formulation [3]. Gels

texture and soaps hardness were evaluated using a texturometer Stable Micro Systems TA-XT2i (U.K.). The rheological behaviour of gels was performed at 20°C, using a rotational viscometer Brookfield DV-E (Germany), with the spindle number 6.

### **Results**

Preparations EP 63, EP 125, and EP250 showed lower firmness and adhesiveness than the respective Base (gel without pumice). After 30 days of storage, a slight decrease of firmness was observed for all the formulations. With regard to adhesiveness, only EP 125 presented a significant decrease after 30 days. All the gels presented reofluidificant behaviour without thixotropy. For all the formulations, there was a stabilization of the apparent viscosity after 15 days of preparation. The SP 125 showed a hardness value of 7.15 N and a pH of 10.25. The pH of gels EP250, EP125, and EP63 was respectively 7.69, 7.38 and 7.70.

### **Conclusions**

In general, the developed gel formulations showed better characteristics for skin application than soaps, and showed also good stability over time.

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**Keywords:** Pumice, Gel, Soap, Texture analysis, Rheology

# Efficacy of a designed peloid with anti-cellulite properties containing bentonite of Porto Santo, Madeira archipelago

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## Introduction and Objectives

Cellulite is defined as a localized metabolic disorder of subcutaneous tissue that causes an alteration in the female body shape. It appears as a modification of skin topography evident by skin dimpling and nodularity that occurs mainly in women on the pelvic region, lower limbs, and abdomen and is caused by the herniation of subcutaneous fat within fibrous connective tissue, leading to a padded or orange peel-like appearance. The relevant properties of bentonite and biogenic carbonate sand of Porto Santo, Madeira Islands, have been investigated in order to be used in therapeutic applications and topical use in local Spas and Geomedicine centers. Therapeutic functions of muds and peloids essentially depend on grain size distribution and composition (mineral and chemical), properties which condition two other important properties: capacity of adsorbed/absorbed water retaining and capacity of heat retaining. Smectitic clays, such as bentonites, are the most widely used in peloid therapy, because of their high specific surface area, ion exchange properties, plasticity, expansibility, absorbing capacity and spreadability. The aim of this work was the design of an anti-cellulite peloid using bentonite clay from Porto Santo Island and two plant extracts (Horse Chestnut Extract and Ivy Extract). In this study, formulations containing 20% of smectite clay <180  $\mu$ m from Porto Santo island and 10% of each of the plant extracts were prepared.

## Materials and Methods

Viscosity and texture analysis of the peloid were performed. The peloid application was performed on both thighs of 10 healthy female volunteers, aged between 25 and 60 years after signing an informed consent. To test the effectiveness of bentonite peloid, a gel base formulation without clay was also applied in accordance with the protocol. To evaluate the effectiveness of the developed peloid, centimeter measurements were made before (T0), after four treatments (T1/2) and after eight treatments (T1) - 2 times a week during four weeks. The observation of the appear-

ance and texture of the skin was also performed before and after treatments. The differences between T0, T1/2 and T1 were evaluated for statistical significance using Student's t-test (paired samples, bilateral). Differences were accepted as statistically significant at  $p < 0.05$ .

### **Results**

After peloid application all the volunteers have reduced the circumference of the thighs. The effect of orange peel skin of all subjects improved with the applied treatment and the leg swelling decreased in subjects with fluid retention. After applying the peloid all the volunteers had a significant improvement in skin texture and appearance: the skin was smooth, hydrated and with tighter pores, presenting a greater firmness. The gel base formulation without clay caused an improvement in skin condition but there was no change in the centimeter measurements of the thighs of the volunteers.

### **Conclusions**

The results obtained in this study demonstrate that the developed peloid with bentonite is effective for anti-cellulite treatment.

**Keywords:** Bentonite, peloid, cellulite, skin

# Treatment of varicose veins: experimental-clinical study on the effects of hidromassage with salsobromoiodine water and comparison with medical therapy

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## Introduction and Objectives

The purpose of this study is has been to evaluate the efficacy of thermal therapy, in particular of the hydromassage therapy with salsobromoione water , in patients with varicose veins. The frequency of these patients has a range between the 15-30% in the people of the east countries.

## Materials and Methods

To complete this study we have selected 52 patients suddivided in:

a) casistic group( study's group):32 patients

a) control group:20 patients

All of them had the problem of varicous veins of the 2-3-4 class of the CEAP classification. In the anamnesis we have considered the following symptomatologic indicators : pain, perception of heaviness, paresthesias, nocturnal cramps, “ restless leg “ syndrome”, pruritus .The symptoms were evaluated for intensity and frequency second following scale of evaluation, Intensity from 0 (o: lack of sintomatology) to 4 ( maximal syntomatology). Frequency in the day: 0 ( never present),1( sometimes),2 ( frequently), 3 ( always).The score obtained for each symptom has been summed to obtain the total relative scores. In the ambit of the examination we have considered the centimetres measurements of the leg diametres : supramalleolar, middle calf and middle thigh

The patients of the casistic group have been for 12 days daily submitted to a thermal treatment. The treatment was composed of the hydromassage in a single basin with salsobromoiodine water at 33 degree of temperature for 20 minutes, while the patients of the control group have been submitted to a medical therapy using flebotonic drags ( 600 mg-1000mg daily)

At the end of the treatment, symptomatologic and clinical data were reassessed in addition to morphological and velocimetric parameters related to the function of the peripheral vascular system. The statistical results are been estimated with the t Student.

### **Results**

The results showed in casistic group an improved reduction of subjective and objective symptoms as compared to the control group, demonstrating a superior efficacy of thermal therapy: the application of t Student with the average before and after therapy showed  $P(T \leq t) 0,02$ . In particular the hydromassage influences for the favourable action of hydrostatic pressure ( whit increase of venous drainage) and also for the paculiar chemical and physical characteristics of the thermal salsobromiodine water utilised. Its elevated osmotic power is responsible for the significant intrinsic antioedematous properties. In particular

Thermal therapy cost (12 hydromassages) in the agreed spa, varies from 3,10 euro (for free of charge patients) to 50 euro (for unfree of charge patients). Whereas medical therapy cost for three months (the minimum length of therapy) is about 65 Euro.

### **Conclusions**

The study has showed the superiority of the thermal therapy respect to the medical therapy in the treatment of the varicose veins.

**Keywords:** Varicose Veins, Hydromassage, Salsobromiodine Water, Medical Therapy, Costs



# Introducing BANA: “Balneotherapy Association of North America”

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## Introduction and Objectives

This presentation will introduce a new organization, BANA: Balneotherapy Association of North America that was founded in 2011 to bring national attention to the extensive history and future potential of using natural mineral waters for therapeutic benefits, as well support the environmental protection of these unique waters. Our Mission is to support the cultural and scientific research, education and training of Balneotherapy in North America. Our goals are to promote Balneotherapy for preventive care as well as treatment of chronic disorders and rehabilitation.

In the United States, the use of natural mineral waters for health has essentially disappeared since the 1930s, leaving Americans with one their most important and accessible natural healing benefits, hidden in plain sight.

BANA members believes that the field of Balneotherapy should be recognized in North America as one of healing practices within the field of integrative health, alongside of acupuncture and chiropractic. It is useful for prevention of disease, as well as treatment and rehabilitation.

There have been extensive studies of the harmful impacts of excessive amounts of pharmaceutical drugs now in our fresh water supplies, as well as entering into the oceans which is changing the biology of our children and numerous other species.

Balneotherapy would reduce drug use as a first option, thus reduce the flow of pharmacological agents into our water supply thus further minimizing negative environmental impacts, on earth.

The founding members are all active leaders within their professions, including spa owners, medical education and health insurance & policy specialists.

This presentation will provide an overview of why BANA was founded, our current goals and obstacles and our hope to collaborate with ISMH members in the future.

## Materials and Methods

BANA is focusing on the following goals in 2012:

- 1) Research: Balneotherapy Case Study Development
- 2) Information Exchange: Host the First National Conference
- 3) Education: Communities and Health industry to set up pilot research Projects, nationwide.

One of our first tasks was to submit to the US Federal Agency for Health Care Research, a formal request to do a review on Balneotherapy and its effects on improving the mobility of patients suffering from chronic diseases such as rheumatoid arthritis, fibromyalgia, low back pain, and resulting depression from pain & reduced quality of life compared to allopathic pharmacological interventions. We also have requested that the research includes examining the effectiveness of using Balneotherapy in combination with pharmacological interventions.

### **Results**

The anticipated results of our work will lead to the formal recognition of the field of Balneotherapy as a medical treatment provision within the field of integrative medicine. This would include training courses, certification standards, and ongoing medical research work on the practice.

BANA concludes that there are positive economic incentives for regional health care industries, as well as support environmental protection and appreciation of these unique waters.

We believe that a secondary benefit to highlighting the natural the healing benefits will lead to increased tourism, with many people coming back regularly, to support their best health in adapting to the seasonal changes in temperature.

Balneotherapy sites will be recognized as healthy vacation sites, for preventive care, as well as treatment of chronic diseases and rehabilitation goals.

The popularization of use of these unique waters would be highlighted in major newspapers, magazine articles, television shows, etc—and increase visibility to these towns and unique regions, nation-wide—as well as fill support local hotels, restaurants, and encourage medical training institutions, and new medical doctors to consider Balneotherapy as a potential growth industry.

### **Conclusions**

BANA concludes that there are positive economic incentives for regional health care industries, as well as support environmental protection and appreciation of these unique waters.

We believe that a secondary benefit to highlighting the natural the healing benefits will lead to increased tourism, with many people coming back regularly, to support their best health in adapting to the seasonal changes in temperature.

Balneotherapy sites will be recognized as healthy vacation sites, for preventive care, as well as treatment of chronic diseases and rehabilitation goals.

The popularization of use of these unique waters would be highlighted in major newspapers, magazine articles, television shows, etc—and increase visibility to these towns and unique regions, nation-wide—as well as fill support local hotels, restaurants, and encourage medical training institutions, and new medical doctors to consider Balneotherapy as a potential growth industry.

**Keywords:** Balneotherapy, North America, New Organization; Research, Education & Information; Health Benefits; Environmental Protection

# Analysis of the neuromuscular activity during scapulohumeral exercises in water and on land

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## Introduction and Objectives

Early mobilization is essential to restore normal shoulder function. Aquatic Physiotherapy (AP) has been promoted as a method for improving the scapulohumeral rhythm by reducing the weight on the arm.

To compare the activation of the muscles of the right scapulohumeral rhythm, and synergists in different movements and speeds, on land and in water for extrapolation to clinical practice.

## Materials and Methods

Cross-sectional, analytical inferential that uses surface electromyography (sEMG) to measure the level of muscle activation scapulohumeral rhythm right shoulder in healthy subjects.

sEMG was examined by eight muscles (erector spinae neck, trapezius, supraspinatus, infraspinatus, pectoralis, anterior deltoid, middle deltoid and latissimus dorsi) involved in scapulohumeral rhythm right shoulder of 16 right-handed subjects of which 8 were males and 8 females. Each subject performed elevations from 0° to 90° in abduction, antepulsion and combined (45°) of the glenohumeral joint in dry and in water at three different speeds (30°/sec, 45°/sec, and 90°/sec). The normalization in each of the movements was determined by maximal voluntary contraction (MVC). Comparisons between in water and on land were by Wilconxon or T-Student as normal variables.

## Results

The results of the 8 muscles studied muscle activation during the test of three speeds (30°/sec, 45°/sec and 90°/sec) and three movements was significantly lower when performed in the water off when done on land the rate of 30°/sec; similar when performed in water compared to when on land to the speed of 45°/sec, and significantly higher when performed in water versus when performing on land to speed of 90°/sec.

## Conclusions

These data suggest that the active movement of the shoulder from 0° to 90° in water and on land should be performed following a progression according to results

obtained. For early rehabilitation through active movement of the shoulder in water and on land arrangements must be made in water at low speeds (30°/sec) because muscle activation is lower than on land at this speed, then at medium speeds (45°/sec), where there is no dominance between on land and in water, so you would in the environment most favorable to some specific criteria in the rehabilitation process, and finally, at high speeds (90°/sec) on land again because muscle activation is lower for a single run in water. On the other hand, outlining the importance of the pectoralis in the stabilization of the shoulder in the FA. And regarding the movement in early periods begin with the reeducation in abduction, then antepulsion and finally the combined work of the movement (45°). This protocol, progressing as muscle activation, allows for early active motion, reducing the time to achieve therapeutic goals and increasing patient safety.

**Keywords:** Physiotherapy, Surface Electromyography, Shoulder, Movement

# Halotherapy in Rehabilitation of Patients with Chronic Obstructive Pulmonary Disease

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## Introduction and Objectives

The main objective was to estimate the efficacy of halotherapy -inhaled dry sodium chloride aerosol (DSCA) - in rehabilitation therapy (RT) of patients with chronic obstructive pulmonary disease (COPD).

## Materials and Methods

It was double- blind placebo study. 72 patients (pts) with moderate and mild stage of COPD were recruited. They were randomized in 2 groups - halotherapy group (HT) (21 m, 18 f, 60.3±10.8 yrs) and control group (CG) (22 m, 11 f, 58.5±8.9 yrs). All patients received RT: daily procedures of chest massage, light radiation, physical exercises. Pts of HT group were treated with the procedures of halotherapy (45 min twice a day for 14 days). DSCA containing particles with size of 1-5 m and level of mass concentration in the room of 10-15µm/m<sup>3</sup> was produced by halogenerator GDA-01.17 (Halomed, Lithuania). CG received placebo (inhalations with room air) instead of DSCA. Clinical, functional parameters and measures of health-related quality of life (HRQL) by SF-16 and LCQ (10 items) were estimated after RT procedures and in 3 months.

## Results

Improvements of clinical symptoms scores were observed in the both groups after the course of RT ( $p<0.05$ ), but in 3 months positive effect was noticed only in IG (before-13.8±5.4, after RT- 9.1±4.9, in 3 months -9.6±4.3,  $p<0.05$ ). Measures of LCQ were changed significantly after RT only in pts of IG, received DSCA (35.2±5.2 and 52.4±6.3,  $p<0.05$ ). Positive changes of physical functioning measures were observed (SF-16) in IG and CG groups after RT, but they have been kept till 3 month only in IG.

## Conclusions

Application of halotherapy, using DSCA, on the background of the RT in pts with COPD renders to positive effect.

**Keywords:** Movement Halotherapy, Dry Sodium Chloride Aerosol, Chronic Obstructive Pulmonary Diseases (COPD)

# Miscellaneous – 1 - Session 14

## Lectures

Health Resort Medicine in Italy and Teaching Medical Hydrology: the State of the Art

*A FRAIOLI, M FONTANA, G MENNUNI, L PETRACCIA, M GRASSI*

FEMTEC and ISMH : a Global Alliance for the Development of Medical Hydrology and Climatotherapy in the Health Government Systems and human resources

*U SOLIMENE*

## Papers

“Balneo-check”: software for balneological evaluation of mineral/medicinal waters

*K NGHARGBU, HK ODUWOLE, JT ADEAGBO, CU OBILO*

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Clinical practice and scientific investigation in a French spa resort: the Professor Paul Valdiguié example

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# Health Resort Medicine in Italy and Teaching Medical Hydrology: the State of the Art

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Spa therapy, using mineral waters, muds, baths in mineral water and caves, is applied in 390 thermal stations, almost all in activity, standing in 185 thermal sites. In every region of Italy it is present one or more spa resorts. Toscana, Emilia-Romagna, Veneto, Campania are leader regions of thermalism. Overall 500 health resorts supply spa therapy, if we include also the hotels qualified to give some thermal therapies or thermal wellness. Each year about 1,500,000 people attend italian health resorts. So the thermal system of Italy needs of specialists in Thermal Medicine, who know very well the composition of mineral waters, their physical-chemical properties, their medical applications, alone or associated or alternated with medical therapy, physiotherapy and climatotherapy. Spa physicians also must know very well the contraindications of spa therapy and the possible collateral effects, albeit no frequent. Finally, university medical schools and spa resorts perform controlled and longitudinal-observational studies to evaluate the beneficial effects of spa therapy and the cost/benefit relationship of this therapy. These efforts are documented by researches and studies published in international medical journals.

The teaching of Thermal Medicine actually comprises in Italy: 1) School of Specialization in Thermal Medicine. It is included in the Schools of Specialization of medical area, class of General Medical Clinic, which include Internal Medicine, Geriatrics, Sport Medicine, Thermal Medicine, Medical Oncology, Community Medicine. They are two Schools of Specialization in Italy: one in Rome and one in Milano. National referee for the Schools is Prof. Antonio Fraioli. 2) Basic knowledge of Thermal Medicine are given to medical students mainly as seminarial activities. 3) Lectures of Thermal Medicine are present in the Schools of Specialization in Physical Medicine and Rehabilitation and Rheumatology. 4) A II level Master in spa medicine

is working at Sapienza University of Roma 5) Chapters regarding Thermal Medicine and its therapeutical applications are included in the most important italian textbooks of Internal Medicine: *Trattato Italiano di Medicina Interna – Teodori, Società Editrice Universo, Roma, 2004* and *Strumenti di Medicina Interna-Terapia Medica, a cura di Negri M., UTET, Torino, 2011.*



# **FEMTEC and ISMH: a Global Alliance for the Development of Medical Hydrology and Climatotherapy in the Health Government Systems and human resources**

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**Text not received in time**

# “Balneo-check”: software for balneological evaluation of mineral/medicinal waters

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Balneotherapy is an ancient practice in many parts of Europe, Asia, America, the middle east, and some parts of north Africa. With the advent of Medical Hydrogeology and recent advances in software engineering, the need to inculcate computer software application in generating and analyzing medical hydrogeological data makes it compelling on modern day inter-disciplinary research to establish a link between geologic materials, their analysis, and application. This paper therefore, presents a brief review of AQUAMED – a software designed for balneological evaluation of mineral/medicinal waters. The software uses a Microsoft server SQL database to exchange data between the client system and the server. This evaluation software compares the physical/chemical properties (pH, mineralization, dominating mega ions, and phamarcodynamic elements) of mineral/medicinal waters to standards and generates reports based on these properties. The report covers medical benefits, disease applicable and contra-indication of the analyzed samples. AQUAMED v1.1 was developed using Microsoft Visual Studio.Net platform. AQUAMED version1.1 is a good analytical tool in evaluating the balneological quality of mineral/medicinal waters useful for balneotherapy.

**Keywords:** Balneology, Mineral Waters, Medicinal Waters, Software Engineering

# Cardiovascular risk factors in patients of the social thermal program in Lanjarón Spa

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## Introduction and Objectives

The main cardiovascular risk factors (CVRF) are dyslipidemia, hypertension, smoking, diabetes and obesity. There are studies that show that hydropinic treatment from Lanjarón spa springs produces a positive effect decreasing some of these parameters.

**OBJECTIVE:** To determine the cardiovascular risk profile in patients who have been in the Lanjarón Spa through the social thermal program in 2003 and 2011. To determine if there are significant changes in the population profile and compare the data with the Spanish average.

## Materials and Methods

A descriptive and retrospective study using the database of medical records of Lanjarón Spa by cross- sections study at different times, in years 2003 and 2011.

A total of 15,769 medical records retrieved, 6650 are from patients who visited the spa in 2003 and 9119 in 2011. There were identified those who recorded any of CVRF and compared with recent data published by the Spanish Ministry of Health and Consumption in cardiovascular prevention.

## Results

From an amount of 15,769 medical records with an average age of 70 years (67.1% women and 32.9% men), 42% were patients who came to the Lanjarón Spa in 2003 through the social thermal program and 57.82% in 2011.

In 2003 of 6650 patients, a 64.1% had at least one CVRF in the medical records, a 5.2% registered obesity, a 17.52% suffered diabetes, a 20.63% had dyslipidemia, a 43.87% were hypertensive and a 5.2% were smokers.

In 2011 of 9119 patients, 73.5% at least one CVRF in the medical records, a 6.4% registered obesity, a 21.1% suffered diabetes, a 39.7% had dyslipidemia, a 49% were hypertensive and a 1.6% were smokers.

In 2007, a report about CVRF control, published by the Spanish Ministry of Health and Consumption, showed that around a 20% of the adult population suffers dyslipidemia, a 68% of the population older than 60 is hypertensive, the prevalence of tobacco consumption is 26% (underlining that in 2003 it was 31%), it is estimated that the frequency of diabetes is about 10% in the population of 60 or older, the prevalence of obesity was 36%.

### **Conclusions**

Data reflects that there is no significant change in the CVRF profile in patients who visited the spa between years 2003 and 2011.

By comparing the Spanish population data is shown that the percentage of the spa visitors that has one or more cardiovascular risk factors is greater than the Spanish average.

This may be due to increased cardiovascular risk factors with age, with the exception of smoking. Thus in dyslipidemia and diabetes in the population it is appreciated that spa visitors doubles the percentage compared with the Spanish average. However in hypertension it is recorded 19% less than in the Spanish population of the same age group.

With regard to smoking and obesity, the record is well below. A 73.5% of the population attending the Lanjarón Spa is susceptible to primary prevention interventions regarding cardiovascular risk factors. Therefore the spa should be promoted as a center for primary prevention of cardiovascular risk factors.

**Keywords:** Diabetes, Dyslipidemia, Hypertension, Smoking, Obesity, Balneology

# Evolution of social thermalism program of IMSERSO

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## Introduction and Objectives

The importance of healthy living models in the maintenance of the activity until later in a time when the capabilities of the person, their life chances and opportunities for participation in all spheres of social life are prolonged much longer than in previous decades, all of them justify that this Social or Public Thermalism Program is included in the social policies of our country as one of the “Active Ageing Programs”. The Social Thermalism was set in Spain as a complementary service to benefits under the Social Security System and aims to provide older people who need it, the assistance that is provided by thermal resorts in Spain. As a public initiative this Social Program is a service that facilitates Imserso, an agency within the Ministry of Health, Social Services and Equal, and has twenty-four years of existence. Over the years, managers have seen fit to introduce regulatory and administrative changes that would allow better management and better adaptation of the program features to his philosophy and character of public service. This report aims to analyze both the justifications that have motivated these changes and the consequences they have had in the thermal sector actually involved in this program in our country, from a qualitative and also quantitative point of view.

## Materials and Methods

The revision of the regulations governing the program and the statistical data of annual reports of activity the public agency that manages the service.

## Results

The basic regulations governing the program has changed to expand access to people in greatest need of thermal treatment and special social and family situations. And they have sought management solutions to facilitate wider and flexible coverage of seats in spas. But also there have been to find solutions to budget cuts and freezes to ensure the program's growth. The initial medical report has been dropped to streamline procedures for our seniors, and medical activities in the resort during the stay has been reduced to the detriment of the shares of the insurance company contracted.

## **Conclusions**

The increase of seats has been spectacular since 2004, and although we now have better means of management and control, they are less direct than it was before this date. The medical aspects of the program have lost ground and it's now an eminently social program, rather than a social and health one. However, the number of people benefited from the thermal cure, and the income that the sector has seen , allowing reinvestment in improving and upgrading its facilities and services and the creation and maintenance of direct and indirect jobs support the conclusion that we have largely met the objectives for which this social program was born. The economic crisis has had a clear impact on the decline in demand in recent years and may also be levied through possible changes in future budget, will necessitate further adaptive changes to ensure the absorption of this demand and minimize economic losses in the sector.

**Keywords:** Regulatory Changes, Thermalisme, Public, Aging

# Thermal resorts of the Roman world according to the Tabula Peutерiana

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## Introduction and Objectives

The Roman expansion at the height of the empire covered a large part of Europe and Mediterranean Basin. During all the Roman domination, circulation of legions, administration of territories, and the trades put a multitude of travelers on Roman ways.

Since the end of the Republic, guides were elaborated to help them : routes, lists of stages to go from a city to the other one, often on hundreds of kilometers. The only representation of these “guidebooks” in the form of map which is known is Tabula Peutерiana.

Elaborated in the first century and updated until the fourth, this map is known by a copy on parchment dating of the thirteenth century and today preserved in National library of Vienna. This document, which covers the totality of the imperial Roman world, reproduces all the main routes by detailing the stages and the distances.

Among 555 mentioned cities, about 10 % are specified as thermal resorts.

We wonder about the reasons of the presence of these health resorts on routes.

Then, by drawing up the inventory of these about fifty thermal resorts, we can determine those which preserved a thermal identity until our days, and those which are always active.

The examination of Tabula Peutерiana, an ancestor of our guides of thermal towns, shows that thermal resorts very early participated to structure territories.

This examination also allows to confirm the durability of people attachment in thermal springs.

## Materials and Methods

Examination and comments of an ancient map : Tabula Peutерiana

## Results

not concerned

## Conclusions

see introduction

**Keywords:** History, Thermal Resorts, Roman World

# Clinical practice and scientific investigation in a French spa resort: the Professor Pau Valdiguié example

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## Introduction and Objectives

Professor Paul Valdiguié (1907-1988) was a clinical pathology professor of the Toulouse University and a consulting physician in Ax les Thermes, a sulfide steam and water resort in the Pyrenees mountains, in the South of France. He graduated in Toulouse University as a pharmacist (1929) and as a medical doctor (1934). He became professor of clinical pathology at 32 in 1939 (Toulouse Medicine and Pharmacy Faculty). He acted as a consulting physician during 27 years (1935-1962), mainly involved in the treatment of patients with rheumatic conditions.

## Materials and Methods

As a consulting physician in Ax-les-Thermes, he administrated mineral water using intra-dermal, transdermal, or intramuscular injections (an authorized treatment at that time) to the rheumatic patients attending balneotherapy in the resort; his clinical works were aimed at the chronic rheumatic conditions (osteo-arthritis, inflammatory chronic joint diseases, gout) investigating the therapeutic efficiency of balneotherapy and/or mineral water injections.

As a scientist he participated in the Ax les Thermes Laboratory, a Toulouse university research unit; the director was Professor Fernand Caujolle (1901-1988) a chemistry and toxicology professor in Toulouse University and the papers were published in a particular review issued 4 times a year (the Annals of Ax les Thermes Laboratory). But many works were also implemented in his own clinical pathology laboratory. The main topics investigated were: actions of sulfide balneotherapy on the glucidic and on the polypeptidic metabolisms; actions of sulfide balneotherapy on the endocrine system (thyroid using the basic metabolism determination; adrenocortex measuring 17-ceto and 17-OH corticosteroids) and the anti-oxidant system by the study of the action of Sulfide balneotherapy on the glutathion-reductase. He also developed a chemical dosage of SH<sub>2</sub>.

## Results

He put an end to his clinical implication in Ax les Thermes in 1962 to create, in Toulouse University Hospital, the clinical pathology central laboratory which he



managed until his retirement in 1982. One of his sons, Pierre, co-author of this paper, also a professor of clinical pathology, succeeded him for 5 years in Ax les Thermes until he joined himself onto the hospital laboratory; he was also fully dedicated to the rheumatic patients and investigated the interest of the measure of C Protein reactive, during his stay in Ax les Thermes.

### **Conclusions**

This historic presentation provides us with the opportunity of presenting an original and fruitful model of clinical practice and medical scientific investigation in the field of balneology; one could speak of a golden paradigm for medical balneotherapy: high level trained physicians, scientific investigation implemented in university laboratory under academic supervision, periodically issued scientific review, topics (investigated with the means of that time) constituting a very innovative and still relevant approach of medical balneology (actions of sulfide balneotherapy on metabolic, anti-stress, anti-oxidative systems).

**Keywords:** History Of Medicine, Clinical Balneotherapy, Scientific Investigation

# Sociedad Española de Hidrología Médica

## Session 15

### Lectures

The psychiatry showers in the nineteenth century: a peculiar episode  
*JC SAN JOSE*

The story of Spanish Society Medical Hidrology  
*A MUELA*

Water Journeys (II): Granada Spas and Springs through Travelers' and Hydrologists' eyes  
*F ARMIJO*

### Papers

Hippolytus' house: a roman medical bath in complutum?  
*N GRAÑA, E DIAZ*

Long-term effects of psoriasis treatment with mineral water and peloids of la Toja  
*M ARRIBAS, R MEJIDE, ML MOURELLE*

Balneology Research in Spain  
*F MARAVER, C MORER*

# The psychiatry showers in the nineteenth century: a peculiar episode

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## Introduction and Objectives

During the the nineteenth century, several events converged in Psychiatry, in Hydrotherapy and in Thermal Medicine. Began the end for prepharmacological age to psychiatric illnesses. The psychiatric institutions left to be the asylum by vagrants, prostitutes and disabled. Pinel undertook the liberation of psychiatric patients with the remaining chains to keep them locked. Appear the systems to give water under pressure and to use the showers. There is not institution psychiatric that not use the showers for the treatment of their sick.

If we consider, in Thermal Medicine that a shower is a projection of water on the individual, this stage of the nineteenth century is a peculiar event because it was used several kind of showers which have not been used again, most of the time to break the sick and other to cause them a real shock therapy

**Keywords:** Thermal Shower, Hydrotherapy, History, Psychiatric

# The story of Spanish Society Medical Hidrology

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About the history and development, until our days, of Spanish Society Medical Hidrology . Taking into account the personalities who contributed especially to the study of mineral waters.

The Spanish Society Medical Hidrology was founded in 1877, one of scientific societies more Spain old. Since then it has developed its activities without interruption. Regularly organize scientific activities to discuss topics related to the medical hydrology and publishes a scientific magazine.

The primary purpose is the promotion of the study of the medical hydrology and the momentum of the cure seaside, encouraging education and its practical application in medicine, research, social aspects and organization of the spa facilities; as well as seeking greater prestige, dissemination, scope and effectiveness of the services of the Spanish Medical Hydrology.

# Water Journeys (II): Granada Spas and Springs through Travelers' and Hydrologists' eyes

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This book has been prepared as a simple contribution to the 38th ISMH World Congress to be held in Lanjaron in the month of June 2012

It can be considered a continuation of a first text entitled "Water Journeys. Waters in the Aragonese Pyrenees through the eyes of its travelers", published in 2007 on the occasion of Expo Zaragoza 2008. At that time, my interest in travel books, waters that heal or that do not, and the mountains that crown Aragon, my homeland, moved me to write the book. Now travelers and water, as well as, the beautiful land of Granada, which is hosting this year's world meeting of hydrologists, drive me to write this new book

The province of Granada is rich in healing springs that have been used since ancient times with great satisfaction, waters that are still in use and that thanks to their properties, their flow and their temperature have surpassed the ordeal of time adapting itself to the trends along time.

Using the texts of travelers seems to me a suitable way to obtain information on how the water was, what were the facilities, the lodges and the roads at that time. This seems to me a reliable source that cannot be considered biased, because these people have only been witnesses of what they saw and later wrote in their personal journals.

Granada has been visited by many travelers throughout time for various reasons. These travelers even used the spa facilities leaving their written comments as a testimony of their experience. We will find travelers like Al Idrisi, Ibn Batutah, Jerome Münzer, Andrew Navagero, Georg Hoefnagel, Antonio Ponz, William Jacob, Richard Ford, Pedro Antonio de Alarcon, John Leycester Adolphus, Alfred Germond of Levigne, Gerald Brenan, Francisco Izquierdo Martinez, Federico Bermúdez-Cañete and many others, commenting the situation of Granada spas, sometimes with praise and sometimes not so.

The texts are divided into those occurring in currently active spas, Alhama, Alicún de las Torres, Graena and Lanjaron, and those that took place in popularly recognized healing waters not considered officially today, though local people know them and use them because of their positive effects, hoping that soon they will recover official recognition and activity.

The lodges, roads, and transportation of these times, indirect conditioners of the situation of the spas, as well as a text from a Medical Hydrology book, to get to know the professional point of view on the subject, occupy some of the pages. It is curious that most of the time, travelers and doctors agree in their appreciations.

**Keywords:** Alhama de Granada, Alicún de las Torres, Graena, Lanjarón, Travelers

# Hippolytus' house: a roman medical bath in complutum?

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## Introduction and Objectives

In Spain, a substantial number of the archaeologist findings of Roman Medical Bath are located in Extremadura, Galicia, east of Catalonia, south Andalucía and Murcia, all related to the main roman roads of Hispania. However, in the way from Tarraco to Emerita Augusta, are not many archaeological sites and practically none of them in Madrid, despite the abundance of medical mineral water (MMW) springs in the region.

Because of this information we start a search of the archaeological sites with MMW in Madrid. In the site of Complutum, nowadays Alcalá de Henares, we found information about the site called La Casa de Hippolytus (Hippolytus House) where the architectural buildings are a bath structure, set out as a collegia see, build by the Annios family<sup>1</sup>.

## Materials and Methods

We realized an analysis of the data about the Casa de Hippolytus, also we analyze the hydrogeological characteristics of the field and the water of the site zone and finally we compare the architectural structures of different romans baths with Hippolytus ones.

In this site it was found a well with mix sulphurated and strong mineralized water that correlated with another sites finds.

In a geological context, inside the Madrid basin<sup>3</sup> Hippolytus House is over the Henares river terraces. The terraces are of the Medial Pleistocenus Age and consist of chippings, gravel, clay and sands, all of these materials are placed over clay, sand and gypsum of the Medial Miocenum of Madrid. Owing to the Miocen sediments works as an aquifer inside de Madrid basin, and are affected by a NorthEast-SouthWest fault, this would be the origin of the sulphurated water springs.

## Results

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In a geological context, inside the Madrid basin<sup>3</sup> Hippolytus House is over the Henares river terraces. The terraces are of the Medial Pleistocenus Age and consist of chippings, gravel, clay and sands, all of these materials are placed over clay, sand

and gypsum of the Medial Miocenum of Madrid. Owing to the Miocen sediments works as an aquifer inside de Madrid basin, and are affected by a NorthEast-SouthWest fault, this would be the origin of the sulphurated water springs. The North-South architectonical orientation with a little inclination of 15°W, follows the Vitruvio's rules and the another roman baths too, in addition it have the tipical roman bath facilities with a similar distribution and size.

### **Conclusions**

This communication aims to show that the bath facilities correlated with a MMW roman bath, used by collegia see, turn Complutum on a Medical Bath Village. We based for this proposal in the abundance of epigraphic founds dedicated to the Nymphas, the presence of an Hercules altar stone and a sacellum dedicated to Diana, both gods related with MMW, the architectonical structure of the building and mainly the MMW spring.

**Keywords:** Archeological Site, Roman Bath, Medicinal Mineral Water Spring



# Long-term effects of psoriasis treatment with mineral water and peloids of la Toja

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## Introduction and Objectives

Psoriasis is an epidermal, proliferative, chronic, relapsing, genetically determined illness. It is clinically characterised by the appearance of erythematous dry scaly plaques that evolve in the form of outbursts. Flare-ups may be related to systemic and environmental factors.

The medicinal-mineral water from La Toja (SPAIN) is hyperthermal, it has a strong mineralization (30 gr/L), it is radioactive and rich in calcium, iron, potassium and magnesium and it contains sodium chloride, bromine, strontium, borax and fluor. It is used for the treatment of skin conditions, specially psoriasis and atopic dermatitis, because of its therapeutic benefits. At the La Toja Spa, besides medicinal-mineral water, a thermal peloid made with mineral sediments from the spring is also used.

We have established the aim of this study to assess long-term effect the thermal peloid and the La Toja medicinal-mineral water have in the clinical course of patients with psoriasis.

## Materials and Methods

Sample of 25 patients diagnosed with psoriasis vulgaris, aged between 12 and 50 (30 being the average age).

The treatment lasted an average of three weeks in which baths with medicinal-mineral water were taken and peloid was applied.

We estimated the different parameters after treatment (12 or 18 months): duration of effect of treatment with mineral water and peloids, relapse disease, evolution in outbreaks, relapse disease related to stress, relapse disease intensity (more, less), affected areas, subjective assessment (significant improvement, improvement, slight improvement, nothing or worse) and need for medications.

## Results

Time after treatment, we observed improvement in all parameters measured in this test, having decreased relapse disease, intensity, affected areas and the subjective assessment.

Our findings are consistent with those of other studies:

### **Conclusions**

The La Toja medicinal-mineral water and peloid clinically improve the clinic of psoriasis, especially disease severity.

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**Keywords:** Psoriasis, Peloid, Pelotherapy, Mineral Water

# Balneology Research in Spain

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Balneology has been highly developed in Spain in the last decade since the improvement of the spa facilities and institutional aids to the Thermal Program. In fact it has doubled the attendance at the spas due to the “Public social and health programs” development.

However, research in balneology has not followed the same development.

Centers and Institutions dedicated to research in balneology in Spain are analyzed: lines of work and major published works.

In the past years 15 articles were published in the PUBMED about the role of Medical Hydrology in Spain.

Highlight studies are on bottled water.

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**Keywords:** Health Resort Medicine, Balneology, Research, Spain

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# Medical Hydrology and Climatology Teaching at the University of Seville

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## Introduction and Objectives

Since the late eighties of the last century there has been an important development of health resorts, spas and wellness centers in Spain. One important factor for this huge step towards the use of water in its different conditions and techniques of application and more concrete the use of medicinal mineral waters was the implantation since 1989 of the Programm of “Social Thermalism” in this country that benefits the third age pensioners with almost two weeks of balneotherapy in a health resort.

The aim of this paper is to show how the great importance of Thermalism nowadays in our country with the large expansion of health resorts, spas and wellness centers make the teaching of the subject “Medical Hydrology and Climatology” at University level essential for the complete formation of Medicine students.

## Materials and Methods

In this paper we show our teaching programmes of Medical Hydrology and Climatology and the complementary Therapies that are used in health resorts, spas and wellness centres, like thermotherapy, criotherapy, hydrotherapy, crenotherapy, peloidotherapy, thalassotherapy, climatotherapy, aquatic exercise therapy, massage therapy, inhalation therapy, electrotherapy, ultrasound therapy, phototherapy, and all the diseases that can be treated in health resorts depending of the chemical composition of their waters and their physical characteristics, like rheumatic illness, respiratory diseases, digestive and metabolic diseases, endocrine diseases, neurological diseases, skin diseases, hearth and circulatory diseases, urological diseases, pediatric diseases, geriatric diseases,...

## Results

We have teached Balneotherapy in the University of Seville for the last two decades with the subject Medical Hydrology and Climatology that is imparted at the Faculty of Medicine with 4,5 credits since 1990 and will be given until 2015 in the Licentiate Degree in Medicine (plan to extinguish) and nowadays since 2008 in the new Medical Degree derived from the new European University Formation System (Superior Education European Space) with 6 credits ECTS.

We also taught the course of Complementary Formation in Balneology, Health Resorts and Touristic Medicine in our Faculty and participated in several Masters of “Analysis and Water technologies” in the Faculty of Chemistry of our University.

### **Conclusions**

All this facts make the teaching of Medical Hydrology and Climatology at University level important in order to form the future physicians in the theory and practices of this medical field.

Thus, we present our broad teaching experience, showing the contents and methodology of our programmes with the aim of sharing this experience in the european model of Medical Hydrology and Climatology Education.

# Hippolytus' house: a roman medical bath in complutum?

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## Introduction and Objectives

The luxury market grew at a rate of more than 20% per annum, and is not affected by the economic recession. One of the most important luxury market in this moment is the russian one, also they have a long tradition of spa health and wellness.

The relations between Russia and Spain have been increased during the last year with the “dual year, Spain in Russia and Russia in Spain” and both countries are very interested in open new markets, included health and tourism. Nowadays the russian tourism in Spain is focused on the “sun tourim” in Costa Brava, Costa del Sol, and Canary island, and “cultural tourism” mainly Barcelona and Madrid.

The aim of this communication is to analyze if the spanish health spa have the conditions to be attractive for Russian tourism. We consider that internet is an easy way to have information about the health spa, and probably the russian tourist use it for decide their holliday destination.

## Materials and Methods

We create a database in Excel with all the Spa in Spain, for create this we compile the information from the web page of the Spanish National Assosiation of Spa (ANBAL), the tourist web page balnearios bz, the electronic journal Termasworld, and the Vademecum II de Aguas Mineromedicianles Españolas. We analyze the Spas through their web pages and selected the Spas with a high stars classification (4 or 5), quality classifications, and those with an interesting histoy or landscapes for the studie aims. Once we choose the target spas, we reanalyze the web page with a quality criteria: useful, navigability, complete information, language options, medical information, luxury offers, socialnets and booking system amongst other items.

## Results

We found 115 Spas, some of them ceased their activity years ago, and select 25 Spas of the former list. All of them have lack of information in the web page, the principal problems were the absense of the russian language option, navigability, and luxury status. There are so much spas with differents quality classifications,



almost all of them based on management parameters, and only one with an european quality classification that also asses medical criteria.

### **Conclusions**

In conclusion we consider two points: first, the russian tourism could be an important source of income and must be promoted; and second the spanish spa market is not ready to be open to the russian ones yet. There are to many areas to improve, reinforce medical and tourist relationships between both countries`spas, and increase the luxury offer. Spite this, there are some Spas with the characteristics and resources to provide a good level to make one`s way into the russian tourism market.

**Keywords:** Health Spa, Luxury Market, Russian Tourism, Web Page, Luxury Market

# Spatio-cultural sustainability of turkish baths in modern thermal cure complexes

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## Introduction and Objectives

Human beings have always given importance to “Baths” used for bathing and cleaning as well as curing purposes with thermal and mineral water resources. Architectural development of these buildings differs from each other in terms of socio-cultural and architectural features of the communities. Architecture of Baths have been developed since 19th Century and then they have been transformed into the “Thermal Cure Complexes” of modern times.

Turkish Bath, with its specific spatial characteristics have been developed as a continuity of ancient bath traditions of Roman Architecture of the Antique Age and Turkish (Seljuk) - Islamic Architecture. Turkish Bath had been developed in Anatolia from the beginning of the 15th Century, and spread through far lands of the Ottoman Empire. After the existence of cure complexes in Western countries, Turkish Baths have begun to take place in those complexes.

This paper aims to highlight the spatio-cultural qualities of “ Turkish Bath” and proposes ways to sustain these qualities in the design of “Modern Thermal Cure Complexes”.

## Materials and Methods

The architectural and spatial features of the Turkish Baths will be discussed and their importance in the socio-cultural life will be mentioned. In addition, as an example of their integration with thermal cure centers, the Historical Rudas Thermal Complex in Budapest, Historical Old Spa (kaplıca) – Kervansaray Hotel Complex in Bursa and Modern Kurmittelhaus-Turkish Bath Complex in Bad Griesbach will be presented.

## Results

Turkish Baths were/are used for bathing, body cleanness, rubbing the skin, hand massage, sweating and inhalation. Furthermore, due to their features which increase social communication and communal share, they are also served as a psychological relaxing function. Turkish Bath in which thermal water is used, are also used for thermal treatment purposes beside those functions. Main spaces in Turkish (Thermal) Baths are Camekan (dressing, undressing-resting areas), Soğukluk (lukewarm passing arae), Sıcaklık (warm bathing area with pool and basin-kurna) and Halvet (sweating area).

## **Conclusions**

The spatio-cultural sustainability of Turkish Baths had begun in the Middle Age and has continued until today. Turkish Baths being located both in modern and historical buildings, continue to live by being integrated to those buildings. Besides its architectural beauty and its spatial diversity; the main reasons of that continuation is, the possibility of using those spaces due to the thermal cure perspective of the today's world. The locational sustainability of the Turkish Bath has to continue also in the future since it is the only building which successfully maintained the bath tradition that begun in the Antique Age until today.

**Keywords:** Turkish Bath, Thermal Cure Complex, Spatio-Cultural Sustainability

# An introduction to clinical ethics in medical hydrology and balneology

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## Introduction and Objectives

In the modern world increasingly face people of different cultures, religions and customs. Places of such meetings are also centers of hydrology and balneology. These meetings, in addition to the many advantages are associated with the risk of mutual misunderstanding and therefore potential conflicts. Conflicts erupt especially around what many seem obvious, but the opposite appears in different cultures. Common language of their agreement can and should be ethics, but this can be only when they are successfully agree on the generally accepted rules or even the meaning of words used.

## Materials and Methods

My intention is to present a proposal to introduce to the discussion about the ethics of clinical medical hydrology and balneology. Thus, to specify the area of interest, especially the controversy, the accepted sources of information and potential projects, of declarations, recommendations or codes. Today, in addition to a direct output for our field, we can already rely on a number of similar positions on other clinical disciplines, but of course it would be dangerous their direct, especially thoughtless copying.

## Results

Medical Hydrology and balneology as a clinical discipline in practice, uses the principles of medical ethics, which is why my proposal seeks only to some of its clarification and standardization on a global scale. That underlines the need for ethical reflection on the moral two decisions which we often have to make "here and now".

I think that balneological ethics, of medical ethics is a part and as such should relate primarily to the medical issues, considering the value of patient health, as particularly protected. The intention of its potential universality must, however, respect the right of some people, especially the patients to their own hierarchy of values and show full respect for their religious beliefs and cultural backgrounds. Although from the beliefs of those may result the subordination of health other values. Respect for ethical principles of one person does not mean that absolute submission to them by other people because they are sometimes contradictory. As

can be substantially different opinions on what is beautiful, good and even real, with an overall consensus on the need to seek truth, goodness and beauty.

In addition to these very important general decisions, clinical ethics must refer to the method of conducting research in balneology and medical hydrology, and determine its relationship to other disciplines of medicine as an alternative or complementary (that is my point of view). Very important is also the question of the relationship to non-medical and paramedical uses of hydrological resources. The task of ethics is also a more detailed reference to the principles of fair competition, technical progress and relationships with the producers of medical equipment.

### **Conclusions**

The proposed lecture presents an overview of these issues and presents some suggested solutions. But it is not a closed work, and the author's intention is only to open the discussion.

**Keywords:** Medical Hydrology Balneology Clinical Ethics

# Influence of sodium alginate on the thermophysical properties of diluted Dax peloid (Terdax®)

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## Introduction and Objectives

The particularity of the Thermal Town Dax, in France, is its peloid TERDAX® which is obtained by an automated and controlled production. It is based on maturation of Dax natural mineral water, silt from Adour River and development of specific algae and bacteria. Nowadays, this mud is used for the rheumatology therapeutic indication in all thermal centers of Dax as poultice or pack. Our current project leads to study the feasibility of implementing its use as individual bath, in order to open up new outlets and increase the added value of this product. Therefore, in the first stage of our research, the evolution of physical properties in function of Dax peloid dilution with Dax mineral water has been studied. Indeed, in thermotherapy, the efficiency of a peloid depends in particular of its thermal quality and an appropriate and detailed chemical and physical characterization is necessary to understand the thermal behaviour of these products<sup>1,2,3</sup>. The most influential physical properties are the specific heat, the thermal conductivity and the density. The mixture Dax péloïde-natural mineral water at 50% has been chosen for energetical and textural point of view and a gelling agent, sodium alginate, has been added to this mixture in order to avoid settling. In this second stage, this work focuses on the influence of this gelling agent on the previous studied thermophysical properties.

## Materials and Methods

The experimental specific heat data were measured in the temperature range from 298.15 to 314.15 K using a Calvet calorimeter, SETARAM BT 2.15, which permits studying with high precision all kind of substances and materials (oils, polymers, hydrates, powders) and simulate almost any process condition (reactions, crystallisation, freezing, etc)<sup>4</sup>. The pycnometer method and an Anton-Paar DMA-4500 vibrating-tube densimeter were used to measure density values while thermal conductivity was determined by the Model KD2 Pro, Decagon Devices, Inc<sup>5</sup>.

## **Results**

As expected, the specific heat, the thermal conductivity and the density present a normal behaviour: the specific heat increases with temperature and decreases with concentration whereas the thermal conductivity increases with an increase in temperature and concentration and density decreases with an increase of temperature and increases with concentration.

## **Conclusions**

The results of this study will be used to determine the best proportion between peloid and mineral water for an individual bath.

**Keywords:** Mud Therapy, Dax Peloid, Specific Heat, Density, Thermal Conductivity

# Bathing in hot water, utilizing onsen (hot springs) and drinking green tea may contribute to good health status of Japanese

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## Introduction and Objectives

Life expectancy of Japanese is longer compared with other countries. It is presumed that some life-style factors may be in part related to Japanese good health status. Among lots of life-style factors, we focused on bathing in hot water (over 40 centigrade) in daily, utilizing ONSEN (hot spring), and drinking green tea as we think these are mostly particular in Japan. It has been showed that bathing in hot water augments blood flow. It has also reported that daily consumption of green tea may inhibit LDL oxidation followed by preventing the incidence of atherosclerotic diseases. In this study, we used self-rated health (SRH) as an indicator of health condition since SRH has been known as a powerful predictor of future morbidity and mortality.

The purpose of this study is to investigate the contribution of bathing in hot water, utilizing ONSEN, and drinking green tea to Japanese health status using the estimation of SRH.

## Materials and Methods

A cross-sectional questionnaire survey was conducted on 5,000 residents among 20 years old and over in Shizuoka prefecture on 2011.

SRH was evaluated using five-point scale from "excellent" to "very poor".

The frequency of bathing in a bathtub was categorized into two groups: "less than 7 days/7 days in a week" (less bathing/bathing group). The frequency of utilizing ONSEN was categorized into two groups: "less/more than once in a month"(less ONSEN/ONSEN group). Amount of green tea consumption was classified into two groups; "less/more than 1 litter per day" (less green tea/green tea group).

Using SRH as a dependent variable, unconditional logistic models were analyzed and odds ratios and their 95% confidence intervals were calculated.



## **Results**

The number of respondents was 2,779 (56%). In bathing group there were 1,310 cases (47%), in ONSEN group 663 (23%), and green tea group 462 (17%). Cases who are applicable both in bathing and green tea group were 254 (9%), both in ONSEN group and green tea group were 121(4%). Respondents who were in bathing group (OR = 1.18, 95%CI, 1.0-1.3), ONSEN group (OR = 1.5, 95%CI, 1.1-1.9), green tea group (OR= 1.2, 95%CI, 1.0-1.5), bathing and green tea group (OR = 1.4, 95%CI, 1.1-1.9) and ONSEN and green tea group (OR = 1.8, 95%CI, 1.2-2.6) showed a strong association with better SRH.

## **Conclusions**

This study suggests that bathing in hot water every day, utilizing ONSEN often and drinking green tea a lot, and the combination of these daily habits may contribute a good health status of Japanese. We think that promotion to have these lifestyle habits may augment person's own perception of general health. It is also possible that these results may explain part of the reasons for higher life expectancy of Japanese.

**Keywords:** Bathing, ONSEN (Hot Spring), Green Tea, Self-Rated Health, Longevity

# **POSTERS PAPERS**

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# Omega-6-eicosanoid may be involved in the cutaneous vasodilation mechanism of the rat bathing in CO<sub>2</sub>-rich water

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## Introduction and Objectives

Bath water of high concentration CO<sub>2</sub> (about 1000 ppm) evokes comparable physiological responses to natural CO<sub>2</sub>-hot-spring water, which is the local responses (e.g., a blood flow increase, a vasodilation, and a reddening in the skin in bathwater) and the global responses (e.g., a decrease in heart rate and blood catecholamine level, and a blood pressure stabilization). Among these reactions to the CO<sub>2</sub>-water, reddening of the skin is a remarkable reaction evoked within a few minute of immersion. Though the skin flush is not obvious in skin of the experimental animals, the skin vasodilation is detectable instead.

Though the hypercapnea caused vasodilation is well known, the underlying physiological mechanism remains still obscure. In this study, we investigated the possible mediators of skin vasodilation that is evoked by bathing with the CO<sub>2</sub>-water in experimental animals.

## Materials and Methods

A series of study was permitted by the animal experiment ethical committee of Teikyo University of Science, and was conducted according to the guideline of the animal experiment approved by the Physiological Society of Japan. Male Wistar rats (12-21 weeks, 340±60 g) were anesthetized by Urethane (1~1.5 g/kg, ip), fleeced with cut machine, equipped with probes for measurements of the rectal and skin temperatures and with a laser Doppler probe for measurement of the skin tissue blood flow. The CO<sub>2</sub>-water (CO<sub>2</sub> ≥ 1000 ppm) was made with an artificial CO<sub>2</sub>-hot spring maker (MRE-Spa, Mitsubishi Rayon Cleansui, Tokyo). Rats were immersed into the tap-water (30 °C) or the CO<sub>2</sub>-water of same temperature in head out position for 30 min.

## Results

Intravenous infusion of indomethacine (10 mg/kg) inhibited skin vasodilatation by CO<sub>2</sub>-water immersion, a nitric oxide-inhibitor (L-NAME) infusion had no effect.

The pH of the perfusate collected through a fine microdialysis probe laying between skin and muscle was decreased by about 0.2 during CO<sub>2</sub>-water immersion.

The skin of immersed part was removed immediately after the 30-min immersion in CO<sub>2</sub>-water and the tap-water, and was frozen in liquid nitrogen immediately after the sampling, and was stored at -80 °C until analysis. Skin was homogenized in ethanol containing prostaglandin-biosynthesis inhibitor (indomethacin) and centrifuged. Supernatant was collected and analyzed by using ELISA-kits for the vasodilatory prostaglandin(PG)E<sub>1</sub>, PGE<sub>2</sub>, and PGI<sub>2</sub>. Among 3 PGs analyzed, PGE<sub>2</sub> levels were significantly increased by about 40% after CO<sub>2</sub>-water immersion, and the level during immersion was significantly larger than tap-water immersion control animals.

### **Conclusions**

Results clearly indicated that arachidonate metabolites, probably PGE<sub>2</sub>, mediated skin vasodilation during CO<sub>2</sub>-water bath. PGE<sub>2</sub> may be released in the skin in response to the lowered pH during CO<sub>2</sub>-water bath, and may dilate the vasculature. Because skin reddening is observed within several minutes of CO<sub>2</sub>-water bath in human, according to this context, PGE must be produced within several minutes. Whether or not PGE<sub>2</sub> is sole mediator of this vasodilation is still controversial, but at least, this vascular effect of CO<sub>2</sub>-water may not be expected in the patient to whom non steroidal anti-inflammatory drug is administered.

**Keywords:** CO<sub>2</sub>-Rich Water, Skin Vasodilation, Prostaglandin

# Health effects attributed to endocrine disrupting compounds from mud and lake waters sources

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## Introduction and Objectives

Endocrine disruptors are substances that "interfere with the synthesis, secretion, transport, binding, action, or elimination of natural hormones in the body that are responsible for development, behavior, fertility, and maintenance of homeostasis (normal cell metabolism)." They are sometimes also referred to as hormonally active agents, endocrine disrupting chemicals, or endocrine disrupting compounds (EDCs).

## Materials and Methods

EDC studies have shown that endocrine disruptors can cause adverse biological effects in animals, and low-level exposures also cause similar effects in human beings. The term endocrine disruptor is often used as synonym for xenohormone although the later can mean any naturally occurring or artificially produced compound showing hormone-like properties.

## Results

The Endocrine Society released a scientific statement outlining mechanisms and effects of endocrine disruptors on "male and female reproduction, breast development and cancer, prostate cancer, neuroendocrinology, thyroid, metabolism and obesity, and cardiovascular endocrinology," and showing how experimental and epidemiological studies converge with human clinical observations "to implicate EDCs as a significant concern to public health."

Endocrine disruptors are estrogen-like and anti-androgenic chemicals in the environment. They mimic natural hormones, inhibit the action of hormones, or alter the normal regulatory function of the endocrine system and have potential hazardous effects on male reproductive axis causing infertility.

Endocrine disruptors are chemicals that interfere with endocrine (or hormone system) in animals, including humans. These disruptions can cause cancerous tumors, birth defects, and other developmental disorders. Specifically, they are known to cause learning disabilities, severe attention deficit disorder, cognitive and

brain development problems, deformations of the body (including limbs); sexual development problems, feminizing of males or masculine effects on females, etc. Any system in the body controlled by hormones, can be derailed by hormone disruptors. Health effects attributed to endocrine disrupting compounds include a range of reproductive problems (reduced fertility, male and female reproductive tract abnormalities, and skewed male/female sex ratios, loss of fetus, menstrual problems); changes in hormone levels; early puberty; brain and behavior problems; impaired immune functions; and various cancers.

### **Conclusions**

Although mud action on various functions is still little known, some beneficial effects on some genital disorders have been observed empirically since antiquity, when sterile women are recommended to make partial or general mud baths. The experimental results on the composition and physico-chemical inter-relationships that contribute to its therapeutic effects are limited in the literature.

Salt water and mud are extracted from Heliothermal Ursu lake and contain human-like estrogen and progesterone hormones liberated by *Artemia salina*, which improves significantly the hormonal status of the body. Human -like measured hormone levels are: in salt water estrogen human-like 95 S.U % and progesterone human-like 0.7-0.8 mg%, in mud estrogen human like 355 S.U.% and progesterone human like 2.5 mg%. On the other hand, the high amount of salt in water – 300 g/l and in mud – 95% of mineral fraction of mud relieves pelvic tissue fluids and stasis and decreases pelvic inflammation. Both estrogen and progesterone levels are important for embryo implantation.

**Keywords:** Estrogens, Endocrine Disruptors, Mud, Salt Waters, *Artemia Salina*

# Underground microclimate influence of Romanian Ocna Dej and Cacica salt mines on wistar white rats induced pathologies experimental model

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## Introduction and Objectives

The aim of this study is to determine the effect of underground microclimate from romanian Cacica and Ocna Dej salt mines on protein metabolism and hidroelectrolyte balance in different age Wistar white rats with induced pathology subjected to speleotherapy cure in mentioned salt mines.

## Materials and Methods

The study was performed on 80 young and adult Wistar white rats sensibilized with induced allergic pathology by ovalbumine or skin pathology (wounds, burns) divided in experimental and control groups. The rats from experimental groups were subjected to a speleotherapy cure in Ocna Dej or Cacica salt mines.

The air composition of underground environment in the Cacica and Ocna Dej salt mines were determined with RAE gas detection tubes and the following gases and volatile compounds were assayed: O<sub>2</sub> (%), CO<sub>2</sub> (%), CO (ppmv), SO<sub>2</sub> (ppmv), O<sub>3</sub> (ppmv), Cl<sub>2</sub> (ppmv), NH<sub>3</sub> (ppmv), NOX (ppmv), HC (ppmv), H<sub>2</sub>O (mg/L). Total protein concentration was assayed by microplate biuret reaction, the readings being made with a Modulus Multimode Microplate Reader (Turner Biosystems). Serum protein electrophoresis was performed on cellulose acetate using a Genio S (Interlab) electrophoresis automated system.

In order to study the electrolyte balance animals were kept for 24 hours in individual metabolic cages without food and with free access to a saline solution. After 24 hours were measured water volume (ml/24 h) and the amount of sodium intake (mEq/24 h), urine volume (ml/24 h) and concentrations of sodium and potassium in urine (mEq/24 h) using a Ciba Corning 480 flame photometer. From these values were calculated the urinary Na/K ratio as an expression of the mineralocorticoid response of adrenals in the experimental conditions.



## **Results**

The experimental data obtained show that the air composition of the both studied salines is characterized by an increased level of CO<sub>2</sub>, absence of toxic compounds and the presence of hydrocarbons. Onto the serum protein fractions the salt mine speleotherapy cause a variation of their values depending on the pathology and used salt mine.

Experimental cure of speleotherapy in Ocna Dej and Cacica salt mines normalize hydric and electrolyte balance parameters in most cases (water and sodium intake, diuresis and renal sodium concentration ability) of rats with induced pathologies due to the direct effect of salt microclimate on the wounds and burns, and also due to saline load of the body in the presence of NaCl aerosol.

## **Conclusions**

Induced pathology (burns, wounds, sensitization) does not cause a significant change in mineralocorticoid function of the adrenal glands regardless of animal age, instead speleotherapy cure lead to an increase in that, possibly due to a stimulation of the renin – angiotensin - aldosterone system in Wistar white rats exposed to salt mines microclimate.

**Keywords:** Salt Mine Speleotherapy; Induced Pathology; Air Composition; Electrolyte Balance; Protein Electrophoresis

# Carbogaseous mineral water for patients with metabolic syndrome

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## Introduction and Objectives

The carbogaseous mineral water from Borsec, nr 1 spring, was intensively studied before '90; its effect on decreasing the level of glicemia in diabetics are well known. The results were reinforced in more recent studies, conducted by endocrinologists and diabetes mellitus specialists (2005 – 2009). The metabolic syndrome is a frequent modern sufferance and it has been incriminated in increasing the risk of cardiac ischaemic disease and cerebrovascular disease. The present study intends to evaluate the influence of carbogaseous mineral water from Borsec, nr 1 spring, on the components of metabolic syndrome.

### Materials and Methods

The study is a prospective one, single blind, randomized, on going. We included, up until now, 40 patients with metabolic syndrome, divided in 3 groups: group A received carbogaseous mineral water, group B received plain water and group C received tap water. The patients dranked the corresponding study water for 3 weeks, 2 liters daily. The assessment of the subjects was done at the beginning of the study and after 3 weeks and consisted of a clinical and biological evaluation of the components of metabolic syndrome. The following parameters were determined: MCP – 1(monocyte chemoattractant protein-1), Human MCSF (macrophage colony stimulating factor), TNF beta, Interleukine 6, PCR high sensitivity, Glycemia, Cholesterol (total, LDL, HDL), Triglycerides, Uric acid, Fibrinogen.

### Results

The study is still on going, but preliminary results are already available. Obtained data shows a statistical decrease of the level of glycemia and also an increase of the urinary uric acid. We have to include patients until the end of February; the final results are expected before the first of May.

### Conclusions

The water is present in daily alimentation of every human being. Using it as an adjuvant to prevent or to treat diseases like metabolic syndrome or diabetes could be cheaper and easier for patients.

**Keywords:** Carbogaseous Mineral Water, Diabetes Mellitus, Metabolic Syndrome

# **A developing complex research on naturally therapeutic factors: geological, physicochemical, microbiological, climatic and experimental animal studies in the Turda aria**

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## **Introduction and Objectives**

The natural resources research is crucial in promoting a spa resort by underlying the therapeutic properties of natural factors and identifying the biological mechanisms in action. In this context, the objective of this ongoing project is to create a balneary research platform in the Turda area, strategically situated on the Romanian Balneary Map, and having a huge balneary potential.

## **Materials and Methods**

Geologically, the area of Turda town is situated at the joint between the Jurassic facies limestones formations of Mount Petrid and the tertiary sedimentary rocks of the Transylvanian Plateau floor, here formed from marls, clay, greystone, and volcanic tuff strata. Approaching Turda, the strata comes bending towards the town, where they appear deformed, due to the salt grains which lifted them in a vault-like shape. Due to the erosion, the sediments' cover was washed off and the salts from these vaults rose to the surface, allowing exploitation. Because of these low-resistant deposits, there are frequent land slidings in the area. Water flooding into the former mines dissolved the salt, giving birth to salt lakes (the spas area). The actual antropossiline lakes were formed in the Middle Ages, up to 13th century. The existence of a salt deposit and the exploitation of this reserve over the centuries, created in the North-East of the town, at about 2 Km from the center, a specific landscape. It is the Salty Spas micro-depression.

The climatic factors are very stable during Turda's history with the exception of some minor and inconstant changes due to the human activities.

Another therapeutic factor of the zone is the medicinal mud situated at 0,5 –1m depth; it is used for cure, spread on the body followed by heliotherapy. The treatment is often applied in unorganized empirical manner.

The complex research consist of:

- geological and hydrogeological tests for the identification and quantitative evaluation of natural resources in Turda area: land and laboratory geological research, geophysical and geochemical studies
- physico-chemical and microbiological studies on the identified, prospected and quantified natural factors from Turda area; microclimatic and bioclimatic studies
- experimental research on laboratory animals (Wistar rats and New Zealand rabbits)

### **Results**

The end products of our project are: the research studies on natural therapeutic factors from Turda, a new balneal curative model dedicated to Turda, patented and then transferable to other localities with similar balneary profile, a Scientific Park for research, education and business dedicated to natural therapeutic resources at Turda, spa products obtained by research on natural therapeutic factors

### **Conclusions**

The project theme has an absolute novelty at national level, because of the innovative methodology for naturally therapeutic factors research; also, the cooperation with the local authorities, represented by Turda Municipal Council and Turda City Hall, is a national innovation and represent the key of the good ending of this work.

**Keywords:** Salt Lakes, Salt Caves, Medicinal Mud

# An analysis of the behaviour of a mixture of the algae fucus vesiculosus with bentonite for therapeutic uses

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## Introduction and Objectives

Fucus vesiculosus is a brownish algae belonging to the family Fucaceae which is found in the Baltic Sea, and in the Atlantic and Pacific coasts. Its properties are derived from its composition, mainly from its iodised matter and sulphated polysaccharides such as fucoids and alginates. It is used in therapeutic, pharmacological, and cosmetic applications amongst others due to its antioxidant, anti-cancer, anti-diabetes, photoaging prevention, and anticoagulant properties, and because it improves mechanical properties and aspect of skin.

The algae Fucus vesiculosus mixed with clay and seawater gives rise to a peloid that can be used for thermotherapy and pelotherapy. This work focuses on studying the properties of a mixture of Fucus vesiculosus and bentonite, and seawater, in order to determine whether it can be used for treating cellulitis, an alteration which affects skin at the epidermis, dermis, and hypodermis levels.

## Materials and Methods

Algae studied belongs to the species Fucus vesiculosus, seawater was supplied by Quinton Labs. and the bentonitic clay used was supplied by the Spanish company "BENESA".

The properties studied are density, specific heat and thermal conductivity.

The density has been obtained using a pycnometer. Hexane and tridistilled water have been used as calibration liquids. The technique is described in Deeds and Van Olphen (1961). The thermal conductivity was measured by a conductivimeter KD2 proThermal Properties Analyzer (Decagon Devices, Inc.), and the specific heat was measured with a Calvet microcalorimeter

## Results

The behaviour of specific heat, density and thermal conductivity of these mixtures with temperature depends on the concentration of algae, seawater and clay. Thus, the more concentrated samples exhibit also higher increase in specific heat and thermal conductivity values with the temperature. The density decreases with increasing temperature.

### **Conclusions**

The thermal behaviour of the mixtures of algae, seawater and clay depends mainly on the content in water of the sample. The thermal conductivity and density values increase with decreasing concentration of sea water while the specific heat increases with increasing concentration of seawater. The results obtained indicate that mixtures of algae, sea water and clay are suitable for thermotherapeutic applications in thalassotherapy centers.

**Keywords:** Fucus Vesiculosus, Bentonite, Peloid, Thermophysical Properties

# Technical audit of the thermal water cooling systems and energy enhancement

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## Introduction and Objectives

Natural mineral waters from Dax and its surroundings (France) present hot temperatures, named hyperthermal waters, ranging from 54 to 62 °C. They necessitate a very high energy potential to be cooled so as to use them for treatments at 35°C in rheumatology and 28°C in phlebology.

## Materials and Methods

In order to know the cooling systems from the 18 thermal centres (Dax and Saint-Paul-les-Dax- France), a technical audit was realised thanks to a questionnaire enabling:

- to assess the geothermal potential of the natural mineral water.
- to take inventory of the various cooling systems and to assess the energy spending needed for each centre to cool the thermal fluid.
- to correlate the various factors so as to think about the creation of energy enhancement systems and thus to decrease the expensive exploitation costs when the cooling system is not optimised.
- To set the thermal spa city as a national reference in terms of sustainable development.

## Results

Among the 18 audited centres, 9 possess a geothermal energy upper than the energy produced by the city gas.

The energy produced by the gas for heating purposes could then be replaced by the energy potential of the thermal water circulating in the thermal spas.

## Conclusions

For this approach to be implemented, more personalised audits should be realised with costs depreciation for each centre.

**Keywords:** Natural Mineral Water, Hydrotherapy Centre, Technical Audit, Geothermal Potential, Cooling System



# Bromine chemistry applied to swimming pools water disinfection - A bibliographical study

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## Introduction and Objectives

When we worked on the hypobromous acid creation mechanisms and its modes of action as an active principle for swimming pool disinfection, we noted that the bactericide effect of this biocide was developed against 4 pathogenic bacteria likely to be present in water: Enterococcus, Pseudomonas aeruginosa, E.coli and Staphylococcus aureus.

## Materials and Methods

Bibliographical study

## Results

This article more particularly details the group of predominant bromination by-products generated by the oxidation of nitrogenous and non-nitrogenous organic pollution brought by bathers, as well as their relative stability in aqueous environment.

As for the bromamines created in these high oxidation conditions, they are reckoned as unstable odourless and disinfectant, thus proposing a substantial bathing comfort. This is not the case for chlorine which generates stable, irritating and noxious chloramines in addition to an unpleasant smell.

The works of the various authors quoted in this study show well the limitations of chlorine for hot and lightly alkaline hot waters, even if it is considered as cheaper. On the toxicological point of view, the concentration in bromine by-products found in the swimming pools waters and their toxicity -at the scale of a nanogram for some of them, underline the importance of regular analytic checks for these derivatives (more particularly for dibromoacetic acid and bromates) so as to preserve safety for bathers and the maintenance staff.

## Conclusions

In this context, bromine plays a privileged role and could be a true alternative to chlorine for this type of water used in rheumatology pool as well as in thalassotherapy, recreational balneology, hot tubs...

**Keywords:** Bromine, Disinfection, Bactericide, By-Products, Toxicity

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# Does balneology still have gynecologic indications?

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There are still some precise and traditional indications for the use of spa-treatment in gynecology, even though they have been reduced or limited by the extraordinary progress made in exploratory techniques and different medico-surgical treatments. It also appears that the most recent and varied of these indications, especially concerning the multiple problems linked to menopause, can be usefully treated by spa-therapy.

We review the articles published in the last 20 years in pubmed and we find only 34 articles when we introduced the words “balneotherapy” and “gynecology”: most of the articles talk about water birth. secondly highlight the items covered in the chronic pelvic pain after a pelvic infection.

If we introduced the key words sterility and balneotherapy we find 73 articles during the last 20 years. Most of them are about seminal disorders. Others talk about polycystic ovarian syndrome , or the luteal-phase defect.

We not find more items if we introduce the terms “pelotherapy” or “mud-therapy” and gynecology .

If we focus our search on the words menopause and balneotherapy, we find again, only 6 papers.

It is the role of practitioners, well informed of the multiple treatments available in the centers of hydrotherapy, to make the right choice, at the right moment, and concerning the right spa-center. Both perhaps the role of these treatments has become something anecdotal in the field of gynecology.

**Keywords:** Balneotherapy, Gynecology, Spa-Treatment, Pelotherapy

# Effectiveness of exercise program for osteoporosis on quality of life in relation to body mass index

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## Introduction and Objectives

Prevention of osteoporosis and osteoporotic fractures among others include adequate physical activity. Previous epidemiological studies indicate less break in active women, whether it is the result of direct effects on bone or improving coordination, balance and muscle strength. The aim of research was to examine the impact of exercise program for osteoporosis in the duration of four weeks on health and psychological aspects of patient using quality of life questionnaire SF-36, used before and after the program, with considering the BMI (body mass index) of subjects.

## Materials and Methods

The study included 39 subjects with osteopenia and osteoporosis. Participants were divided into two groups, patients with an ideal BMI (19.1-25.8), and patients with increased BMI (> 25.9). Program for osteoporosis in duration of four weeks was conducted. It consisted of exercises for osteoporosis, advice about diet, advice on preventing falls, interview and medical examination before and during program implementation. For self-assessment of health status generic questionnaire SF -36 model was used. It is a multi-purpose, short form model containing 36 ordinal scale items on eight dimensions: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE) and mental health (MH). The questionnaire items selected also represent two general concept of health as physical and mental health. Filled in by the subjects in the two time points, before the implementation of this program and at the end of the program.

## Results

Research results showed that in subjects with an ideal BMI improvement was recorded when it comes to quality of life in all dimensions, following a program, with greater improvement in mental (MCS) component summary in relation to the physical (PCS) component summary. In subjects with a BMI over normal range also showed an improvement in quality of life for all eight dimensions, with greater

improvement in PCS in relation to MCS. In the group of subjects with a BMI over normal range was proved the deterioration of self-reported of general health status compared to the year ago, HT (health transition).

### **Conclusions**

Using short-term exercise program and education of subjects leads to significant changes in self-reported quality of life. Future research will point out long-term effects of exercise (6 months after implementing the primary program) on the quality of life.

**Keywords:** Osteoporosis, Exercise, Quality Of Life

# Sulphurous mineral water for lower limb osteoarthrities therapy in elderly? Short and long term outcome

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## Introduction and Objectives

The objective of this work was to follow some clinical and functional parameters of knee and/or hip osteoarthritis, in order to evaluate the therapeutic effects of sulphurous mineral water from Pucioasa balnear resort.

## Materials and Methods

We studied 570 patients with knee and/or hip osteoarthrities, treated in Pucioasa balnear resort during 2010; they accepted to enter this study and they came after one year for another balnear cure for the same pathology. The group consisted of 325 women and 245 men, 65 to 87 years of age, accepted for treatment according with well-establish criteria. 36% of them needed surgical treatment, but they refused that for different reasons. 10% from the group with knee localization had inflammatory exacerbation at the baseline. More than three quarters refused to walk with a cane, despite the pain and the poor gait pattern.

We used QOL questionnaires and a clinical evaluation report (WOMAC scale, VAS, clinical items of gait analysis etc) to be completed at baseline, after 18 days of treatment and after 1 year. Adverse effects were also noted. For the third evaluation, the number of exacerbation and/or hospitalizations for lower limb osteoarthritis were recorded.

## Results

All the patients received sulphurous mineral applications as general bath during 18 treatment days, using a standardized methodology; cardiac function was daily evaluated. The treatment also included education and adapted physical exercises.

Clinical complaints were significantly reduced comparing with the baseline level, even for those with inflammatory exacerbation. Qol and patient satisfaction also had a significant improvement.

After one year, 102 patients had more than one clinical exacerbation of the pain; 35 patients suffered a surgical procedure (26 hip replacement and 9 knee replacement); radiologic evaluation for the others showed no further joint deterioration.



More than half of the patients were using a cane and followed the medical advices concerning physical exercises and joint protection.

**Conclusions**

Balnear therapy with sulphurous mineral water determined a significant and consistent improvement of clinical aspects and quality of life for knee and/or hip osteoarthritis patients in our study. The health education under continuous medical supervision during the 18 days cure helped the patients compliance for medical advices and joint protection.

**Keywords:** Sulphurous Mineral Water, Knee Osteoarthritis, Hip Osteoarthritis

# Salt mines therapy for pulmonary rehabilitation of chronic obstructive pulmonary diseases

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## Introduction and Objectives

Using naturally therapeutic factors for treatment and/or rehabilitation cures of different respiratory pathologies knows a continuous development in Romania and elsewhere. The indications and the methodology are still to be well established.

The objective of this study is to standardize and to assure a scientific background for salt mines rehabilitation therapy (speleotherapy) in patients with chronic obstructive pulmonary diseases (COPD).

## Materials and Methods

30 patients (group A) diagnosed with COPD, men and women, ages between 50 and 65 years, without cardiac complication, accepted to be included in this prospective controlled single-blind study; the matched control group (group B) also included 30 patients. The inclusion and exclusion criteria were applied for both groups. The subjects were evaluated before and after the treatment period and after three months for pulmonary function, effort testing, degree of dyspnea and fatigability, quality of life, number of exacerbations and number of hospitalizations. The evaluation and the statistical analysis of recorded parameters were done by independent individuals.

All the patients were included in a standardized training program (respiratory training); the subjects from group A received 12 daily salt mines therapy sessions

## Results

Statistical analysis showed a significant improvement for the clinical and functional parameters in the study group, comparing with the baseline data and with the control group. However, the functional pulmonary testing shows no significant changes. After 6 months, the number of disease exacerbations was significantly lower in the study group

## Conclusions

The method of speleotherapy proposed by this work for the COPD rehabilitation seems to be more beneficial for patients' outcome, on a medium term, than only respiratory training. Further studies are ongoing for a more precise conclusion

**Keywords:** COPD Rehabilitation, Salt Mines, Speleotherapy, Respiratory Training

# High concentration artificial CO<sub>2</sub>-water immersion facilitates a recovery from muscle fatigue after submaximal exercise

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## Introduction and Objectives

Clinical observations of CO<sub>2</sub>-hot spring (CO<sub>2</sub> ≥1000 ppm) immersion revealed the effects, an immersed part reddening, skin blood flow improvements, blood catecholamine decrease, etc. Recently an apparatus was developed for making water containing comparable CO<sub>2</sub>-concentration to natural CO<sub>2</sub>-hot spring water.

Studies using this artificial CO<sub>2</sub>-water and experimental animals revealed that cardiac sympathetic nerve activity was decreased by bathing with the CO<sub>2</sub>-water, which has long been assumed by the observation of human. In response to the CO<sub>2</sub>-water bath, the reduction of sympathetic nerve activity indicating stress may imply the facilitation of muscle fatigue recovery.

We have demonstrated that repeated immersion of the forearm in CO<sub>2</sub>-water augments the local muscle O<sub>2</sub> consumption and blood flow using near-infrared spectroscopy (NIRS).

In the present study we investigated whether an immersion into the water containing high concentration CO<sub>2</sub> (CO<sub>2</sub>-water) after submaximal exercise could facilitate a recovery from muscle fatigue.

## Materials and Methods

Six male healthy students (Age; 21-22 yrs, Height; 176.6±1.7cm, Weight; 65.0±2.2kg, %fat 14.6±1.6%) performed 10 min pedaling exercise at 60% Vo<sub>2</sub>max were given one of the following 3 treatments in a different day; immersion into tap-water (CO<sub>2</sub><20 ppm) or artificial CO<sub>2</sub>-water (CO<sub>2</sub>>1000 ppm) (30 °C, 10 min), or bathtub sitting rest (air) after exercise. Blood flow in the immersed skin (BF) and electrocardiogram (ECG) were recorded continuously throughout the experiment. Cardiac autonomic nerve activity was evaluated by R-R interval fluctuation power spectrum analysis (PSA) using ECG. Muscles stiffness (right vastus lateralis dominant; MS), blood lactate concentration (BLa), salivary cortisol (SCo), visual analogue scale in muscle (VAS) were evaluated at pre-exercise, immediately after exercise, during immersion (at 5 min of immersion, not measured MS) and at 10 min after the end of immersion. Statistical evaluation of the data was done by

repeated-measures two-way ANOVA, using Turkey test for post hoc multiple comparisons at the 0.05 level of significance. This study was approved by Japanese Red Cross Hokkaido College of Nursing Review Board for Health Sciences Research Involving Human Subjects.

### **Results**

BF was significantly larger in CO<sub>2</sub>-water immersion throughout the recording period compared to the other 2 treatments. At 10 min after immersion, MS in CO<sub>2</sub>-water treatment was significantly small ( $22.2 \pm 1.2$  tone,  $p < 0.01$ ) compared with air ( $28.0 \pm 2.0$  tone) and tap-water immersion ( $31.8 \pm 2.2$  tone). In CO<sub>2</sub>-water immersion, BL<sub>a</sub> were significantly decreased compared with air ( $4.3 \pm 1.6$  vs  $3.7 \pm 1.7$  mmol·l<sup>-1</sup>,  $p < 0.05$ ), while the other 2 treatments did not affect. A power ratio, LF(0.04~0.15Hz)/HF(0.2~0.4Hz), in PSA was smaller in CO<sub>2</sub>-water treatment than in tap-water treatment, while HF-power did not change. Compared with the air, SCo was significantly decreased in tap (24%) and CO<sub>2</sub>-water immersion (48%).

### **Conclusions**

Results showed that the recovery of increased sympathetic activity and muscle stiffness was facilitated by CO<sub>2</sub>-water immersion after submaximal exercise. CO<sub>2</sub>-water immersion might relax the muscle through some CNS mechanism and facilitate flexibility of human muscle. The present results agree with the hypothesis that CO<sub>2</sub>-water immersion after submaximal exercise would promote a recovery from muscle fatigue.

**Keywords:** CO<sub>2</sub>-Water, Muscle Fatigue, Submaximal Exercise

# Hypoxic adaptation in patients with arterial hypertension associated with coronary artery disease

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## Introduction and Objectives

Goal: to study the hypotensive effect of "dry" carbon dioxide baths, which are by hypoxic adaptation in patients with arterial hypertension.

## Materials and Methods

Patients contingent consisted of 60 people with a combination of Arterial Hypertension II-III degree, and coronary heart disease, angina II-III functional class. All patients were treated at high and very high risk of developing cardiovascular complications.

Adaptation to hypoxia was performed on a special installation for flow-through "dry" carbon dioxide baths firm "Reaboks" (Russia) of 600 l of a standard procedure: t to 32 ° C, flow rate - 15 l / min, duration - 15 minutes treatment procedures, 15: 5 daily treatments with 2 days of rest.

## Results

During the application of hypoxic adaptation of "dry" carbonic acid baths, was marked expressed sympatolitic vazodilic action to facilitate the implementation of anti-hypertensive, anti-anginal and anti-arrhythmic effects.

Number of episodes of myocardial ischemia (pain and pain-free) reduced to 62,3% (p <0,01), their duration in 70,1% (p <0,01). Antiarrhythmic effect was detected: decreased the number of ventricular premature beats (p < 0,05)

Pronounced hypotensive effect was detected: decreased average daily, daytime and nighttime SBP and DBP, the indicators "pressure load" - SBP and DBP IV for a day, day and night, morning rise in the value decreased SBP variability in SBP and DBP for the day, night and day; circadian rhythm of blood pressure normalized in 15% of patients, which was the result of sympatholytic and vazodilatatic effects of a decrease in the activity of the RAAS: a marked decrease in the level of renin in the giperreninovom profile (p <0.05) decrease in aldosterone (P <0.05).

Sympatolitic effect of "dry" carbon dioxide baths came out as economisation of heart activity: decreased index of efficiency of the heart (IERS) (<0.01), increased left ventricular performance index (IPLZH) (p <0.05.), which was accom-

panied by a decrease in excretion of norepinephrine in the 23%,  $p < 0.05$  level of cortisol in blood plasma - 32%,  $p < 0.01$ ;

A rise in vazodilyatiric effect was detected: decreased rates PR alone ( $p < 0,01$ ), when the standard ( $p < 0,01$ ) and the threshold load ( $p < 0,01$ ), improved diastolic left ventricular function: reduced relaxation time izovolyumetric ,  $p < 0.01$ , increased rate of early diastolic filling  $p < 0.01$ , the ratio of early diastolic filling velocity and the velocity of late diastolic filling (E / A)  $p < 0,01$ .

Hypoxic training have contributed to an increase in coronary flow reserve - increased power threshold load,  $P < 0.01$ , myocardial - SI increased load on the threshold  $p < 0.05$ , aerobic reserve,  $p < 0.05$ .

### **Conclusions**

Thus, the hypoxic adaptation, carried out by "dry" carbonic acid bath is effective non-pharmacological therapy for patients with arterial hypertension associated with coronary heart disease

**Keywords:** Hypertension, Cardiovascular Disease, Carbonic Acid Bath, Adaptation to Hypoxia

# Control of legionella

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## Introduction and Objectives

Legionella is an aerobic, flagellated, non-spore forming and Gram-negative bacteria. Legionella pneumophila is responsible of the majority of infections by this microorganism, and it cause legionellosis or Legionnaires' disease.

### OBJECTIVE:

To identify the critical points and develop measures to prevent and/or correct the hazard.

## Materials and Methods

- To search regulations applied for facilities with risk of Legionella growth.
- To identify hazards and preventive measures.
- To find corrective measures in case of proliferation of the bacterium

## Results

Water used in Spas is considered with a high risk of being contaminated by legionella because of facilities like water systems with agitation and recirculation through speed jets or air injection, and other systems of cold water for human consumption (pipes, tanks, cisterns) and hot water.

### CRITICAL POINTS:

Some critical points would be storage, treatment and water flows out of taps and jets.

### HASARDS:

Microbiological contamination due to entry of Legionella in the circuit and growth to reach dangerous concentrations, and passage of water contaminated through air as aerosols.

### CRITICAL LIMITS:

- The temperature of hot water storage will be at least 60 ° C and cold water below 20 ° C.
- The temperature at the furthest point of the network will not be below 50 ° C.
- Maintaining appropriate levels of biocides according to facilities type.
- Absence of dirt even in filters and other removable parts of faucets.

### EXAMPLES OF PREVENTIVE MEASURES:

- Daily monitoring of biocide levels and temperature.
- Have a good system of cleaning, disinfection and maintenance.
- Have installations of suitable materials and correctly designed.



### EXAMPLES OF CORRECTIVE ACTIONS

- Do not use the affected facility until corrective measures are taken.
- Repeat cleaning and disinfection or reset the corresponding plan.
- Replace defective materials such as changing old filters.
- To form the handles or reset the corresponding plan.

### Conclusions

-We deduced the critical points to consider in order to control the proliferation of Legionella.

-We explained how to control such critical points to protect people health.

### References

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2. SCO/317/2003 Order of 7 February, which regulates the procedure for approval of training courses for personnel performing the maintenance of hygiene and health facilities.
3. Real Decreto 830/2010 on training for treatments with biocides.
4. DIN EN ISO 11731:2007
5. Technical Guide for the Prevention and Control of Legionella in facilities ([www.msc.es](http://www.msc.es)).

**Keywords:** Legionella, Bacteria, Hasard.

# Puente Viesgo's spa therapy for parkinsons patients

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## Introduction and Objectives

Balneotherapy in patients with Parkinson's disease (PD) has always to be considered from the point of view of no healing but an adjuvant treatment. Spa treatment is never going to replace pharmacological neither surgical treatment that the patient is under use. The aim of balneotherapy in these patients, would be improving functional capability, improving psychological repercussion of the disease (up to 50% of these patients have depressive symptoms) and therefore, improve the patient's quality of life, but the number of Parkinson's patients that goes to spa centers is small and this beneficial effect is not well known. The objective of this study is to evaluate the welcome and the physical and psychological effect of balneotherapy among PD patients.

## Materials and Methods

Eleven patients (n=11) diagnosed with PD, coming from a PD association were included in the study. The patients attended to our Spa through the Spanish Social Thermalism Program (IMSERSO). Individuals: 8 men and 3 women, aged between 56 and 80 years old. According to the Hoehn and Yahr Scale the patient's stage was from 1 to 4. Five of the patients received thermal pool exercises in addition to respiratory techniques or showers; the other 6 patients received bathtub in addition to jets, showers or respiratory techniques. Spa treatment lasted 11 days.

## Results

After 11 days of balneotherapy, 73% of the patients (n=8) referred general health state improvement: n=5 were "better" and n=3 "much better". 18% (n=2) felt "equal" than at starting treatment and 9% (n=1) said that was "worse".

All patients enjoyed with the received thermal treatment: 36% (n=4) enjoyed "a lot" and 64% (n=7) enjoyed "really much". None of them dislike the treatment. Highlight the positive evaluation that patients made of the thermal pool exercises; some of the patients that received bathtubs told that in future they would like to do thermal pool exercises. Finally, patients were asked if they considered that received treatments were appropriate or not for their disease; 54.5% said "very suitable" and 36% said "appropriate". Only one patient (9%) considered the treatment "inappropriate" because he felt worst.

**Conclusions**

The positive results in general state of these patients and the positive welcome and evaluation among these patients in our spa, makes balneotherapy a tool to consider and to promote, since it is possible to improve functional capability and psychological conditions, and therefore an improvement in the quality of life of these patients.

**Keywords:** Parkinson's Disease; Spa; Balneotherapy; Water Exercise Therapy; Thermal Treatment

# Association of behavioral and psychological symptoms of dementia with nighttime spa bathing

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## Introduction and Objectives

Dementia symptoms include a core symptom (cognitive impairment) and behavioral and psychological symptoms. The behavioral and psychological symptoms of dementia (BPSD) are sometimes called peripheral symptoms or accompanying symptoms. The behavioral symptoms include restlessness, agitation, wandering, socially inappropriate behavior, sexual disinhibition, collectionism, swearing, and hanging around, and the psychological symptoms include anxiety, depression, hallucination, and delusion. Many patients with dementia cannot take baths by themselves and need bathing care. Bathing for institutionalized persons is typically conducted during the day. However, many patients fall asleep after daytime bathing, and subsequently, they experience BPSD during the night. From these viewpoints, we examined the association between nighttime bathing and BPSD.

## Materials and Methods

This study involved 10 patients with Alzheimer's disease in a special nursing home for the elderly. Assisted spa bathing conducted between 2:00 PM and 3:00 PM twice a week was changed to nighttime bathing between 6:00 PM and 7:00 PM twice a week. Nighttime bathing was performed 18 times over a period of 9 weeks. The extent of sleep, restlessness, wandering, and aggression was observed for 13 weeks in total: during the 2 weeks before the onset of daytime bathing, during the 9 weeks of nighttime bathing, and during the 2 weeks after the onset of daytime bathing.

## Results

Nighttime bathing improved not only sleep but also restlessness, wandering, and aggression. These improvements became statistically significant after 6 weeks of nighttime bathing.

## Conclusions

A study of spa bathing in a facility (referred to as a local interaction home) adjacent to our hospital, and a further study of day service and day care users, showed good sleep and increased appetite. Spa therapy may cause the phenomenon of thermal crisis. Systemic symptoms of thermal crisis include sleep symptoms (par-

ticularly a sleepy condition) and changes in appetite (particularly an increased appetite). According to the results of the above mentioned 2 studies, good sleep and increased appetite are not considered to be side effects of spa therapy, but rather the direct effects of this therapy. Therefore, spa bathing is considered to be effective for the improvement of sleep symptoms.

The present study showed improvements in BPSD as well as in sleep symptoms as a consequence of switching from daytime bathing to nighttime bathing. However, changes in life rhythm only manifested after approximately 2 months. The core symptom is treated with acetylcholinesterase inhibitors and N-methyl-D-aspartate (NMDA) receptor antagonists. In contrast, therapy for BPSD is based mainly on administration of atypical antipsychotic drugs or antianxiety drugs and non-drug treatment. Nighttime bathing is likely to become one of the therapeutic approaches for BPSD.

**Keywords:** Alzheimer, Bathing, BPSD, Dementia

# Effects of a rehabilitation treatment including kinesitherapy and hydrokinesitherapy: a randomized controlled trial in patients with postmenopausal osteoporosis

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## Introduction and Objectives

Recent studies have shown that women with postmenopausal osteoporosis present postural modifications associated with changes in balance, leading to increased risk of falling. The aim of rehabilitation in these patients is to reduce fall risk and prevent fall complications. The objective of this study was to evaluate the impact on posture and balance of an association of kinesitherapy and hydrokinesitherapy in a spa centre, in females with postmenopausal osteoporosis.

## Materials and Methods

A group of 65 subjects with postmenopausal osteoporosis (mean age 63.1 years; T-score < -2.5 measured by the DEXA technique), were randomized into 2 groups: an experimental group (EG) with 32 subjects (mean age, 62.9±2.1) and a control group (CG) with 33 subjects (mean age 63.9 ±1.5). The EG underwent rehabilitation treatment including kinesitherapy and hydrokinesitherapy in a spa centre, while the CG received no rehabilitation treatment. At baseline and after 12 months all subjects were evaluated with a compass-needle pocket goniometer (IncliMed®) for spinal mobility and a force platform balance, with eyes both open and shut.

## Results

At baseline assessment no significant differences were found between the two groups. At final assessment, after treatment, the women in the EG presented a significant improvement in balance compared to those in the CG. In particular, analysis with the force platform balance yielded a statistically significant decrease ( $p < 0.050$ ) in sway path, sway area and A-P sway values with eyes shut, in addition to a non-statistically significant decrease in the same parameters with eyes open. Assessment of the vertebral column showed postural alignment at the level of the thoracic kyphosis, with changes in partial values and an improvement in vertebral column mobility in the sagittal plane.

**Conclusions**

This study suggests that our rehabilitation programme can alter postural state, improve spinal mobility, reduce balance instability and consequently decrease the risk of falling.

**Keywords:** Osteoporosis, Hydrokinesitherapy, Kinesitherapy

# Water physical therapy is effective to reduce pain, pressure sensitivity and trigger points in breast cancer: randomized controlled clinical trial

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## Introduction and Objectives

Our aim was to evaluate the effects of an 8-week water physical therapy program on cervical and shoulder pain, pressure sensitivity, and the presence of trigger points (TrPs) in breast cancer survivors

## Materials and Methods

**Design:** Randomized controlled trial. **Setting:** To date, no study has investigated effects of water therapy in breast cancer. **Patients:** Sixty-six breast cancer survivors were randomly assigned into 2 groups: WATER group, who received a water exercise program; or CONTROL group who received the usual care treatment for breast cancer. **Interventions:** The WATER therapy program consisted of 24 sessions (3 times/week-8 weeks) of low-intensity exercises in a warm pool (32°C). Each session included 10min warm-up period; 35mins of aerobic, low-intensity endurance and core stability training; and a 15min cool-down period (stretching and relaxation)

## Results

Neck and shoulder pain (visual analogue scale, 0-100mm), pressure pain thresholds (PPTs) over C5-C6 zygapophyseal joints, deltoid muscles, second metacarpal, and tibialis anterior muscles, and the presence of TrPs in cervical-shoulder muscles were assessed at baseline and after the 8-week program by an assessor blinded to treatment allocation. **Results:** The WATER group demonstrated a between-group improvement for neck pain of -31 mm (95%CI -49 to -22,  $P < 0.001$ ; effect size 1.1, 0.81-1.75) and for shoulder-axillary of -19mm (-40 to -04,  $P = 0.046$ ; effect size 0.70, 0.14-1.40). Improvements were also noted for PPT levels over C5-C6 joints (between-group differences, affected side: 27.7kPa, 95%CI 3.9-50.4; unaffected: 18.1kPa, 95% CI 6.1-52.2). No between-group differences for PPT over the remaining points were observed ( $P > 0.05$ ). Finally, patients in the WATER program showed a greater reduction of active TrPs as compared to the CONTROL group ( $P < 0.05$ ).



**Conclusions**

An 8-week water therapy program was effective for improving neck and shoulder/axillary pain and reducing the presence of TrPs in breast cancer survivors as compared to usual care; however, no significant changes in pressure pain hyperalgesia were found.

**Keywords:** Breast Cancer, Water Exercise, Pressure Sensitivity Pain

# Effects on body composition in breast cancer survivors with a water versus land-based multimodal exercise program: a controlled clinical trial

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## Introduction and Objectives

Our aim was to investigate the effects of land and water multimodal exercise programs on body composition and breast cancer-specific quality of life in breast cancer survivors

## Materials and Methods

Ninety-eight breast cancer survivors were assigned to 3 groups: control, land exercise, and water exercise. Both exercise groups consists of an 8-week multimodal program. Adiposity was measured by anthropometry (body mass index, waist circumference) and bioelectrical impedance (body fat and muscle lean body mass). Incidence of clinically significant secondary lymphoedema was also assessed. Finally, specific quality of life was assessed using the European Organization for Research and Treatment of Cancer Quality of Life BR-23.

## Results

Using ANCOVA, significant group x time interactions for body fatpercentage (F=3.376; P=0.011) and lean body mass (F=3.566; P=0.008) were found. Breast cancer survivors in the land exercise group exhibited a greater decrease of percentage of body fat than those in the water exercise (P<0.001) and control (P=0.002) groups. The ANCOVA revealed significant a group x time interaction for wrist circumference (F=4.553; P=0.002): breast cancer survivors in the control group showed an increase of wrist circumference when compared to water (P=0.003) and land (P<0.001) exercise groups. A significant group x time interaction was also found for breast symptoms (F=9.048; P<0.001): participants in the water exercise group experienced a greater decrease of breast symptoms than those in the land exercise (P<0.01) and control (P<0.05) groups.

## Conclusions

Land exercise produced a greater decrease in body fat and an increase in lean body mass, whereas water exercise was better for improving breast symptoms.

**Keywords:** Breast Cancer, Exercise, Body Composition, Quality Of Life

# Depression and thermal treatments: a case report

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## Introduction and Objectives

Depression is the name assigned to a series of behavioural, emotional and thought changes. When these changes become chronic they significantly harm different areas of a person's life. The depressed person sees the world differently and expresses his emotions differently. According to the World Health Organisation, Depression is a widely prevalent disease in the world.

## Materials and Methods

Case description: Female, 46 years-old, married, one son with 22 years-old. No relevant personal background. In June 2011 her father died suddenly. She started to reveal sadness, lack of interest in activities she used to appreciate, relevant weight loss (12kg in 4 months), insomnia, devaluation feelings, relevant asthenia and anorexia, difficulty concentrating and generalized pain that did not disappear with analgesics. She went to a psychiatrist that diagnosed Major Depressive Disorder. She was medicated with antidepressants that she could not specify. She went on a sick leave and was forbidden to go out alone and to drive. Since she revealed no clinical improvements, a relative that used to go to Termas de São Jorge (São Jorge Thermal Baths -TSJ), suggested her doing a thermal treatment.

## Results

She went to TSJ (medical consultation) on the 29th October 2011. She was thin, pale, hypotonic and revealed severe apathy and sleepiness. She could not walk by herself and was helped by her sister. Several symptoms strongly influenced her everyday life. She was clinically and physically evaluated and was prescribed a 21 days treatment that consisted of: Gymnasium, aerobaths and full body manual massage. At the gymnasium the first main aims were: walk training and muscles strengthening. After this period of thermal treatment she continued the same treatment thrice a week until the end of 2011. By end 2011 she had a medical consultation at TSJ and she revealed major improvements. She continued doing stronger muscular strengthening exercises at the gymnasium and more intensive walk training. In December 2012 she changed to a different psychiatrist and the antidepressant medication was reduced. In 2012 she went to TSJ again. She arrived by herself for medical consultation and she looked stronger and livelier. She had gained 3kg. Her emotional and physical symptoms had improved. Medical evaluation at TSJ

enabled to conclude she has evolved favourably, but that until recently she was dependent from others.

### **Conclusions**

This clinical case wants to raise consciousness to the importance of thermal treatment in depression cases. Treatments should be personalized both in terms of mental and physical aspects. In addition to maintaining the antidepressant treatment prescribed by the psychiatrist, it is fundamental to advise the patient to change his lifestyle (for instance make exercise and eat healthy food), socializing in a supportive environment, correcting negative thought patterns and improving his adaptation to the outside world. Independently of its specific therapeutic indications, attending thermal baths, with a supportive environment and the professionalism of hydrologist doctors and qualified technicians, is always positive for a period of active rest, healthy eating, relaxing balneotherapy and climate change. All this helps improve the different symptoms associated to Depression.

**Keywords:** Depression, Thermal Treatment, Improvement

# Analysis of the effects of a hydrotherapy procedure on cerebral palsy children in a heated pool

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## Introduction and Objectives

The goal was to assess the effects of an Aquatic Physical Therapy (Hydrotherapy) intervention in a heated pool on children with Chronic Non-Progressive Childhood Encephalopathy, known as Cerebral Palsy. This lesion occurs when the child presents an accelerated pace of development and may affect the skill acquisition process. As to motor disorders it may alter movement and motor skills which favor body positioning and alignment, as well as change of position, body rectification, coordination and balance reactions.

## Materials and Methods

The method has met the requirements of the Research Ethics Committee in Brazil. Photometry was applied as an assessment tool comparing the pre and post intervention period with immersion in a heated pool, observing the acute effects of a single aquatic intervention on four subjects with spastic quadriplegia. Immersion took 50 minutes in a heated pool at 34°C. Photometric postural assessment was conducted on four children with spastic chronic non-progressive encephalopathy, with anatomical demarcation of acromions, lower ribs and antero-superior iliac spines, in a sitting position, in wheel chairs. The Corel Draw software was used to verify the effects of hydrotherapy on body symmetry and alignment, comparing the height between the two acromions, between the antero-superior iliac spines and between the lower ribs bilaterally, in the horizontal plane. The statistical analysis of data was done following the therapeutic intervention, with the software SPSS 15.0. The interexaminer reliability test was done, with a result of 0.095, indicated as excellent and with the t-student test.

## Results

Body alignment and symmetry was obtained in all four subjects, being statistically significant ( $p < 0.05$ ) between the right and the left acromion (0.022742) and the right and left antero-superior iliac spine (0.033388); and not statistically significant between the lower ribs (0.484382).

## Conclusions

In this trial, it is concluded that hydrotherapy in a heated pool has had a positive acute effect on the posture of children with Chronic Non-Progressive Childhood Encephalopathy.

**Keywords:** Aquatic Physical Therapy. Photometry. Hydroterapy. Chronic Non-Progressive Childhood Encephalopathy. Cerebral Palsy

# A comparison land-water environment of maximal voluntary isometric contraction during manual muscle testing

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## Introduction and Objectives

The aim of this study was to compare the degree of reproducibility and validation using surface electromyography (sEMG) of the maximum voluntary contraction (MVC) on land and in water for standardization in absolute values (%).

## Materials and Methods

Sixteen right-handed healthy subjects (8 males and 8 females) participated in the measurement of muscle activation of the right shoulder. The muscles selected were: Erector spinal neck, trapezius, supraspinatus, pectoralis, anterior deltoid, middle deltoid, infraspinatus and latissimus dorsi. The test conditions were random MVC regarding the order of measurement on land and in water. All this to determine differences in muscle activation in both conditions.

## Results

After analyzing the results using the test T-Student or test Wilcoxon as normality of the variables, we note that for all muscles except the supraspinatus ( $p = .003$ ) and latissimus dorsi ( $p = .001$ ), not statistically significant differences between the scores on land and in water in the test MVC test.

## Conclusions

As the conditions of manual muscle test (MMT) of the test are comparable in the test MVC sEMG on land and in water, as the integrity of the sEMG records were kept. Also the stability of the evaluator and the evaluated mediated by gravity can hinder education by testing resistance to the MMT in the test MVC in water.

**Keywords:** Surface Electromyography, Aquatic Exercise, Rehabilitation, Isometrics



# Analysis of the neuromuscular activity during adapted swimming with a snorkel

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## Introduction and Objectives

**Study Design:** Cross-sectional, analytical inferential that uses surface electromyography (sEMG) to measure muscle activation cervical-brachial axis of the right shoulder in healthy subjects during front crawl swimming and crawling with and without tube.

**Objective:** To compare the activation of the muscles of cervical-brachial axis of the right shoulder and synergists in the execution of crawling and crawl tube with and without extrapolation to clinical practice in Therapeutic Physical Activity programs (AFT).

**Hypothesis:** There are significant differences in terms of cervical-brachial muscle activity of the right shoulder during the performance of crawling and swimming to crawl with and without tube in healthy subjects.

## Materials and Methods

**Methods and Measures:** sEMG was examined by cervical-brachial eight muscles (erector spinae neck, trapezius, supraspinatus, infraspinatus, pectoralis, anterior deltoid, middle deltoid and latissimus dorsi) of the right shoulder of 16 subjects (8 men and 8 women). Each subject was measured 5 complete cycles of swimming to crawling and crawl tube with and without speed 40BMP. Previously, carried out (land) test maximum voluntary contraction (MVC) to normalize, in absolute terms, the percentage of activation in every gesture. Statistical comparisons were made with the nonparametric test Kolgomorov-Smirnov and use test Wilconxon or test T-Student according to normality of the variables.

## Results

**Results:** The results of the 8 muscles studied muscle activation during the test was statistically significant for the infraspinatus ( $p = .020$ ) and erector spinae muscle of the neck ( $p = .050$ ) in the crawl, and the erector spinae of the neck ( $p = .020$ ) in front crawl swimming.

## **Conclusions**

Conclusion: By holistic we can say that the implementation of the swim tube produces an average increase in muscle activation of 100 microvolts. When we faced the same muscle in front of the tube placement or not crawling, we see that the infraspinatus muscle and the erector spinae of the neck are the only ones that have statistically significant changes in muscle activation due to the suppression of head movement (erector spinae) and resistance underwater recovery phase (infraspinatus) As the underwater recovery by the application of the tube causes the neck muscles are less active. However, in the act of crawl, faced the same muscle on the use of pipe or did not observe statistically significant changes of the erector spinae of the neck, we can conclude that in the crawl there is an increased activation of that muscle when we apply tube.

In response to the theoretical models used in empirical Aquatic Physical Therapy, we say that for the rehabilitation of cervical-brachial axis work in progress: (1) crawl without tube, (2) crawling tube, (3) crawl tube and (4) crawl without tube.

**Keywords:** Aquatic Therapy, Snorkel, Surface Electromyography, Shoulder

# Spa, hydrotherapy's treatment, and quality of life

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## Introduction and Objectives

Introduction: The health-related quality of life (HRQOL) is associated with mortality, hospitalization and utilization the sanitary resources, for this now the HRQOL is also and therapeutic target. Now is a result's variable with interest in research and in the clinic practice.

Objective: Study the quality of life the patients that go to health resort for receive the thermal cure.

## Materials and Methods

Design : Transversal descriptive study .

Field: Medical hydrology.

Participants: 68 patients.

Main variables: Demographic variables (age, sex, chronic diseases, surgical interventions). Applicant pathology. Measure of the quality of life with the SF36 test questionnaire.

## Results

Mean age: 70 years. Sex: women: 54,4 %. Chronic diseases: hypertension 47,1 %, diabetes mellitus 16,2 %, dyslipidemia 38,2 %,asthma/ chronic bronchitis 8,8 %, heart vessels disease (ischemic heart disease/cerebral vessels accident/ arrhythmia) 14,7 %, cancer (colon, prostate, breast) 7,4 %, varicose veins 32,4 %, gastric – duodenal ulcer 8,8 %, depression/ anxiety 7,4 %, osteoporosi 14,7 %, hypothyroidism 8,8 %.

Applicant pathology: pain pathology 100 %, bronquial-pulmonary pathology 14,7 %. The punctuation in the different dimensions of the SF -36 test were top to 50: physical function (FF) 71,62, physic role (RF) 67,64, physical pain (DC) 58,08 , health standards (SG) 59,33, vitality (V) 63, 97 , social function (FS)81,61, emotional role (RE) 76,47, mental health (SM) 73,17. Women present lower punctuations in the SF-36 that the men (Figure 1). The oncological patients diagnosed and treaty and stable situation of the oncological disease present lower punctuations in the SF-36 that no oncological patients.

## Conclusions

Patients that go to sanitary resource for receive thermal cure are elderly age.

The main applicant pathology are pain pathology.

The measure of the quality of life is not different that the value of population reference.

The women like previous study have worse quality of life that men.

The oncological patients have worse quality of life that no oncological patients.

**Keywords:** Medical Hydrology, Quality of Life, Hydrotherapy 'S Treatment

# Quality of life and thermal cure

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## Introduction and Objectives

The quality of life is now and health 's target, The therapies that are doing in the health resort they can get the quality of life 's improvement, measure this variation can help to the health professional to recommend and/or prescribe these treatments to their patients.

Objective: To assess if there is differences in the measure of the quality of life before and after of the hydrotherapy 's treatment with medicinal mineral water in a accredited health resort (thermal cure).

## Materials and Methods

Design : Descriptive study .

Field: Medical hydrology.

Participants: 68 patients.

Main variables: Demographic variables (age, sex, chronic diseases, surgical interventions). Measure of the QVRS with the SF36 test questionnaire before and after of the hydrotherapy 's treatment. Dimensions SF-36: physical function (FF), physic role (RF), physical pain (DC), health standards (SG), vitality (V), social function (FS), emotional role (RE), mental health (SM).

## Results

Mean age: 70 years. No significant differences in the SF-36 test questionnaire before and after of the thermal cure. Women present lower punctuations in the SF-36 before and after of the thermal cure. The oncological patients diagnosed and treaty and stable situation of the oncological disease present lower punctuations in the SF-36, but after of the thermal cure there is and improvement of this punctuations in 50% the SF-36 's dimensions (Figure 1).

## Conclusions

In that study we can not show a improvement of the quality of life after of the thermal cure.

The women like previous study have worse quality of life that men.

The oncological patients before of the thermal cure have worse quality of life that no oncological patients.

After the thermal cure the oncological patients show a improvement of the quality of life.

**Keywords:** Spa Treatment, Quality of Life, Hydrotherapy

# How does obesity affect the effectiveness of a multimodal physiotherapy program in patients with chronic low back pain?

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## Introduction and Objectives

Background context: A relationship between obesity and lower back pain, two of the most important public health concerns, has been demonstrated. However, there are no studies comparing the effectiveness of a multimodal physiotherapy program (MPP) (combination of manual therapy, therapeutic exercise and health education) in patients with chronic non-specific lower back pain (CNLBP) where the criteria for the groups is the patients' BMI.

Purpose: To compare the results of an MPP for 8 weeks between two groups: obese (G1) (BMI:  $\geq 30$ ) and non-obese (G2) (BMI:  $< 30$ ) suffering CNLBP.

## Materials and Methods

A quasi-experimental study with pre-post intervention evaluations of an MPP (lasting 8 weeks) conducted on two groups: obese and non-obese patients, suffering from CNLBP. Inclusion criteria for the patients were CNLBP without radiation to the lower limbs for more than twelve weeks duration. The exclusion criteria used were: patients who refused to participate, who were suffering pain in the spine following a specific lumbar spinal pathology or nerve root/radicular pain, pain process, patients who had an infection, neoplasm, metastasis, osteoporosis, arthritis, or fractures and patients who showed cognitive impairment of any etiology and exercise intolerance from any cause. Patients whose pre-intervention rate in the Roland Morris Questionnaire (RMQ) was less than 7 and greater than 13 did not participate in the study. All patients were measured to calculate pre-intervention (baseline) and post-intervention (8 weeks) changes in disability (RMQ), physical and mental component state (PCS-MCS) and quality of life (EQ5D-EQVAS).

## Results

Table 1

## Conclusions

In patients with CNLBP, a BMI equal or more than 30 minimizes the effects of an MPP lasting 8 weeks on the disability, quality of life and physical health state variables.

**Keywords:** Quality of Life: Obese: Health State: Low Back Pain: Physiotherapy

<b>TABLE 1</b>	<b>G<sub>1</sub>: BMI ≥ 30</b>	<b>G<sub>2</sub>: BMI &lt; 30</b>
<b>AGE (year)</b>	<b>51.67</b> (±10.02)	<b>49.87</b> (±12.08)
<b>HEIGHT (cm)</b>	<b>162.84</b> (±5.39)	<b>163.94</b> (±7.41)
<b>BMI (Kg/m<sup>2</sup>)</b>	<b>31.88</b> (±2.97)	<b>26.67</b> (±4.39)
<b>PHS (0-100)</b>	<b>55.76</b> (±35.93)	<b>50.19</b> (±17.77)
<b>MHS (0-100)</b>	<b>43.23</b> (±13.65)	<b>45.19</b> (±12.44)
<b>EuroQoL (0-1)</b>	<b>0.56</b> (±0.26)	<b>0.61</b> (±0.32)
<b>EQ VAS (0-100)</b>	<b>48.01</b> (±24.76)	<b>58.71</b> (±21.77)
<b>RMQ (0-24)</b>	<b>10.67</b> (±5.98)	<b>9.43</b> (±6.16)
<b>N (♂/♀)</b>	<b>34</b> (16/18)	<b>38</b> (18/20)

PHS: Physical Health State  
MHS: Mental Health State  
EuroQoL: Mean Index from EuroQoL 5D  
QoL VAS: Visual Analogue Scale From EuroQoL 5D  
RMQ: Roland Morris Questionnaire

**Table 1:** Descriptive and results variables of the groups at baseline



# Land Based or Hidrotherapy: which is the most effective multimodal treatment in low back pain?

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## Introduction and Objectives

**Aim:** To study the response to the intervention that provide either a land – based multimodal physiotherapy program as an aquatic – based multimodal physiotherapy program, for comparison to identify which of the two media (environments) provides a greater improvement in subjects suffering chronic nonspecific low back pain.

## Materials and Methods

Through questionnaires SF-12 (PHS and MHS), EuroQol-5D (EQ5D and EQVAS) and Roland Morris Questionnaire (Disability), measure the general health state, quality of life and functional capacity of 75 patients (44 women, 31 men) with a mean age of 51 ( $\pm 12,83$ ) years suffering chronic nonspecific low back pain without radiation to lower limbs, divided into two subgroups depending on the environment where the principal action takes place: subgroup 1 (aquatic-based multimodal physiotherapy program), with 49 subjects, and subgroup 2 (land-based multimodal physiotherapy program) with 26 subjects. These measurements were performed before and after the intervention where there are integrated manual therapy, therapeutic exercise and health education, during eight weeks

## Results

## Conclusions

There were no differences between both environment when performing the procedure, being clear the importance of patient preferences have, these findings will provide the patient with two alternatives when making the proposed protocol

**Keywords:** Physiotherapy: Quality Of Life: Low Back Pain: Deep Water Running.

# Aquatic physiotherapy program in pregnant women: Short-term effects on quality of life and health state

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## Introduction and Objectives

The physiological and anatomical changes that occur during pregnancy have the potential to affect the musculoskeletal system. Instability and joint overload and even loss of balance, as a result of increased ligamentous laxity, weight gain and changes postures respectively, are some of the negative consequences suffered by the musculoskeletal system, while changes in respiratory requirements result in increased respiratory minute volume of 50%, leading to reduced pulmonary reserves and limiting the possibility of anaerobic exercises.

This whole sequence of changes can lead to stress that adversely affects the process of gestation, may have obvious impact on quality of life of the mother as well as their health status.

Objective: to determine how it affects the quality of life related to health in women who are making a gestation period PCHCE for 8 weeks with a frequency of 2 times per week for one hour.

## Materials and Methods

quasi-experimental pre-post intervention trial. Study developed at a community center to promote health and physical activity. Thirty-three pregnant women, which, for eight weeks conducted a hydrokinesitherapy community program for pregnant two times a week. Inclusion criteria: provide optional authorization. Exclusion criteria: women who exceeded the 24 weeks of gestation-behaved no such authorization or the participant didn't want to participate in the study. Were used the SF-12 and EuroQol as specific instruments to measure changes in quality of life and health state of the participants.

## Results

Table 1

## Conclusions

A hydrokinesitherapy community program for pregnant 8-week may help slow the normal decline in the quality of life related to health in pregnant women.

**Keywords:** Pregnancy: Pelvic Floor Exercise: Quality Of Life: Health State

Variable	Minimum	Maximum	Main	SD
Age (years)	22	41	31,59	4,15
Height (cm)	153	181	164,54	6,76
Weight (Kg)	47,0	83,0	64,69	7,15
BMI (Kg/m <sup>2</sup> )	18,3	29,1	23,7	2,02
PHS (0-100)	14,58	65,01	47,30	12,06
MHS (0-100)	36,54	61,69	52,10	7,64
EuroQoL 5D (0-1)	0,25	1	0,85	0,23
QoL VAS (0-100)	38	97	78,60	14,53
1 <sup>st</sup> pregnancy			30 (90,1%)	
Early intervention			0 (0%)	
Smoker			0 (0%)	
Alcohol			0 (0%)	
Breast-feed			30 (90,1%)	
Diabetes			0 (0%)	
Hearth problems			0 (0%)	
Hipertension			0 (0%)	
Circulation problem			10 (30,3%)	
Vasovagal symptoms			7 (21,2%)	
Dental problems			4 (12,1%)	
Urinary Incontinence			3 (9%)	
Pelvic floor Training			26 (78,8%)	
Sport Activity			31 (93,9%)	

BMI: Body Mass Index.

PHS: Physical Health State.

MHS: Mental Health State.

Table 1. Descriptive variables of pregnancy group at baseline.

# Physiotherapy and low back pain: effectiveness of a short-term treatment comparing adults and older adults

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## Introduction and Objectives

Older people experience a diminished of quality of life that increases when suffer daily the symptoms of chronic nonspecific low back pain, so it will be important to identify an intervention to stop this decline in the quality of life or even, as far as possible, improvement it. To study whether the response of elderly (+65 years) suffering chronic nonspecific low back pain is the same as in individuals who suffer the same musculoskeletal problem but are younger, after conducting a multimodal physiotherapy program (MPP) during eight weeks.

## Materials and Methods

through questionnaires SF-12 (PHS and MHS), EuroQol-5D (EQ5D and EQVAS) and Roland Morris Questionnaire (Disability), measure the general health state, quality of life and functional capacity of 60 patients (30 women, 30 men) who suffer chronic nonspecific low back pain without radiation to lower limbs, divided in two subgroups according to age: Subgroup 1 ( $\leq$ 65 years) (n=30) and subgroup 2 ( $>$ 65 years) (n=30). These measurements were performed before and after a physiotherapy multimodal program that integrates manual therapy, therapeutic exercise and health education, during eight weeks.

## Results

Table 1 and 2

## Conclusions

The response after a MPP of eight weeks in patients with chronic nonspecific low back pain is almost similar in both age groups on the measured variables.

TABLE 1	G <sub>1</sub> : < 65	G <sub>2</sub> : ≥ 65
Age (years)	45.56 (±12.64)	68.53 (±4.49)
Height (cm)	165.12 (±7.73)	162.07 (±7.56)
Weight (Kg)	73.11 (±14.03)	69.89 (±9.80)
RMQ (0-24)	8.18 (±5.87)	7.21 (±7.14)
PHS (0-100)	39.70 (±10.45)	42.15 (±10.29)
MHS (0-100)	45.64 (±12.30)	46.49 (±10.25)
EuroQoL 5D (0-1)	0.67 (±0.28)	0.63 (±0.27)
QoL VAS (0-100)	60.04 (±21.93)	52.34 (±24.84)
N (♂/♀)	32 (16/16)	28 (14/14)

PHS: Physical Health State  
 MHS: Mental Health State  
 EuroQoL: Mean Index from EuroQoL 5D  
 QoL VAS: Visual Analogue Scale From EuroQoL 5D  
 RMQ: Roland Morris Questionnaire

Table 1: Descriptive variables of the groups at baseline

TABLE 2	G <sub>1</sub> : < 65 (IC 95%)	G <sub>2</sub> : ≥ 65 (IC 95%)	G <sub>2</sub> - G <sub>1</sub> (IC 95%)
BMI (Kg/m <sup>2</sup> )	2.75* (0.11 / 5.37)	1.15 (-4.59 / 6.89)	1.03 (-6.30 / 4.23)
PHS (0-100)	3.28 (0.42 / 6.15)	3.85 (-3.65 / 11.36)	1.43 (-4.61 / 7.48)
MHS (0-100)	0.08*** (-0.03 / 0.14)	0.06 (0.17 / 0.24)	0.06 (-0.06 / 0.18)
EuroQoL 5D (0-1)	8.04*** (3.44 / 12.71)	5.66 (8.45 / 19.77)	9.17 (1.29 / 19.63)
QoL VAS (0-100)	-1.83*** (-2.85 / -0.81)	-1.07 (-3.01 / 0.87)	0.36 (-2.70 / 3.42)

Table 2: comparative table intragroups and between groups at post intervention

# Musculoskeletal disorders and aquatic physical therapy multimodality program: what is the optimal frequency of treatment?

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## Introduction and Objectives

There is a limitation on the evidence available to know what the optimal frequency of aquatic physiotherapy intervention in people with chronic musculoskeletal problems. The American College of Sports Medicine (ACSM) recommends the need for studies in this regard. Some previous studies have shown that a multimodal program of physical therapy in water (MPPA) achieves best results when performed twice with Respect to when performed only once. However, it is unknown what effect causes the quality of life and health status of a MPPA when performed two or three times a week.

### Aim:

To establish whether there are differences in health status and quality of life of people suffering from chronic musculoskeletal conditions when making a MPPA two or three times a week and if there is some difference to establish which of the two is more effective to be recommended as often optimal intervention in these patients with this type of treatment .

## Materials and Methods

A prospective pilot study was developed over 135 people suffering from osteoarthritis, back pain or neck pain which made an MPPA, including manual therapy, health education and therapeutic exercise for 8 weeks two (G2) or three (G3) times per week, analyzing how it modified the state of health, quality of life and disability that causes specific musculoskeletal problem in patients. Were measured at baseline, at 8 weeks, 6 months and one year.

## Results

Table 1

## Conclusions

A MPPA seems to get similar results when performed two or three weekly sessions in subjects suffering from chronic musculoskeletal disorders, nor short, nei-

ther the medium nor long term. These findings could be taken into consideration by physiotherapists in order to optimize treatment plans and facilities that offer various therapeutic interventions seeking to better use the resources available.

	Sessions weekly	MEAN (SD)	Mean difference	SIGNIFICANCE
<b>AGE (years)</b>	2	49.64 (±11.82)	1.46	0.531
	3	48.18 (±14.69)		
<b>HEIGHT (cm)</b>	2	161.71 (±7.74)	-0.81	0.565
	3	162.52 (±8.30)		
<b>WEIGHT (kg)</b>	2	71.25 (±14.27)	0.38	0.905
	3	70.87 (±14.12)		
<b>BMI (kg/m<sup>2</sup>)</b>	2	26.44 (±4.76)	0.21	0.682
	3	26.23 (±4.34)		
<b>SF-12 Phys (0-100)</b>	2	41.17 (±10.41)	1.41	0.549
	3	39.75 (±10.83)		
<b>SF-12 Mental (0-100)</b>	2	48.19 (±10.65)	1.71	0.488
	3	46.40 (±13.66)		
<b>EuroQoL (0 – 1)</b>	2	0.68 (±0.21)	0.05	0.386
	3	0.63 (±0.26)		
<b>EuroQoL VAS (0-100)</b>	2	57.43 (±17.23)	3.09	0.316
	3	54.34 (±19.05)		
<b>RMQ (0-24)</b>	2	8.12 (±4.54)	-0.77	0.591
	3	8.89 (±6.35)		
<b>NDI (0-100)</b>	2	21,31 (±12,32)	2,34	0.776
	3	23,65 (±14,57)		
<b>WOMAC (0-100)</b>	2	23.18 (±16.45)	8.01	0.334
	3	15.17 (±18.33)		
<b>N</b>	2	70		
	3	65		

BMI: Body mass Index

SF-12 Phys: Physical Health State

SF-12 Mental: Mental Health State

EuroQoL: Mean Index from EuroQoL 5D

EuroQoL VAS: Visual Analogue Scale From EuroQoL 5D

RMQ: Roland Morris Questionnaire.

NDI: Neck Disability Index.

Table 1: Descriptive and comparative table between groups at baseline

Significance value:

p>0.05 = \*

P>0.005 = \*\*

P>0.001 = \*\*\*

# Nutrition as a potential determinant of asthma

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## Introduction and Objectives

**OBJECTIVE:** Diet may be an important component of the comprehensive thermal treatment. The aim of this study was to evaluate the efficacy of nutrition in the improvement of asthma and consequently its inclusion on balneology programs.

**INTRODUCTION:** Asthma is a condition of the lungs that results in inflammation of the air-passages. Asthma is a common source of morbidity and a significant cause of preventable mortality. Several treatments are available, including thermal treatments. Diet can play an important role in the control of asthma symptoms, when combined to a multidisciplinary approach.

## Materials and Methods

Search for articles in Medline, UpToDate, National Guideline Clearinghouse, Cochrane Library, and TRIP Database, using the terms asthma, nutrition and Mediterranean diet. The search was limited to articles published between January 2002 and March 2012, in English, Portuguese, Spanish and French.

## Results

Studies suggest that an adherence to the healthy Mediterranean dietary pattern can confer a significant protection against the development of asthma.

## Conclusions

It is now apparent that this multidisciplinary approach is required to move forward and understand the complexity of the interaction of dietary factors and asthma. The adherence to the Mediterranean diet may provide protection against asthma. However, more studies are needed to better understand the mechanisms of this protective effect.

**Keywords:** Asthma; Nutrition, Mediterranean Diet



# A retrospective investigation of spa cure therapies effecting on serum cholesterol, LDL, HDL cholesterol and trigliserid level changes

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## Materials and Methods

Spa cure treatments have been observed for many centuries, for the benefit of patients who were sent to spa therapy centers in different thermomineral water source districts, which also have distinct climatic properties and environments for two or three weeks of accomodation periods. It has also a supplementary importance for patients to get rid of from their native living regions' detrimental properties.

In this study, the short time lipid profile laboratory findings of reported patients who had rheumatologic complaints and have admitted to Istanbul Medical Faculty, Medical Ecology and Hydroclimatology Department's Locomotor System Diseases Outpatient Clinic, were aimed to be investigated before and after 15 days of spa therapies.

## Materials and Methods

Between the period of the years 2000-2008, 631 patients, when their recurrent spa therapy trips in different years were added, the blood analysis results obtained from the Central Laboratory of Clinical Biochemistry have reached a total of 1000 case files, before and after spa therapies, were examined. Blood analysis results were taken into consideration retrospectively. Since some of the analysis results, mostly after spa treatments were incomplete, patient counts were lesser. For the data acquired prior and after spa, paired t test, was used to solve statistically.

## Results

Serum Cholesterol (<200; ≥200mg/dL), LDL Cholesterol (<135; ≥135mg/dL), HDL Cholesterol (<40; ≥40mg/dL), and Trigliserid (<150; ≥150mg/dL) level analysis were divided into two fractions respectively, and the changes were examined.

The changes of Serum Cholesterol  $<200$  mg/dL ( $p<0,001$ ); Serum Cholesterol  $\geq 200$ mg/dL ( $p<0,001$ ); LDL Cholesterol  $<135$  mg/dL ( $p<0,001$ ); LDL Cholesterol  $\geq 135$ mg/dl ( $p<0,001$ ); HDL Cholesterol

$< 40$  ( $p<0,001$ ); HDL Cholesterol  $\geq 40$  mg/dL ( $p<0,001$ ); and Triglicerid  $<150$  dL ( $p<0,001$ ); Triglicerid  $\geq 150$  mg/dL ( $p<0,001$ ) between former and latter values of spa therapy were found statistically significant. In previous years, some of the literatures published around the world and in our country, showed similar results in between former and latter values of Lipid profile change values in spa treatments.

## Drinking mineral waters

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# Magnesium waters from Serbia

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## Introduction and Objectives

Magnesium (Mg) is the essential element in over 350 cellular enzymes reactions. Surveys in many countries are showing that deficiency of Mg in food is present, indicating that Mg is a “problem nutrient”. Reports are also indicating that Mg and calcium (Ca) concentration in human tissues is varying with the hardness of the municipal water.

In this study we are presenting data on the topic of the presence of Mg in natural mineral waters in Serbia.

## Materials and Methods

Analyses of the mineral composition of the waters supply systems in two municipal regions of Serbia were performed. Chemical compositions of the waters were likened with data from the epidemiological studies.

## Results

Highly Mg ultramafic rocks occupy vast regions in Serbia (3000 km<sup>2</sup>). The present day weathering of these rocks results in leaching of Mg in the form of magnesium bicarbonate. The best studied ultramafic area of about 800 km<sup>2</sup> is in the western Serbia around Zlatibor Mountain. Chemical compositions of spring waters have Mg as a dominant cation (from 52.2 to 68.8 mg/L), while concentration of Ca is low (from 5.0 to 13.5 mg/L). Total hardness of springs corresponds to hard waters. Surveys are showing that, among the human population of this area (65 000 inhabitants) mean level of Mg in serum is in the uppermost part of the reference range (22.7 ± 2.2 mg/L, n = 296). Medical records are showing the lowest mortality rate from cardiovascular diseases in the Zlatibor area compared to the other regions in Serbia.

In central Serbia, near town Trstenik, in the village Veluce, from mineral spring magnesium bicarbonate water, with free CO<sub>2</sub> is bottled. Its commercial name is “Mivela”. First analyses of this water were done in 19th century. Up to now, analysis have shown only a small variation in its Mg content (330 ± 28 mg/L). According to the most recent analyses the composition of “Mivela” is as follows: bicarbonate ion (from 1990 to 2073 mg/L), free CO<sub>2</sub> (from 500 to 872 mg/L), sodium ion (from 109 to 127 mg/L), calcium ion (from 21.2 to 25.1 mg/L), potassium (from 7.9 to 8.7 mg/L) and trace elements boron (390 ± g/L), strontium (358 ± g/L) and

lithium (330  $\mu$ g/L). Epidemiological study of the inhabitants of three villages (n = 1162) who all their life use “Mivela” and those of control villages (n = 1140) in the same community, has shown significantly lesser incidence of cardiovascular diseases (4 times less patients with hypertension, 5 times less patients with disturbance of cardiac rhythm and 4 times less infarcts) and kidney calculus in the villages that are drinking “Mivela”.

### **Conclusions**

In many countries around the world, for the reason of Mg deficiency, tables with Mg supplements are available. It is our opinion that natural mineral magnesium bicarbonate waters from Serbia can be convenient as a supplement of Mg ions.

**Keywords:** Drinking Mineral Waters, Magnesium, Public Health

# Neurological activity of mineral waters of Fuentoror (Canary Islands)

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## Introduction and Objectives

Neurological activity of mineral waters of Fuentoror as well as its physico-chemical properties were studied. The spring where Fuentoror waters comes is in Teror (Gran Canaria Island). This water was declared as Natural-Mineral-Water in 1995 and classified as water of weak-mineralization. Predominant ions: Bicarbonate, choride and sodium.

## Materials and Methods

The activity profile in mice (Irwin Tests and Lim Test) and neurological effects in mice (Curiosity Test) at doses of 05 or 1ml of Fuentoror waters by interaperitoneal route were studied

## Results

Dry residue =234 mg/l; pH= 6.9; Conductivity= 301  $\mu$ S/cm-1; Hardness =8.3 °F; Ions (mg/l): CO<sub>3</sub>H=94.4; Cl=29.5; NO<sub>3</sub>=19.4; SO<sub>4</sub>=17.8; Na+=30.3; Ca<sup>++</sup>=14.7; Mg<sup>++</sup>=11.2; K+=4.7; SiO<sub>2</sub> =57.7 mg/l. Fuentoror water at doses of 05 or 1ml increased spontaneous motor activity, reflected by body position and locomotor scores. These effects were constant during the time of the experiment ( $p < 0.05$  control vs. Fuentoror water). Fuentoror water at a dose of 05 or 1ml increased transfer-arousal and touch-escape scores ( $p < 0.05$  control vs. Fuentoror water at 30, 60, and 120 min). As regards the sensoromotor response, evaluated by toe-pinch (ipsilateral flexor reflex) and corneal and pinna reflex, the results showed that these responses also increased depending on the dose used, 0.5 or 1ml, ( $p < 0.05$  control vs. Fuentoror water 05 or 1ml at 30, 60, and 120 min.). The neurological state was evaluated by noting the muscle tone (body, abdominal and limb tone, grip strength and wire maneuver), equilibrium and gait (righting reflex and hypotonic gait) and central nervous system excitation. Fuentoror water produced an increase in the muscle tone at doses of 05 or 1ml ( $p < 0.05$  control vs. Fuentoror water 0.5 or 1ml at 30, 60, and 120 min.). Fuentoror water at the doses used did not affect equilibrium, gait, tremor, twitch and convulsion indexes. Non-observed CNS excitation

evaluated by phenomena such as tremors, twitches or convulsions. In autonomic system (palpebral closure, piloerection, hypothermia, or respiratory rate) no changes were observed. Those effects denote a stimulant action of Fuentoror water. Similar results have been obtained by others mineral waters. With respect Lim Test, the effects of Fuentoror waters were compared with vehicle on spontaneous movements, muscle tone and righting reflex. Doses of 0.5 or 1ml produced an increase in spontaneous movement ( $p < 0.05$ ) and muscle tone ( $p < 0.05$ ) at 30, 60 and 120 min after administration. Righting reflex was unchanged with the two doses of Fuentoror water. The stimulant activity of Fuentoror doses can be observed in the increase of spontaneous movement and muscle. In the Curiosity Test, Fuentoror water produced an increase in the number counts at doses of 0.5 or 1ml ( $p < 0.05$  control vs. Fuentoror water at 30, 60 min.). The stimulant action also was confirmed by the Curiosity test

### **Conclusions**

Fuentoror waters displayed light central stimulant properties of a dose-dependent manner, The mechanism involved in the effects of Fuentoror waters remains unknown and further studies are necessary.

**Keywords:** Fuentoror, Drinking Mineral Water, CNS Stimulant Properties

# Diuresis-crenotherapy in reno-urinary pathology using oligomineral waters from Calimanesti-Romania

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## Introduction and Objectives

Renal and urinary pathology includes a high frequency of urinary tract infections, urinary stones from different or mixed biochemical categories. Despite prevention programs and conservative or surgical treatment, the 2 groups of pathology can not be controlled from therapeutic point of view enough, context in which complications or chronic disease may occur. A complementary or alternative therapeutic method is the diuresis-crenotherapie.

This study was conducted to find alternative solution for this pathologies.

## Materials and Methods

Our study includes monitoring clinical trial groups of patients (48 with urinary stones and 110 with urinary infection) study of acute and chronic stage, the patients were monitored for 2 years. These patients received a dose of 250-300ml oligomineral water during 6 times per day; the administration of treatment was performed at the spring during the day and the last 2 doses (evening and night) in the clinic. There was made a special assessment sheet monitor clinical, biological and Reno-urinary evolution. Simultaneously there was an epidemiological investigation to determine potential correlations between intrinsic, extrinsic and pathological factors monitored.

## Results

The results were processed statistically, in conjunction with other national and international studies have shown the importance of divided hydration

## Conclusions

Fluid intake with oligo-mineral water can influence both formation of crystals and physicochemical qualities in urine flow. Elements of statistics analysis showed heterogeneity of renal function in analysis of diuresis process in similar amounts ingested, this argument proves a difficult research subject.

**Keywords:** Oligo-Mineral, Diuresis, Crenotherapy, Reno-Urinary, Treatment



# Mud Therapy

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# Thermotherapy applications in spanish resorts using peloids and parafangos

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## Introduction and Objectives

Among the many and varied techniques of heat application used in musculoskeletal system pathology, the extensive use of peloids and parafangos because their main application is thermotherapy is very outstanding in Spanish resorts<sup>1</sup>.

To assess their thermal behavior it is necessary to measure and in some way quantify the heat transfer by studying the cooling curves. We use the Rambeau technique to obtain parameters that allow a comparison between the different peloids<sup>2</sup>.

## OBJECTIVES

Perform heat transfer curves of 6 peloids and 3 parafangos commonly used in Spanish spas and determine the relaxation time parameters.

## Materials and Methods

We used 5 peloids from 5 different Spanish resorts (Murcia, Arnedillo, Caldas de Bohí, The Fox and Lopagán) and 1 from a Thalassotherapeutic establishment in Thalasia, Murcia. The muds (parafangos) used are: A (Battaglia), B (Subita), C (Dauner)<sup>3-4</sup>.

Thermostatic bath LAUDA E100, Thermostatic bath LAUDA model RC-3, Thermometer Thermocouple Cole-Parmer 91100-50, Polystyrene container 250 cm<sup>3</sup> with screw cap and a central hole, Computer and Origin Software.

To perform the heat transfer curves, prepare and fill the container with the sample eliminating air bubbles.

Introduce the temperature probe through the hole in the centre of the lid and put the container in a thermostatic bath at 45° C. Once the probe reaches this temperature, leave the container in the bath during 30 minutes to achieve the thermal homogeneity of the sample and then take the sample to another thermostatic bath at 36° C.

Using a thermometer with a Pt 100 probe, monitor the temperature of the mud at 15 second intervals until it reaches 36° C.

The time-temperature curve is created and the equation that best fits the experimental curve is:

$$T = Y_0 + A e^{-\frac{t-t_0}{t_1}}$$

where,  $t_0$  is the time of inertia; small initial plateau where the temperature is kept constant and  $t_1$  is the relaxation time that in mechanics and electricity is defined as the time required for a magnitude that is exponentially decreasing to decrease its initial value a 63.22% of amplitude A (45-37° C)<sup>3</sup>. A is the thermal amplitude, difference between the initial temperature of the hot product, and the cold focus.

### Results

PRODUCT	Inertia Time $t_0$	Relaxation Time $t_1$
Archena	1.90	9.9
Arnedillo	0.80	4.6
C. Bohí	1.80	10.6
El Raposo	1.30	6.5
Lopagán	1.60	4.9
Thalasia	0.7	7.6
Battaglia	10	14.6
Dauner S.L.	0.1	10.5
Subita S.L.	10	22

The parafangos show relaxation times higher than peloids.

Among the peloids, those from Caldas de Bohí and Archena have the higher relaxation times.

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# Ultramicrofabric SEM-IA of peloids prepared with mineral waters from Balneario de Lanjarón (Granada, Spain)

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## Introduction and Objectives

The Pelotherapy (therapeutic use of medicinal muds or sludges) has been applied for medicinal purposes since antiquity (Tateo et al., 2010) and is a topic of great current scientific. The term "peloid" covers the natural products, therapeutic semi-liquid physical agents, consisting of the mixture of a mineral water, including sea water and the salt lakes, with organic and inorganic material, result of geological or biological processes or both and used in therapeutic form of plasters or baths (Sociedad Internacional de Hidrología Médica, 1949)(Veniale et al.,2004).

The ultramicroscopic fabric (studied by scanning electron microscopy (SEM) and image analysis (IA)) is a property very interesting of peloids, although precedents found in the bibliography have been limited, due to the difficulty of pre-treatment processes. Vali and Bachmann (1988) relate the ultrastructure of the colloidal dispersions of clay with rheological properties affecting the application of peloids. Fabrics like a honeycomb of bees or reticulate increase the mud viscosity or elasticity; both properties favourable to the handling and therapeutic application of these materials on the skin. Our research group has pioneered this type of studies (Gámiz et al., 2009), showing so far the dependence between the fabric and thermal behaviour.

The aim of this work is to study the effect of maturation time and water type on the ultramicrofabric (observed by SEM-IA) of artificial peloids.

## Materials and Methods

The artificial peloids has been prepared using two types of mineral waters of Balneario de Lanjarón (Granada), of the springs Salud V and El Salado, very similar from the point of view of their classification and salinity (limited between 2 and 6 mg/l, respectively), keeping constant the mineral composition of the solid phase

(which is a mixture kaolin-bentonite ratio 9:1 (w:w)) to avoid interference of this variable.

**Results**

We show that the features of the fabric are dependent on the water type and the months of maturation.

**Conclusions**

Open up interesting perspectives for the manufacture of artificial peloids.

**Keywords:** Peloid, Ultramicrofabric, Mineral Waters, SEM , Image Analysis

# Study of the liquid phase of peloids prepared with mineral waters from balneario de Lanjarón (Granada, Spain)

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## Introduction and Objectives

The use of muds for therapeutic purposes (Peloids) and derived therapy (Pelotherapy), for being ancient and effectiveness universally recognized, has generated great interest in the international scientific community, especially in the last five years, thanks to the benefits it makes in the health field. Together with Balneotherapy is a preventive and curative method, that contributes in the treatment of diseases of the musculoskeletal system fundamentally, rheumatic and dermatological diseases, chronic diseases and for use in the elderly who see diminished symptoms associated with these diseases and, therefore, decreases the required dose of drug administration (Bellometti et al., 2005; Nogueira et al., 2007; Forestier et al., 2010; Fioravanti et al, 2011; Fraioli et al., 2011).

## Materials and Methods

The peloids are pasta composed of a solid phase, mixture of various minerals, mainly of phyllosilicates, with organic substances - as a result of the biological activity of flora and microorganisms - and mineral water, sea or salt lake. The peloids need a period of contact between both phases called "maturation", necessary to improve and stabilize the therapeutic properties of those, generally ranging from two to six months (Galzigna et al., 1996) and two years (Gámiz et la., 2009; Veniale et al., 2004).

## Results

The water forming the peloid influence the chemistry of the mixture, through their pH, salinity, and the retention or release of ions between the two phases (solid and liquid). This water brings to the peloid some trace elements (iron, sulfide, etc.) which are responsible of its effects. The type of mineral water and the minerals used

in the preparation of the mud, influence the type of mud and its application. However, the liquid phase that bathes the peloids as interstitial solution of particles, so far has not been studied.

### **Conclusions**

The aim of this paper is to study the effect of maturation time and water type used in the mixture on the chemical properties of peloids. Artificial peloids have been prepared using two types of mineral waters of Balneario de Lanjarón (Granada), of the springs Salud V and El Salado, very similar in terms of their classification and salinity (limited between 2 and 6 mg/l, respectively), keeping constant the mineral composition of the solid phase (a mixture kaolin-bentonite ratio 9:1 (w:w)) to avoid interference of this variable.

There is a compositional change between liquid phases and the mineral waters of starting, which means that the possible therapeutic action via skin absorption of ions changes. Behaviour between the peloids prepared with both mineral waters is also different.

**Keywords:** Peloid, Mineral Water, Liquid Phase



# Effect of pelotherapy on the perception painful and drug use in patients diagnosed with knee osteoarthritis

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## Introduction and Objectives

Given the active aging population and the current high level of interest in investigating what / physical agents is frequently used in the bathing establishments are most suitable in the treatment of osteoarthritis, the objectives of this paper are based to know the effects that the application of natural peloid on perceived pain and consumption of drugs in patients diagnosed with knee osteoarthritis

## Materials and Methods

Experimental, prospective, controlled, single blind. The experimental group (EG) consisted of 61 subjects who come to the Spa the Raposo (Badajoz) for treatment, whose average age was  $(69.13 \pm 5.60)$  years while the control group (CG) consisted of 60 subjects mean age  $73.08 \pm 8.90$  years.

Inclusion criteria were a diagnosis of osteoarthritis according to the criteria of the American College of Rheumatology (Altman, 1986) and that were in the age range between 65 and 80. Exclusion criteria were to present partial denture or total knee and having done some physical therapy in the past two weeks. EG was applied to a total of 11 daily sessions of pelotherapy, with the duration of 60-72 minutes each. The CG did not receive any intervention continuing his routine. The sample was assessed before and after the intervention with respect to the perception of pain by Visual Analogue Scale (VAS) and the record of the evolution in the use of specific drugs for arthritic symptoms, setting the significance level to rule out the null hypothesis if  $p < 0.05$ . Data were analyzed using SPSS 19.0 statistical software

## Results

Are obtained statistically significant changes ( $p \leq 0.05$ ) between pre-and posttest on pain perception in the EG ( $p \leq 0.0001$ ), from 4.53 to 2.55 points on the VAS scale, while the CG not get significant changes ( $p = 0.287$ ), significant differences between groups ( $p \leq 0.0001$ ). In the EG significantly reduces the consumption of specific drugs ( $p = 0.021$ ) in 48.1%, while 22.2% stop taking drugs. Both the GE

and GC, the most frequently used drugs are analgesics (EG: 39.5% GC: 46.6%), followed by drugs SYSADOA (EG: 23.6% GC: 20%) and of NSAIDs (EG: 22.47%, GC: 5.6%).

**Conclusions**

Treatment with natural peloids achieved beneficial effects on pain perception and reduced intake of drugs in patients with osteoarthritis of the knee, forming an effective alternative for symptomatic relief.

**Keywords:** Mud Therapy; Knee Osteoarthritis

# Effect on cinebalneoterapia functional capacity and pain perception in patients diagnosed with knee osteoarthritis

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## Introduction and Objectives

Among the essential elements consisting of balneotherapy is the use of mineral water and its derivatives. The application of these in rheumatic diseases has been widely used, constitute an unquestionable reality. However, there are many studies evaluating the therapeutic effects derived from its application in knee osteoarthritis.

### OBJECTIVES:

1. Knowing the effects of aquatic exercises in thermal water on the perceived pain in individuals diagnosed with knee osteoarthritis.
2. Knowing the effects of aquatic exercises in thermal water on the functional capacity of individuals diagnosed with knee osteoarthritis

## Materials and Methods

Comparative study of experimental and prospective. The experimental group (EG) consisted of 58 subjects who come to the Spa the Raposo (Badajoz) for treatment, whose average age was  $(72.70 \pm 5.90)$  years) while the control group (CG) consisted of 60 subjects mean age  $73.08 \pm 8.90$  years diagnosed with osteoarthritis and an age range between 65 and 80. GE was applied to a total of 11 daily sessions led by a physiotherapist cinebalneoterapia specialist, with the duration of each of 45 minutes. The CG did not receive any intervention continuing his daily drug treatment. The sample was assessed before and after the intervention with respect to the perception of pain by Visual Analogue Scale (VAS) and functional capacity by measuring joint range (goniometry), muscle strength (dynamometry digital) and the WOMAC scale, establishing the significance level to rule out the null hypothesis if  $p < 0.05$ . Data were analyzed using SPSS 19.0 statistical software.

## Results

The EG has 55.17% of bilateral gonarthrosis, compared to 27.58% shown in the right knee and 17.24% on the left. Are obtained statistically significant changes between pre-and post-test on joint range of flexion and extension of both the right

knee and the left ( $p \leq 0.0001$ ), quadriceps muscle strength as both hamstrings ( $p < 0.05$ ) and in the dimensions pain, stiffness and WOMAC functional capacity questionnaire ( $p \leq 0.0001$ ) in the EG compared to GC, but only found differences between groups in pain perception ( $p \leq 0.0001$ ). The effect sizes was moderate in all variables analyzed except for pain VAS and calculated by dimension \"pain\" WOMAC questionnaire has been high (1.04 and 0.94 respectively).

### **Conclusions**

The significant improvements achieved cinebalneoterapia on pain perception and functional capacity of patients with osteoarthritis of the knee, forming an effective alternative in the symptomatic management of the disease

**Keywords:** Cinebalneotherapy; Knee Osteoarthritis

# Serum levels of adiponectin and visfatin in knee osteoarthritis after spa therapy

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## Introduction and Objectives

Osteoarthritis (OA) is the most common form of joint disease and a major contributor of disability in older people. Current treatment of OA include pharmacological and non-pharmacological modalities. Spa therapy can represent a useful backup to pharmacological treatment of OA or a valid alternative for patients who do not tolerate pharmacological treatments, but its mechanisms of action are not completely known.

Adipocytokine, including visfatin and adiponectin, may play an important role in the pathophysiology of OA. In skeletal joints, adiponectin may act as a pro-inflammatory agent and may be involved in matrix degradation and visfatin may affect articular cartilage metabolism.

The aim of this study is to evaluate serum levels of adiponectin and visfatin in patients with OA of the knee treated with a cycle of combination of daily locally applied mud-packs and mineral water baths in a single blind, controlled, randomized trial.

## Materials and Methods

100 outpatients aged between 50 and 75 years with OA of the knee according to the ACR criteria and x-rays of the knee (radiological staging I-III ) were enrolled: 50 patients (Group A) received a combination of daily local mud- packs applied on both knees for 20 min at an initial temperature of 51°C and bicarbonate-sulphate-calcic mineral bath water at 38°C for 15 min, from the spa centre of Chianciano Terme (Siena, Italy) for a total of 12 applications carried out over a period of 2 weeks; 50 patients (Group B, controls) continued regular, routine ambulatory care. Adiponectin and visfatin plasma levels were assessed at baseline time (T0) and after 2 weeks (T15), upon completion of the spa treatment period (for patients of group A). The differences in the plasma adiponectin and visfatin levels at baseline and after fangobalneotherapy were assessed using the Student's paired t-test. Baseline blood samples (6 ml) were drawn from an antecubital vein, in the supine position in the morning after an overnight fast, and again after 2 weeks under the same

conditions. The blood was immediately centrifuged and serum was stored at  $-80^{\circ}\text{C}$ . The concentrations of visfatin and adiponectin were measured by enzyme linked immunosorbent assay (ELISA) method (Adipogen, Inc).

### **Results**

At the end of the cycle of spa therapy, serum adiponectin levels showed a significant reduction ( $p<0.05$ ) and visfatin a significant ( $p<0.05$ ) increase, whereas in the control group no significant differences were noted.

Table 1 shows the results of serum adiponectin and visfatin serum levels at baseline and after two weeks in the two studied groups.

### **Conclusions**

Our results show that spa therapy can modify plasma levels of adiponectin and visfatin. These results confirm our previous published data on a small cohort of patients. Whether this effect may play a potential role in OA needs further investigations. However, further studies on larger numbers of cases are needed to evaluate the effects of spa therapy on adipocytokines.

**Keywords:** Osteoarthritis, Spa Therapy, Fangobalneotherapy, Mud-Pack Therapy

# Ultramicrofabric SEM of extemporaneous peloids

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## Introduction and Objectives

We present the study of extemporaneous peloids conducted through the ultramicrofabric. The extemporaneous peloids are those muds which have not been subjected to any process of maturation, and after preparation and agitation (to acquire plastic consistency and homogeneity desired), are applied with therapeutic purposes (Armijo et al., 2010; Texeira, 2011). The use of extemporaneous peloids is increasingly common in spas and hot springs.

The ultramicroscopic fabric or ultramicrofabric (studied by scanning electron microscopy, SEM) is a property very interesting of peloids, although precedents found in the bibliography have been limited, due to the difficulty of preparation processes. It is necessary to freeze rapidly and lyophilized samples previously. Vali and Bachmann (1988) relate the ultrastructure of the colloidal dispersions of clay with rheological properties affecting the application of peloids. Fabrics like a honeycomb of bees or reticulate increase the mud viscosity or elasticity; both properties favourable to the handling and therapeutic application of these materials on the skin.

## Materials and Methods

In this study, the peloids were prepared using as solid phase two bentonites, aluminic and magnesium respectively, and as liquid phase, distilled water. The fabric has been studied less than seven days.

## Results

Aggregate particles in the powder of the solid phase unmixed with water, are pseudospheroids, with a few sizes of 30-40  $\mu\text{m}$ . When preparing the peloid, suffer a process of scattering determined in both peloids, where are sheets of about 5-10  $\mu\text{m}$ , with an acquired structure.

The peloids have already organized a fabric, where there are small sheets (with a diameter  $<5\ \mu\text{m}$ ) that bind in larger aggregates (20-30  $\mu\text{m}$ ), with linkages face-face, face-edge and development of porosity.

### **Conclusions**

There are small differences in the degree of aggregation between the fabric of the aluminic phase and the magnesium. In the case of peloids made with magnesium bentonite and distilled water, surfaces are less individualized, giving rise to a fabric more clotted, although porous system is detecting. In detail, it is observed that smaller particles adopt forms bacilli, filamentous, that are joining each other with laminar particles larger, leading to larger aggregates which leave voids up to 15  $\mu\text{m}$  (Figure 1c). Gámiz et al. (2009), showed the dependence between the ultramicrofabric and thermal behaviour, so it is hoped that the differences shown in microfabric of the two studied peloids are correlated with a different thermal behaviour. This correlation is being studied at the moment.

**Keywords:** Extemporaneous Peloids, Ultramicrofabric, SEM Microscope, Bentonites.



# Mud therapy for the treatment of osteoarthritis

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## Introduction and Objectives

**OBJECTIVE:** The aim of this study was to evaluate the efficacy of mud therapy in the treatment of Osteoarthritis (OA). **INTRODUCTION:** Osteoarthritis is a common disorder, characterized by progressive cartilage degradation and secondary inflammation of the synovial membrane. Several treatments are available, including mud therapy.

## Materials and Methods

Search for articles in Medline, UpToDate, National Guideline Clearinghouse, Cochrane Library, DARE, Bandolier, and TRIP Database, using the MeSH terms mud therapy and osteoarthritis. The search was limited to articles published between January 2000 and December 2011, in English, Portuguese, Spanish and French. The SORT (Strength of Recommendation Taxonomy) scale of the American Family Physician was applied to evaluate the level of evidence.

## Results

Studies found that mud therapy decrease the duration and intensity of symptoms including pain, reduce TNF-alpha serum level and reduce the use of oral analgesic drugs

## Conclusions

Mud therapy is considered an option of treatment for OA. The available evidence indicates that mud therapy have a beneficial effect on OA (Strength of Recommendation A).

**Keywords:** Mud Therapy; Osteoarthritis

# Mud therapy resources in Bulgaria

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## Introduction and Objectives

Bulgaria is rich in natural resources: mineral waters and mud, which has been used for treatment and recreation since ancient times.

Most important are the deposits of mud in the salt lakes near the Black Sea, peat mud and mud from thermal springs. Rehabilitation hospitals and balneo hotels are built nearby these mud deposits, in which mud therapy is applied for the treatment of musculoskeletal disorders, disease of the peripheral nervous system, gynecological and dermatological problems.

## Materials and Methods

The most important mud resources in Bulgaria are:

Salt lakes mud: Shabla lake (black, high contents of sulphides, 235 000 t.); Ruskalka (black, medium contents of sulphides, 21 000 t.); Balchik Tuzla (black, medium level of sulphides, 38 000 t.); Varna lake (black, medium level of sulphides, 1 300 000 t.); Pomorie lake (black, medium level of sulphides, very good physical characteristics, 1 480 000 t.); Atanasovo lake (black, medium level of sulphides, 600 000 t.)

Peat mud: Baikal – brown and rich in organic ingredients, which is applied usually in combination with mineral water in the famous resorts Kiustendil and Separeva banja.

Mud from thermal sulfated springs: Marikostinovo – 33 900 t. and Banja, Karlovo -12000t

## Results

The application of peloids for treatment is based on their “chemical” and thermal action. The thermal effects of peloids are non-specific and depend on their thermal properties, such as thermal conductivity, specific heat capacity and the consistence of the peloid solution. We compared the thermal properties of mud from Pomorie salt lake and peat mud, which is of relevance for their application in clinical practice.

<b>Thermodynamic characteristics</b>	<b>Distilled water,%</b>	<b>Curative mud solution,%</b>	<b>Peat solution,%</b>
Density at 25 C	100	111	105
Specific thermal capacity at constant pressure	100	80	99,2
Thermal conductivity coefficient	100	85	84,2
Water content	100	75	96
Dynamic viscosity at 25C	100	~7,821229	~1,899445

### **Conclusions**

The comparison between the thermal properties of water and water solutions of peat mud and mud from salt lake show that the thermal effect of the water bath is significantly smaller. The lower thermal conductivity of mud solutions make them a better choice for application as thermotherapy in clinical practice, which in combination with their chemical ingredients explain their beneficial effects in the treatment of different disorders.

**Keywords:** Peloids, Mud Therapy, Peat Mud, Mud Resources, Thermal Effect

# Mud maturation in Copahue, Argentina: the presence of sulphur

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## Introduction and Objectives

Copahue volcano is situated in the province of Neuquén, Argentina. Several geothermal features (hot springs, ponds and fumaroles) occur in the surroundings of Villa Copahue. The associated geothermal system causes the occurrence of singular thermal muds that are intensively used in the Copahue Thermal Center (CTC), an international-level thermal complex.

The natural mud have a composition rich in sulfur, as well as clay minerals kaolinite and smectite type, which are in contact with a highly acidic liquid phase with high salt content and dissolved gases (Baschini, et al 2010). These peloids are extensively used for the treatment of several rheumatic, muscles, neurological and dermatological pathologies (Monasterio and Grenóvero, 2008). The winter station covers the entire thermal center with several meters of snow each year and turns inaccessible the use of these materials.

The objective of this study was carried out an experimental maturation of muds in the CTC, from regional clay minerals and acid water located near Copahue, in order to

obtain appropriate material for therapeutic uses that can be transported out of Copahue during the winter, and used during the winter period.

## Materials and Methods

An Experimental Station was built with a wooden container with about 4000 L of capacity, where kaolinite and smectite (APM and CATAE in proportions 75:25) from regional deposits were mixed with natural thermal acidic waters. The pH value of the system was about 3, the temperature was about 55° C, and water conductivity was between 2.67 to 4.70 mS/ cm, during the experience (1 year). At different times samples from the Experimental Station were taken and analyzed. In previous work cationic exchange capacity, specific surface, Atterberg limits, kinetic cooling and color were analyzed (Baschini et al, 2011). In this presentation we focus on the

presence on sulphur in the matured muds. The sulphur content was determined by chemical analysis and the heat transfer was analyzed by Differential scanning calorimetry.

### **Results**

maturation times evaluated were those detailed in Table 1.

**Table 1** shows the name and maturation time of the different samples analyzed.

Sample	EE0	EE1	EE2	EE3	EE4	EE5	EE6
Time of maturation, month	0	0,5	1	2	3	4	9

Sulphur incorporation increase with maturation time, and the maximum value was reached to 4 months after starting the process. This sulphur content represent around 2% of the dry material. Thermograms show, at the same time, the presence of sulphur, with their corresponding melting and autoignition points, at temperatures of 115 and 240° C, respectively. The DRX diagrams indicated the presence of sulfur specifically in the sample EE 5.

Previous studies showed that the best properties of the matured muds in relation to Liquid Limit, Plastic Limit, Plastic Index, Cationic Exchange Capacity, Specific surface, cooling kinetics, agglomeration and cementation were achieved between the 3 and 4 month of the beginning of the process. These additional studies showed that sulphur incorporated are considerably better for the EE5 material.

### **Conclusions**

The global study showed that the maturation process of muds can be produced, in a period of four months, a material with very good properties for therapeutic use

**Keywords:** Thermal Mud: Maturation: Copahue: Sulphur

# Efficacy and tolerability of mud packs therapy in osteoarthritis of the hand

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## Introduction and Objectives

Osteoarthritis (OA) is the most common form of joint disease and a major contributor of disability in older people. Current treatment of OA include pharmacological and non-pharmacological modalities. Spa therapy has a long history in the treatment of OA, but few articles have evaluated the effectiveness of this treatment in patients with primary OA of the hands. The aim of this study is to assess the duration of the clinical effectiveness of mud-packs application and mineral bath in patients with primary OA of the hands in a single blind, controlled, randomized trial.

Our study will follow the patients for a longer period of time (12 months) than was done in previous studies

## Materials and Methods

60 outpatients with OA of the hand according to the ACR criteria were enrolled; 30 patients received a combination of daily local mud packs and mineral bath water from the spa centre of Fonteverde Natural Spa Resort (San Casciano Terme, Siena, Italy) for two weeks; 30 patients continued regular, routine ambulatory care. Patients were assessed at baseline time, after 2 weeks, after 3, 6, 9 and 12 months following the beginning of the study and were evaluated by Visual analogue Scale for spontaneous pain, Dreiser Algofunctional index, Health Assessment Questionnaire, Arthritis Impact Measurement Scale 1 and symptomatic drugs consumption.

## Results

We observed a significant improvement of all evaluated parameters at the end of the cycle of spa therapy, which persisted throughout the whole of the follow-up period, whereas in the control group no significant differences were noted. This symptomatic effect was confirmed by the significant reduction of symptomatic drug consumption. Tolerability of spa therapy seemed to be excellent.

## Conclusions

The results from our study confirm that the beneficial effects of spa therapy in patients with OA of the hand lasts over time, with positive effects on the painful

symptomatology and a significant improvement on functional capacities. Spa therapy can represent a useful backup to pharmacological treatment of OA or a valid alternative for patients who do not tolerate pharmacological treatments.

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**Keywords:** Hand, Osteoarthritis, Spa Therapy, Balneotherapy, Mud-Pack Therapy

# **Climatotherapy - Thalassotherapy**

## **Derma-cosmetological issues**

- P48 Effects of Thalassotherapy on the cardiovascular response of hypertense individuals  
*S GATO, V ISRAEL*
- P49 Cardiorespiratory response to Thalassotherapy on stroke patients  
*C MORER, I PEÑALVER, F MARAVER*
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- P56 Study of a cosmetologic salt production process  
*C COUSSINE, P CEZAC, J SERIN, F CONTAMINE, J RENEAUME, K DUBOURG, J CAMBAR*



# Effects of Thalassotherapy on the cardiovascular response of hypertense individuals

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## Introduction and Objectives

**PURPOSE:** To verify the effects of thalassotherapy on the behaviour of arterial systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate in controlled hypertense individuals. **RELEVANCE:** In the process of arterial systemic hypertension physical activity is crucial for the systemic control of hypertension throughout an individual's life.

## Materials and Methods

**PARTICIPANTS:** The sample was comprised of 12 hypertense individuals residing in the municipality of Matinhos – PR, who did not perform physical activity, mean age being  $66.5 \pm$ . **METHODS:** Following the Research Ethics Committee resolution, participants were assessed prior to and after the onset of the exercise program, in the following variables: anthropometrics, cardio-respiratory aptitude and quality of life survey SF-36. The physical activity program was comprised of warm-up exercises, muscle stretching and walking in the sea water, referred to as thalassotherapy, a hydrotherapy strategy, with the gathering of data such as heart rate and arterial pressure, before and after the activities. Arterial systolic blood pressure (SBP) and arterial diastolic blood pressure (DBP) were measured by means of auscultation prior to and following physical exercise, Participants were reassessed after the 12 thalassotherapy sessions. **ANALYSIS:** The Mann Whitney U Test was the statistical method used,  $p \leq 0.05$  being considered significant. **ETHICS APPROVAL:** This research follows the guidelines of Resolution 196/ 96 by the Brazilian Ministry of Health having been assessed and approved by the Research Ethics Committee under number 554.091.08.06 at UFPR.

## Results

It was observed that the behavior of systolic and diastolic pressure was significantly reduced following walking and thalassotherapy sessions, as compared to the initial values.

## Conclusions

After 4 weeks of thalassotherapy application benefits could be seen by means of a reduction in the arterial systolic blood pressure. Therefore the trial proposes the intervention as a treatment and prevention measure of Arterial Systemic Blood Pressure. Physical Therapy can use the hydrotherapeutic strategy of thalassotherapy

as a resource in the therapeutic intervention of hypertense individuals, aiming at an improvement in their quality of life.

**Keywords:** Hydrotherapy; Hypertension; Thalassotherapy; Physical Therapy

# Cardiorespiratory response to Thalassotherapy on stroke patients

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## Purpose:

To better delineate medical hydrology intervention programs, knowledge of the factors that are associated with physical fitness in water and land in stroke survivors is crucial. This study aimed to predict cardiorespiratory fitness based on standardized measures along the several dimensions of the International Classification of Functioning, Disability and Health (ICF) model at several time intervals in a patients who had had an stroke (either acute, subacute and chronic). Methods: As a pilot study, eleven patients were assessed from three months to 5 years poststroke. A symptom-limited exercise on water was used to assess cardio respiratory fitness. Outcome variables were Systolic Pressure, Diastolic Pressure and Oxygen conc. (pulsioximeter). Impairments, activity limitations, participation restrictions, personal and environmental factors were also assessed. Results: Water exercise seems to be safer than land exercise for cardiorespiratory fitness on stroke patients rehabilitation. Functional mobility, body mass index (BMI) and emotional status also contributed to explain variance. Conclusions: Thalassotherapy, specifically hydrotherapy on sea water could be a simple and, most importantly, a patient-specific treatment. We believe that incorporating aquatic therapy into the conventional rehabilitation program at an early or not stage of treatment, and applying it intensively on a short period of time ( continuing the land exercise after the treatment), may be beneficial in improving the effects and outcome on motor recovery and function. The limitations of this study are the relatively small study population and the fact that we did not use invasive/imaging cardiorespiratory techniques (eg, functional magnetic resonance of heard, ultrasound, central catheter...) that might have more exact results.

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# Talassotherapy on stroke rehabilitation. Review of classical contraindications, complications. Comparison with a traditional Spa in Murcia

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## Introduction and Objectives

Recent cardiovascular events have been a classic contraindication to perform thermal treatment. However, given the advances in pharmacology for the proper control of the different variables (blood pressure, glucose, heart rate ...) it may be revised and also the indication for treatment in neuro rehabilitation for stroke patients even in very recent phases, as Talassotherapy Centers and Spas offer optimal conditions for the treatment of these patients based on the premise of early, intensive rehabilitation and special environmental parameters along the several dimensions of the International Classification of Functioning, Disability and Health (ICF) model

## Materials and Methods

Forty patients were assessed from three months to 5 years post stroke. Variables assessed were age, sex, body mass index (bmi), medication, type of stroke, year of the stroke and complications occurred on two or three weeks intensive rehabilitation program such as infection, falls, new stroke, skin reactions, cardio respiratory acute events... that affected or not to the starting or continuation of the spa treatment, hospital admission or death. Other forty alleatory patients doing a Rheumatologic or others (non stroke) thermal cure were assessed on a Hot Spring Spa, same items.

## Results

On going indexes.

## Conclusions

Talassotherapy seems to be safe enough for stroke rehabilitation, further studies needed. Hydrotherapy on sea water could be a simple and, most importantly, a patient-specific treatment. We believe that incorporating aquatic therapy into the conventional rehabilitation program at an early or not stage of treatment, and apply-

ing it intensively on a short period of time (continuing with the land exercise after the treatment), may be beneficial in improving the effects and outcome on motor recovery and function. The limitations of this study are the relatively small study population and a lack of a control group of patients with stroke who perform intensive rehabilitation treatment of a similar period of placement, but in a non-thermal environment (residence, physiotherapy center ...)

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# Beneficial effects of Thalassotherapy in upper limb hemiparesis after stroke

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## Objective

The purpose of this pilot study is to objectify improvements in motor function of paretic upper limb of sub acute or chronic stroke patients combining classical physical therapy with seawater hydrotherapy and other Thalassotherapy techniques following a program of intensive neurorehabilitation of 2 or 3 weeks in a thalassotherapy center (spa therapy). Design: 17 patients who had an stroke participated in a standard rehabilitation program and thalassotherapy , for 2h and 30 min, five times a week for 2 or 3 weeks. The Fugl- Meyer Assessment was used to assess changes in upper-limb motor recovery and motor function after intervention. Impairments, activity limitations, participation restrictions, personal and environmental factors were also assessed (Barthel index). Conclusions: Thalassotherapy, could be a patient-upper limb specific treatment. We believe that incorporating aquatic therapy into the conventional rehabilitation program at an early or not stage of treatment, and applying it intensively on a short period of time (continuing the land exercise after the treatment), may be beneficial in improving the effects and outcome on motor recovery and function. The limitations of this study are the relatively small study population and the lack of group control; additional research on spa therapy programs components, intensity, application time, duration need to be a standardized complementary form of arm rehabilitation after a stroke.

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**Keywords:** Spa Therapy, Stroke, Upper Limb Rehabilitation, Talassotherapy, Hydrotherapy.



# The Thalassotherapy in Mexico a therapeutic tourism option

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México is one of the countries that have the best marine and thermal resources, that's why recently most of the efforts are strategically focus on tourism, specially "Health Tourism".

Our Country has about 9330 coast kilometers and that's why has privileged level worldwide. More than 60% of the states are besides of the oceans coast. The Thalassotherapy is the most important therapy to develop at the close future in México. Specially the Pacific Ocean has high flora and fauna bio-diversity. Plancton diversity is one of the most important environmental issues that is the cause that many whales and turtles species come to our Pacific Coast to reproduce and to get better environment conditions to begin new life. Because of that, Jacques-Yves Cousteau called the California Gulf (that is located at the Pacific Coast) "The Worldwide Aquarium".

Unfortunately the Thalassotherapy is a new tourism concept in México. Only 3 Tourism Centers developed with this concept were developed up to now, and people from other Countries are the main customers of these Thalassotherapy Centers.

One of these Thalassotherapy destination is located at the Gold Pacific Coast, Ixtapa-Zihuatanejo at Guerrero State. During the year, this place has between 25 – 35°C temperatures and mainly European, USA and Canadian people enjoy these friendly weather. Based at the European model (Spain and France) this Center that is known as "Loma del Mar", had focus mainly at Health Tourism as the "Healthy, Sport Rehabilitation and SPA Thalassotherapy Center". Their main focus is going to be the retired and sport people in order to prevent disease by getting a wellness life.

This Center has another therapy treatments like the "Temazcal" Treatment that has Prehispanic ritual bases with good therapeutic results.

The Thalassotherapy pool has 20 hydrodynamic equipment, that have different uses based on the type of disease that people could have.

This Center is an example of the beginning of the development of the Healthy Tourism in México that have the benefits of friendly weather and long Ocean Coasts.

# Temperature and relative air humidity as predictors in forecasting of admissions to the emergency department

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## Introduction and Objectives

The influence of weather on health is so widely known as the Insufficient studied. Meanwhile, at least half of us have a clinically significant sensitivity to weather. However, the results obtained in one area climate or one country cannot be automatically transferred to another. We would like to present an analysis of such a relationship in the hospital on the border of the European Union and also on the border of the continental climate.

## Materials and Methods

1. A retrospective analysis of almost 100 000 admissions three successive years, and weather factors on the basis of archival weather data from meteorological stations.

2. The construction of alternative models taking into account the social and organizational factors

3. Verification of the best model in a prospective study

## Results

Was established at least 10 models satisfactorily correlated with weather factors receptions. The best model that accounts in addition to organizational and social factors, only a relative air humidity and temperature has been confirmed in a prospective study in 2011, describes 90% of the variability of admissions to hospital, where the weather accounts for 20% of the variation

## Conclusions

Accurate weather forecast can be useful in organizing the work of the hospital

**Keywords:** Weather, Hospital Admissions, Air Humidity. Air Temperature, Emergency Department.

# Hydrogeochemical, medical and bioclimatic evaluation of kozakli (nevsehir) geothermal waters in central Anatolia, Turkey

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## Materials and Methods

In this study, aimed to investigate the hydrogeological and physico chemical characteristics of thermal water sources, as well as to examine the properties of Nevşehir Kozaklı cure environment, air quality and definition of this region as the possibilities for the human health protection and treatment of diseases. These sources are close the Cappadocia, the world's most important geological structures are located in.

## Materials and Methods

Wet and dry periods, water samples were taken to determine seasonal variation. chemical and isotopic analyzes were conducted. Isotopic dating used to estimate the age and origins of waters. The results obtained are evaluated in terms of the water chemistry and graphics isotope. Air pollution and meteorological records have been examined to analysis of the air quality of spa environment. Therapeutic indications, was based on water and climate characteristics.

## Results

Hydrogeochemical evaluation of Kozaklı (Nevşehir) geothermal waters; The basement units such as quartzite and marbles in Paleozoic age having cracks contain groundwaters in Kozaklı geothermal areas. Sandstone, sandy limestone and conglomerate levels are permeable gypsum, marly and clayey levels are impermeable in Cenozoic age units. Kozaklı geothermal waters (KGW) emerge along the faults. Water type of KGW is Na-Ca-Cl-SO<sub>4</sub>. Aquifer temperatures of the immatured waters from hydrogeochemical viewpoint are calculated as 105°C for KGW by different geothermometers. All the waters are of meteoric origin to  $\delta^{18}O$ ,  $\delta^2H$  and  $3H$  results. KGW has lower recharge area altitude, and has long water-rock interaction and relatively higher circulation time. Sources of CO<sub>2</sub> of the waters are fresh carbonates, marine carbonate and metamorphic origin to the results of  $^{13}C$ ;

and sources of SO<sub>4</sub><sup>2-</sup> of the waters are volcanic sulphur, petroleum-coal and sulphide in limestones to the results of  $\delta^{34}\text{S}$ . Recent travertine depositions are continuing in the geothermal areas.  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  values of the travertines in the areas of high temperature thermal-mineral waters are lower. Coarse calcite crystalline travertines are formed in stagnant medium, whereas fine calcite crystalline travertines are formed in circulation channel. The algal activity was also contributed on travertine depositing. Physico-chemical properties of the water: These thermal spring waters are described as hyperthermal mineral water according to the physical classification. Chemical properties are given above. In this study, however, not possible to conduct analyzes of radioactivity, Istanbul Faculty of Medicine, Department of Medical Ecology and Hydroclimatology study conducted in 1975 by the Bath Municipal Kozaklı source close to the threshold value (16 592 pci / l), Uyuz Hamam bath and Provincial Private Administration Hammam over the threshold value (62 078 pci / L and 85 509 pci / l) radon has been identified. One of the characteristics of thermo-mineral water source Kozaklı has preceded analysis indicated that more than the threshold value in excess of the amount of radon gas that is specific to Turkey and re-made such as analysis and detection of this feature is needed. Bioclimatic evaluation of Kozaklı (Nevşehir): Thermal and actinic stimulation as bioclimatic effects are dominant, and stimulation related to humidity and mechanical effects are mild in this area.

### **Conclusions**

These springs have capacity for specific applications in balneotherapy; baths for the treatment of orthopedic, rheumatological, neurological, gynecological, urinary tract Infections, and osteoporosis. In addition, they may benefit for other balneotherapeutic methods as inhalation and drinking cures. When we examine the average daily sunshine and rainfall, from May to September period is suitable for open air treatments. These waters are evaluated as balneo-climatherapy for skin disorders mainly psoriasis and rheumatic diseases. Balneo-climatherapy may be applied in combination thermomineral baths with heliotherapy.

**Keywords:** Geothermal Water, Isotope Balneo-Climatherapy, Health Tourism

# Cleaning effects for the hair and the skin of the carbonate water

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## Introduction and Objectives

Use of carbonate water for hair washing is recently starting to spread in the hair-dressing industry in Japan. It is said that carbonate water started been used when a patient found that it feels more refreshing to wash with carbonated water during high concentrate artificial bicarbonate warm water shower. It has been expected that by using carbonate water, there will be effects of the acid and of the vasodilatation, however no scientific evidence has been found. In this paper, experimental results on hair and skin washing using high concentration artificial bicarbonate warm water is reported.

## Method & Results

### 1. Removal action of the protein with the hair shower

We divided hair into right and left in the middle. And we performed a shower with tap water on one side and carbonated water on the other side with 38 degrees centigrade for two minutes. As a result, it was confirmed that much protein was included in carbonate warm water by a ninhydrin reaction.

### 2. Adsorption phenomenon of air bubbles seen at a moment of parting from skin

The process of bubble growth and parting from skin surface was observed using high speed camera. It was observed that the bubbles stuck to skin surface when parting.

### 3. Removal action of the lipid with air bubbles

Furthermore, the removal action of lipid by absorption of lipid into air bubbles and floating was observed using the high speed camera.

## Discussion

From these results, the lipids of the skin are taken in the air bubbles, and it is thought that it is eliminated with the surfactant effect of air bubbles. Furthermore, skin is cleaned by adsorbing lipids or dirt when air bubbles float. When there is stimulation such as sebum or the dirt of the skin, the carbon dioxide which dissolved in water forms air bubbles, but, at this time, this sebum and dirt are taken into the air bubbles and - removed. Sebum, dirt and the protein which stuck to skin are released in warm water with air bubbles of the carbon dioxide by these mecha-

nisms. Therefore it is thought that the difference of removal of protein when washed with the carbon dioxide warm water instead of the tap water is seen as shown from the ninhydrin reaction.

### **Conclusions**

The effect of bicarbonate bubbles on human body is assessed using the following methods: taking into the bubble and eliminate action of lipid, observation of separation of bubble from skin surface, and comparison of protein with tap water using ninhydrin reaction.

As a result, it has been shown that the cleaning effect of artificial bicarbonate warm water is achieved by the mechanism of the taking lipid into the bubble and the elimination, adsorption force between skin surface and bubble and buoyancy effect of bubbles resulting from growth and merging of bubbles at skin surface.

**Keywords:** Cleaning Effects, Hair, Skin, Carbonate Water, Air Bubble

# Study of a cosmetologic salt production process

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## Introduction and Objectives

The aim of this study is to control the production of salts and salt waters concentrated in magnesium using salt spring water as raw material. The process is based on sustainable development principles. Indeed, the raw material is exclusively a natural resource (salt spring water like thermal water of Salies-de-Béarn) and the by-product of process can be directly used as concentrated thermal water in spas. Besides, renewable energy like solar energy can be used in this process.

## Materials and Methods

To study the salt production process, we developed a dynamic model based on a thermodynamic approach that can accurately predict the resulting phase distribution and phase composition in salt water. The model is based on a thermodynamic description of the physical-chemical phenomena occurring in a Gas-Liquid-Solid electrolytic system. Two types of equilibriums are considered: phase equilibrium and chemical reaction equilibrium. So the equations used are: the two types of equilibrium, the partial mass balance and the electroneutrality. The non-ideality of solution is described by Pitzer's model (to calculate the activity coefficients). Precipitation of different salts is automatically considered by the integrator as event using the thermodynamic solubility constants.

## Results

Experimental data are compared with the calculated values in order to validate the use of the model for salt waters applications. We experiment the process with artificial salt water like raw material. The lab-pilot is a series of two water jacketed vessels under agitation with a temperature and pressure control. A filtration system is placed between the two vessels in order to separate the solid phases and the aqueous solution. The concentrations of species in the saturated solution (clear supernatant solution) are determined by using ion chromatography.

## Conclusions

The developed model is a suitable tool for the simulation of salt water behavior.

**Keywords:** Salts, Magnesium, Process, Modeling, Dynamic



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# Demographic analysis of the IMSERSO (Spanish Institute for Elderly People and Social Services) patients in the first operating year of a medical spa in Madrid

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## Introduction and Objectives

The Autonomous Region of Madrid boasted a strong medical spa1 tradition until the second decade of the 20th century when the last spas ceased their activity. It was not until a century later that a new Medical Spa, the Rural Hotel Balneario Aguas de Carabaña, started to operate again.

In the 19th century the Carabaña Spa began as a bottling factory and its mineral water was recommended for digestive system diseases2. In May 2010 the new Balneario Aguas de Carabaña3 opened its doors again and initiated a thermal programme for 300 IMSERSO beneficiaries in August of the same year.

The medicinal mineral waters of Carabaña are hypothermal, strongly mineralized, sulphurated, sodic and sulphurized4.

## Materials and Methods

The information was compiled from the analysis of the medical patient records belonging to the period from August to December 2010, which totalled 171. However, 22 medical records were discarded because they contained incorrect information. The data were inputted in Excel tables for analysis.

## Results

We analysed 149 medical records, 58 men and 91 women, who averaged 70,64 and 71,21 years of age, respectively. The age and sex distribution is similar to other population studies5.

## Conclusions

Finally, we can say that the prototypical IMSERSO patient of the Balneario Aguas de Carabaña is a woman over 70 years of age, suffering from arthrosis and at least one cardiovascular risk factor (high blood pressure, diabetes mellitus and dyslipidemia).

**Keywords:** Age, Carabaña, Demography, Medical Spa, Sex

# The medical spa preferences of the IMSERSO (Spanish Institute for Elderly People and Social Services) patients of a medical spa in Madrid

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## Introduction and Objectives

In 2010 the Hotel Rural Aguas de Carabaña started business as a Medical Spa, the only one currently operating in the Autonomous Region of Madrid. Its medicinal mineral water is characterized as hypothermal, strongly mineralized, sulphurated, sodic and sulphurized<sup>1</sup>. In the same year it also began to participate in the thermal program for the IMSERSO, whose beneficiaries can stay at a spa of their choice every year.

## Materials and Methods

We retrieved the information from the analysis of the Carabaña spa's medical records belonging to the period August to December of 2010. The total number of records was 171, but only 149 contained complete information. During the field visit to the facility, the patients were asked if that was their first visit to a spa or if they had previously stayed at another one and, if so, which spa they had chosen. All the data was inputted into Excel tables. 17 spas could not be included in the spreadsheet because the patients were unable to remember their complete names. Likewise, 5 spas identified only with the word Caldas (literally "hot water spring") were discarded because we could not identify them with certitude. Repeated visits to the same spa by the same patient were counted as only 1 visit.

## Results

We analysed 149 medical records, which were divided into 3 groups. Group A for 60 patients visiting a spa for first time; group B for 37 patients who had visited two or more spas previously; and group C for 51 patients who had visited only one spa previously.

## Conclusions

The number of spas previously visited by the beneficiaries surveyed amounts to 47, characterized by various types of medicinal mineral waters<sup>2</sup>. The regions with the greatest number of previously visited spas are Aragón and Galicia. The beneficiaries generally elected the same type of medicinal mineral waters, sulphurated the

most common, but there are beneficiaries that choose with criteria without a medical purpose.

**Keywords:** Carabaña, Medicinal Mineral Water, Medical Spa

# Therapeutic indications of the mineral waters of Galicia (NW Spain) according to their thermo-hydrogeological characteristics

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## Introduction and Objectives

The therapeutic properties of mineral waters from Galicia (NW Spain) are related to the chemical characteristics of the sources that outcrop in Galicia. The chemistry of the water is directly related to the geologic matrix by flowing and which is enriched mineralogically. Therefore, Galicia appears to be very rich in terms of exploitation, applications and using of different thermal, mineral-natural and mineral-medicinal resources.

Galicia is one of a large outcrop dominated by igneous and metamorphic rocks called Hesperian Massif where there are many thermal manifestations. The groundwater flow can develop in very different time scales according to the hydrodynamic and geological characteristics. Groundwater dissolved minerals as they ascend to the surface.

## Materials and Methods

Study of the hydrochemical situation of groundwater and mineral springs of Galicia regarding the common characteristics of Galician waters, the substrate geological outcrop, identifying physical and chemical parameters and therapeutic use

## Results

Most of the groundwater flowing through silicate lithologies is medium and coarse grain. They tend to be sodium/potassium bicarbonate. However, in some thermal source and source near the coast, the chlorinated component can be very important (e.g.: Thermal source of A Toxa, Caldas de Reis). The deepwater ascent through igneous and metamorphic rocks with sulphide content, (where conditions are anoxic) can cause sulfur sources on the surface (e.g.: Spa of Guitiriz, Baños da Brea, Termas de Cuntis) . The water passing through carbonate rocks (limestone and dolomite) causes water with calcium bicarbonate or calcium / magnesium chemism. There is also a characterization gaseous in some sources for the chemical imbalance of water with the carbonated rock (e.g.: Mondariz, Agua de Cabreiroá, Agua de Fonte Nova).

On the other hand, the measured temperature at the thermal sources does not usually coincide with that corresponding to the maximum depth to which they are heated. This is because a series of processes which causing cooling. Thus, thermal waters are classified as hypothermic (water temperature higher than 4 °C to air temperature), Orthothermic (water temperature equal to air temperature over 4 °C) and hypothermic (the difference of water temperature and air temperature below 4 °C).

The planning of mineral and thermal waters of Galicia is developed by a set of management criteria. Thus, medicinal mineral waters are those that flow to the surface naturally or artificially and its characteristics and qualities are declared of public utility and are suitable for therapeutic treatments. There are different therapeutic actions associated with medicinal mineral waters: chlorides (e.g., stimulate body functions), sulfates (e.g., purging), bicarbonates (e.g.: increased pancreatic activity), gaseous-carbonated (e.g.: aid digestion), sulfur (e.g.: immunological effects on the skin), ferruginous (e.g.: improve tissue trophism), radioactive (e.g.: nervous system regulating) and mineralization below 500 mg / l (diuretic).

### **Conclusions**

As a result of the study was able to establish a clear classification of the different medicinal mineral waters, geographical spatial distribution in Galicia and therapeutic use.

**Keywords:** Hydrogeochemistry, Mineral Water, Thermal Water, Groundwater

# Study of density, thermal conductivity, and ph of mixtures of clays, seawater and tridistilled water

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## Introduction and Objectives

Clay minerals with less than 2 micra grain size when mixed with water produce a malleable paste which can be used for different purposes. Such products are generally used in Spas and thalassotherapy centres, mainly for thermal therapeutic uses, but are also used in aesthetic medicine and for cosmetic applications because of their physico-chemical properties [1].

This study evaluates whether minerals with a high internal porosity such as zeolites are suitable for preparing the abovementioned products because they offer the possibility for later incorporation of active substances which can be gradually released from the internal pores of zeolites. The aim of the first stage of this study is to determine the density, thermal conductivity and pH of the several pastes obtained from mixing clinoptiolite (zeolite) and montmorillonite with seawater and tri-distilled water, for their possible use in thermal therapy and dermo-cosmetics.

## Materials and Methods

Seawater was supplied by Quinton Labs. and tridistilled water was supplied by CACTI. The clays used were supplied by the Spanish company "Sigma-Aldrich".

The physico-chemical properties studied are density, thermal conductivity and pH.

The density has been obtained using a pycnometer. Hexane and tridistilled water have been used as calibration liquids. The technique is described in Deeds and Van Olphen (1961) [2]. The thermal conductivity was measured by a conductivimeter KD 2 proThermal Properties Analyzer (Decagon Devices, Inc.) [3], and pH was measured with a pHmeter Hanna Instrument 99121 [4].

## Results

The results for density obtained from the different samples are: a) 1.42g/cm<sup>3</sup> for clay and tri-distilled water mixtures and, b) 1.43 g/cm<sup>3</sup> for mixtures with clay and seawater. The values for mixtures obtained with zeolite and montmorillonite were 1.5 and 1.97 g/cm<sup>3</sup>, respectively. The thermal conductivity is 0.608 W/m•K for the tri-distilled water mixture while that for the seawater mixture is 0.616 W/m•K. The



pH values of the mixtures studied at room temperature were 5.14 for the tri-distilled water mixture and 4.54 for the seawater mixture.

### **Conclusions**

Montmorillonite was found to present a higher density than zeolite.

The density of the clay and tri-distilled water mixtures is less than that of the clay and seawater mixture.

The thermal conductivity value of the seawater and clay mixture is higher than the mixture obtained with tri-distilled water.

Both density and thermal conductivity values were found to be adequate for use in Spa centres.

**Keywords:** Thermophysical Properties

# **Efficiency of underwater ultrasound therapy in hand osteoarthritis**

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## **Introduction and Objectives**

Osteoarthritis (OA) is the most common form of arthritis and a leading cause of musculoskeletal disability in the middle-aged and older people. The hand is one of the most commonly affected joints in OA. Hand OA is more common in women and is significantly associated with functional impairment and reduced independence. Physiotherapy is one of the recommended nonpharmacological management options in patients with OA. Heat therapy is applied to obtain analgesia, decrease muscle spasm, increase collagen extensibility and accelerate metabolic processes.

Two forms of heat therapy are available. Superficial agents such as hot water heating the skin and subcutaneous tissues, while deep heating agents such as therapeutic ultrasound may produce temperature elevations of deep tissues.

Application of ultrasound in small joints such as the interphalangeal joints is difficult even with small transducers, most of the ultrasonic wave being lost in air.

## **Materials and Methods**

We conducted a prospective experimentally cohort analytic study, which included 16 female patients with proximal and distal interphalangeal osteoarthritis of the hands.

The main objective was to determine the effectiveness of underwater ultrasound therapy in pain management appreciated with VAS for pain. Secondary objectives were to determine that underwater ultrasound therapy can influence the functional scores on hand joints.

Ultrasound in continuous wave, with a frequency of 1MHz, 0.2 W/cm<sup>2</sup> intensity was given underwater with the hands immersed in water for 10 days, 10 minutes /day. VAS pain, Dreiser's functional index, AUSCAN Osteoarthritis Index and Michigan Hand Outcomes Questionnaire were determined before and after ultrasound therapy.

## **Results**

The data were processed statistically using Wilcoxon test. The results showed a statistically significant improvement (p 0.05) for all parameters follow.

## **Conclusions**

In conclusion, underwater ultrasound therapy is effective in relieving pain and functional scores in patients with osteoarthritis of the hands.

**Keywords:** Hand Osteoarthritis, Underwater Ultrasound Therapy

# Health workers knowledge about medical hydrology in Spain

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## Introduction and Objectives

This study wants to determine the degree of knowledge about basic aspects of medical hydrology among the health personnel working in the Spanish National Health Service and to evaluate the attitude, perceptions and experience of the health workers regarding medical hydrology.

## Materials and Methods

**Design:** Descriptive study. Anonymous survey with closed questions.

**Participants:** Health personnel (physicians, nurses, physiotherapists and occupational therapists) of four different autonomous communities (Cantabria, Castilla-León, Cataluña and Comunidad Valenciana) working for the Spanish National Health Service.

**Main variables:** Demographic data of the interviewed health workers were collected and they were asked about their knowledge and experience about medical hydrology and their perceptions regarding medical hydrology. Data were collected in an access file and analysed with a statistical program (SPSS 15.0)

## Results

A total of 172 health workers (mean age: 42 years, mean working experience 17 years) were included. Women made up 62% of the sample. We interviewed 172 health workers, 83 physicians, 70 nurses, 7 physiotherapists and 12 others (occupational therapy, students). 39% of the interviewed ones worked in a primary care center, 33% in a hospital, 9% in a penitentiary and 2% in the ambulance. The autonomous community where they worked was Cataluña 44%, Cantabria 32%, Comunidad Valenciana 17% and Castilla-León 6%. Asking about the level of knowledge about basic aspects of medical hydrology, around the half of the sample gave an incorrect definition of a "spa", 80% didn't know about "medicinal mineral water", 86% ignored the definition about "medical hydrology", 72% about "hydrotherapy", 86% about "thalassotherapy", 94% about "climatotherapy" and 98% about "Kneipp's hydrotherapy". When they were asked if they knew the indications and contraindications of a thermal cure, 75% answered no, 67% had

never advised a thermal cure to a patient and more than half didn't know that medical hydrology is a medical speciality in Spain. 24% of the interviewed ones affirmed had never visited a spa and when they were asked to name the spas they knew, the average number of spas appointed was 3. Around 60 different spas were mentioned, the most named were: Puenteviesgo in Cantabria (8%), Termes Montbrío in Cataluña(7%), Caldea in Andorra(6%) and La Toja in Galicia(5.5%).

### **Conclusions**

Basic aspects of medical hydrology are not well known among the Spanish health personnel. The general level of knowledge about medical hydrology is low and indicates the need of improvement.

**Keywords:** Medical Hydrology, Survey, Knowledge, Health Workers, Spain

# Health workers knowledge about medical hydrology in Argentina

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## Introduction and Objectives

This study wants to determine the degree of knowledge about basic aspects of medical hydrology among the health personnel who worked or keep working in the patagonian region of Argentina. To evaluate the attitude, perceptions and experience of the health workers regarding medical hydrology.

## Materials and Methods

Design: Descriptive study. Anonymous survey with closed questions.

Participants: Health personnel (physicians, nurses, physiotherapists, nutritionist) from Argentina.

Main variables: Demographic data of the interviewed health workers were collected and they were asked about their knowledge and experience about medical hydrology and their perceptions regarding medical hydrology. Data were collected in an access file and analysed with a statistical program (SPSS 15.0).

## Results

A total of 50 health workers (mean age: 31 years, mean worked experience: 7 years) were included. Women made up 68% of the sample. We interviewed 50 health workers, 24 physicians, 18 physiotherapists, 7 nurses and 1 nutritionist. 70% of the interviewed ones worked in a care health center and 30% in a hospital. Asking about the level of knowledge about basics aspects of medical hydrology, around 90% of the sample gave a correct definition of “spa”, more than half of the sample defined correctly “medical hydrology” and “hydrotherapy”, 42% defined correctly “medicinal mineral water”, 28% “thalassotherapy”, 22% “climatotherapy” and 22% “Kneipp’s hydrotherapy”. When they were asked if they knew the indications and contraindications of a thermal cure, 82% answered yes, 82% had ever advised a thermal cure to a patient and more then the half knew that medical hydrology is a medical speciality. 90% of the interviewed ones affirmed that they had visited a spa and when they were asked to name the spas they knew, the average number of spas appointed was 2. The spas named were: Termas de Copahue-Caviahue (49%), Termas de Cacheuta (17%), Termas de San Clemente del Tuyu (10%), Termas de

Río Hondo (8%), Termas de Villa Elisa (8%), Termas de Pedro Luro (6%) and Termas de Reyes (2%).

### **Conclusions**

Basic aspects of medical hydrology are well known among the argentin health personnel but when they are asked about specific data the level of knowledge is low. The general level of information about medical hydrology is high, probably because the interviewed people worked next to the Termas de Copahue-Caviahue, one of the most famous spa in Argentina and lived near of the School of medicine (Comahue University) where there is a course about basic aspects of medical hydrology.

**Keywords:** Medical Hydrology, Survey, Knowledge, Health Workers, Argentina

# Historiography of acidulous waters in the Canary Islands

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## Introduction and Objectives

To do a histographical revision of acidulous waters in the Canary Islands.

## Materials and Methods

Histographical description of acidulous waters in the Canary Islands.

## Results

Sour waters or mineral acidulous waters can be found in abundance in the Canary Islands, due to the fact that the islands are entirely of volcanic origin. These waters appear on the surface through springs. In Tenerife, sour waters were mainly concentrated in the area of Chasna. The most important sour waters of Gran Canaria are in Teror, Telde, Guía, Mafur in Agüimes, in the Rapador Mountain and in the ravines of Azuaje and the Valle de Agaete. Diachronic analytical tests were carried out with several samples taken from different springs. The results showed that these waters are highly-charged with carbonic acid gas.

The sour water of the springs is crystalline, colourless and with no smell. It is water which is fizzy with an imperceptible sour taste - comparable to that of cider or slightly sparkling wine.

In 1785, the Real Sociedad Económica de Amigos del País de Gran Canaria (RSEAPGC) presented a report about the water in the Fuente Agria of Teror, explaining that there are just a few particles of iron and salt in this water. In Guía, the level of iron in the water is higher. The water in Telde contains magnesium too, which gives the water laxative properties, an excellent way to cure the lack of appetite and digestive problems such as flatulence and intestinal obstructions (Viera y Clavijo 2004).

## Conclusions

The springs of sour waters in the Canary Islands are still highly prized by the resident population. Some of these waters have received official acknowledgment as minero-medicinal waters. The most popular springs have been located in the north, where some of them still support a major bottled water company in the Canary Islands.



**Keywords:** Historiography. Acidulous. Waters. Canary Islands

# Perception and Knowledge about Balneology therapies in Spanish people attended in primary care

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## Introduction and Objectives

To know the opinion knowledge and perception of Balneology therapies in a population of Spanish people attended in a primary care office.

## Materials and Methods

Transversal descriptive studies.

Location and participates: 117 persons attended in San Fernando's primary care office during the first two weeks of April 2012.

We use self-administered questionnaire.

## Results

The Characteristics of the population surveyed is 51,7% between 40 and 60 years old, 21,6% between 60 and 80 years old, and over 80 1,7%. Female 73,3% and 26,7% men.

The word balneology is associated with relaxation by 40,5% and 44% to health problems.

The majority, 79,3% believe that in a balneology can be treated a lot of problems and 89,7% believe they would improve their health's conditions.

48,3% of the population surveyed, think that could be treated of stress and anxiety with 39,7% of their pain relief.

57,4% answered that they know some balneology, confused by 10,9% with a spa.

About 80% do not know request for a place in a balneology and 70,3% do not know that there are administration helps to go to a balneology.

Of the total surveyed population 21,4% have ever gone to a balneology.

Of those who went to some balneology, only 21,7% went with some form of state financing.

60% of those who came were for pain. Of these, 50% noticed improvement in their muscle aches and 36,4% of their anxiety. This effect remained a month in 40,0% of the population who had improvement.

90,9% would recommend the balneology again and almost 50% would return even if they had to assumed the full cost of stay.

### **Conclusions**

The majority of the population surveyed 79,3% believed that in a balneology can be treated multiple health problems and nearly 90% believe they could improve some of the health problems they suffer.

The 57,4%, knows any balneology, but about 11% of this population confuse it with a Hotel spa.

**Keywords:** Primary care, Balneotherapy, Balneology, Health Knowledge, Attitudes, Practice

# Splendour and decadence of spa tourism in the island of Gran Canaria

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## Introduction and Objectives

To describe the situation of splendour and decadence in the use of spas by health tourism in the island of Gran Canaria.

## Materials and Methods

Historical description of two spas in Gran Canaria: Azuaje and Berrazales.

## Results

Initially, in Gran Canaria, Health Tourism was associated with the Big Rest formula. This began in the XIX century, when English travellers following the itinerary by steam boats to get to Cape Town, found an island with the best winter in Europe, a great climate and manatial and thermal waters.

The island of Gran Canaria represents a limited environment. It is called a “Miniature Continent” since it has different climates and a variety of landscapes. This is the reason why this island has turned into a tourist lure. Gran Canaria was viewed as one of the best health tourist destinations. Many travellers took the advantage of the perfect microclimates that Gran Canaria offers, and came to stay on the island for a long period of time in order to rest and get over various diseases.

During the second half of the 19th century, Gran Canaria was well-known to the wealthy tourists of northern and central Europe. They visited the island and took medicinal baths in the ancient resorts of Azuaje and Los Berrazales, found in the north of Gran Canaria, and also enjoyed the islands excellent weather at any time of the year. (Patronato de Turismo de Gran Canaria 2012).

Unfortunately, since the second half of the past century, those stately buildings have been out of use. Both private and state companies have taken the initiative to rehabilitate the facilities in order to promote health tourism but this goal has not yet been achieved.

People used to come to the spas to convalesce from different illnesses. The highly-therapeutic water still flows in the ancient Doramas forest - where Azuaje was located - at a spot that also boasts the best of the islands fine weather. On the Los Berrazales ravine, at the seaside town of Agaete, we find the remains of the ancient

resort of the same name, one that profited from a fertile valley. Its iron-filled spring water had great healing power for those suffering from rheumatism and stomach and lung ailments (Fedac 2012).

**Conclusions**

However, these thermal water spas are still waiting to receive the acknowledgment they used to have for tourism in the past.

**Keywords:** Spa. Tourism. Health. Canary Islands

# Health workers knowledge about medical hydrology in Spain

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## Introduction and Objectives

This poster discusses the tendencies and legal situation for medical hydrology services in Spain through a review of the literature published in the last years in our country

## Materials and Methods

A literature search was conducted using PubMed, CINAHL, MEDLINE, Vlex and another specific databases as well as grey literature and less specific search engines.

## Results

There are no publications that address medico-legal aspects in the field of hydrology in our country so we have proceeded to an analysis of the articles and the current legislation in the private medicine and have been analyzing legal issues that should take into account a physician hydrologist in the exercise of their functions. The most relevant articles and texts were selected.

## Conclusions

The current state of the practice of medical hydrology in our analysis of medical liability, informed consent, patient information and medico-legal documents (mainly medical history) is similar to the practice of general medicine in the private sector, with the advantage that no treatment hydrology is aggressive and can only be present conflicts in the care of an emergency. We must not forget that public health situations and hypothetical cases of abuse screening should be known but are exceptional.

**Keywords:** Medical Hydrology, Forensic, Medical Liability, Informed Consent, Medical History

# **Archaeology and Healing Spas: a value added in the differentiation and prestige of baths using mineral-medicinal water**

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## **Introduction and Objectives**

In the last years, thanks to the increase of interdisciplinary studies about mineral-medicinal waters in which archaeologists have taken part, we have a more complete outlook about thermal spas. The discovery of new archaeological testimonies is revealing new information about the origins and the singular evolution of a selected number of mineral springs.

## **Materials and Methods**

To give a comprehensive overview of the situation of these thermal complexes in the Ancient World, we have started to make a complete bibliographic collection of the archaeological evidences present in the thermal baths with a longer historic tradition. In this sense, the study has been based on three main aspects: written documentation, architectonic plans and archaeological remains. This information is being introduced into a database and into a GIS system in order to discover the meaning and the dispersal of these complexes in the Ancient World.

## **Results**

In this way, we are preparing a detailed description of Roman healing baths with scientific-analytic criteria. This study will make it possible to understand the singularities of these buildings as opposed to other ancient baths using common water (from a functional, cultural, social, political and architectonic point of view).

## **Conclusions**

So, according to our ongoing research, we defend the interest held in the archaeological remains to understand the origin of modern healing spas. Their study will allow us to show a rigorous historical trajectory of these places, to increase the interest in mineral springs (for example from a historical perspective, including them in tourist guide books or in archaeological routes), and recover the prestige that healing spas had in the Ancient World.

**Keywords :** Archaeology, Roman Healing Spas, History, Tourism, Thermal Baths

# **Aqui o Thermes, cluster thermal aquitain, connecting professional of hydrotherapy, health, tourism, formation and research**

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## **Introduction and Objectives**

Created in 2009, AQUI O Thermes, cluster thermal Aquitain, is a nonprofit association who connects professionals of hydrotherapy, health, tourism, education and research. AQUI O thermes is mainly composed of SMB's from The Aquitaine (South West of France) which bring together competitive or complementary know-how in the field of medical spa.

## **Materials and Methods**

Moreover, AQUI O Thermes is involved in Dax, the 1st spa town in France and in Aquitaine: universities (Université Bordeaux Segalen ), research institution (Institute of thermalism), and local authorities (Communauté d'Agglomération du Grand Dax).

This cluster is unique in France and the first in Europe. Its position is clear: to foster spa medicine in France, the water cure therapy, and to enhance both qualities of medical spa treatment and thermal bath in the Dax area.

Its orientation is consolidated by the "Plan National pour les Dououreux Chroniques" of the French Ministry for Health and by the recent scientific publications.

## **Results**

AQUI O Thermes works to modernize the water cure therapy (using mineral water) in Dax. The area of Grand Dax is the first medical spa destination in France. The medical spa community, deals with a majority of patients suffering from chronic pathologies such as arthritis (Degenerative osteoarthritis), or vascular pathologies.

## **Conclusions**

The aim of AQUI O Thermes is to share good practices and find new business opportunities.

**Keywords:** Cluster, Complementary Know-How, Competitivity, Spa Medicine, Aquitaine



# Contribution to study conditions of formation, distribution and use of healing waters in Serbia

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## Introduction and Objectives

Introduction: The Republic of Serbia, in proportion with the territory it covers (88,361 square kilometers), is among the countries rich in mineral, thermal and thermomineral waters. Its very complex and heterogeneous lithofacial geological column has provided favorable conditions for the establishment, spread and long-term exploitation of underground waters which are of quality chemical composition and satisfactory amount (4000 l/sec). It was contributed by the thinned out Earth crust (33 km in average), the geothermal heat flow density (83-111 mW/m<sup>2</sup>), and the high geothermal gradient (which is the highest in Vojvodina, 5.26 °C/100 m) which values are twice the European average.

Objective: The objective of this review is to point to the huge significance of existing natural resources again.

## Materials and Methods

Method: Present knowledge about the conditions of formation, genesis, quality and capabilities of exploitation of mineral waters, is supplemented in this paper with new available data. Based on a very exact and rational classification of mineral waters by Quentin accepted in the balneological practice of the country, a unique categorization of the healing waters was performed in spa resorts, or rehabilitation centers in which they are now used for the purpose of balneotherapy. The analytical review of the phenomena, reservoirs and properties of the most common group of mineral waters is shown, by the hydrogeological areas in the active spas of Serbia.

## Results

Reviewer work.

## Conclusions

Conclusion: The hydrogeological potential of the state has not yet been reliably defined in terms of rational, planned and sustainable use. The absence of macro-economic impulse for multidisciplinary, comprehensive, and organized use and consumption of water from the mineral deposits is the main reason for symbolic utilization of underground waters, although survey results indicate that the real potential of geothermal wells is at least five times higher than the implemented (180.6 MWt thermal power, produced heat 2415 TJ/year, utilization for balneotherapy and recreation 36%).

**Keywords :** Mineral Waters, Classification, Balneotherapy, Utilization

# Application of geochemical modelling for quantifying processes affecting high silicon content in groundwaters of northern Gran Canaria (Canary Islands, Spain)

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## Introduction and Objectives

The chemistry of silicon-rich groundwater in the north part of Gran Canaria (Canary Islands, Spain) has been investigated to elucidate processes responsible for high Si concentrations. In the study area, basaltic and basaltic lavas and ignimbrites of the Roque Nublo and Post-Roque Nublo groups and sediments of Las Palmas detritic Formation outcrop. Groundwater comes mainly from Roque Nublo group and underlying Miocene trachytic and phonolitic lavas. The island aquifer is conceptualised as a stratified and heterogeneous water-body, with groundwater flows from recharge area (at the summit) towards the coast. In the study area, groundwater flows generally from the south to the coast, located at the north.

## Materials and Methods

Waters in 19 large-diameter (2.5 and 3 m) wells were sampled. After complete chemical analysis, geochemical (speciation and inverse mass balance) modelling combined with data mining methods have been applied.

## Results

Studied groundwater are fresh and mineral (SEC up to 2760  $\mu\text{S}/\text{cm}$ ), with temperature ranges from 16.3°C to 25.5°C, and pH between 4.40 and 7.40. Hydrochemical types of  $\text{HCO}_3\text{-(Cl)-Mg-Ca-Na}$  prevail. In fresh groundwater of near-neutral pH, silicon usually occurs at concentrations of 0.1-0.3 mM. In studied groundwater Si concentrations are 0.42 to 1.82 mM (mean 1.28 mM), and show positive correlation with ionic strength and temperature, and highest values at pH of 6.0-6.5.

In most groundwaters, silicon occurs as (ortho)silicic acid ( $\text{H}_4\text{SiO}_4$ ), and is mainly governed by temperature and pH. At chemical equilibrium in the groundwater-rock system, Si concentration is controlled by solubility of minerals. In aquifers of active zone, like in studied fissured volcanic aquifer, at non- or metastable-equilibrium, Si concentration meets quasi steady-state conditions, i.e. is a resultant

of the effects of Si released from decaying silicate minerals, and Si removed by neoformed mineral phases and outflowing groundwater.

Reactions which affect water chemistry in Post Roque Nublo, Roque Nublo, and phonolites aquifer-rocks were defined and quantified. In all aquifer-rock types, important effects of marine aerosols and lithogenic CO<sub>2</sub> influx were confirmed. Reactions with particular mineral phases strictly depend on bedrock mineralogy.

### **Conclusions**

Understanding processes which form chemistry of groundwater is important from the applied view-point, because it helps us to protect quantity and quality of water resources, like valuable medicinal waters.

In some countries, silicon is regarded as a beneficial component which provides balneotherapeutic benefits. Silicic acid is the only form of silicon which is biologically available. Many studies have showed beneficial and essential aspects of silicon in humans, because it limits bioavailability of toxic aluminium, and detoxify organisms. Silicic acid at concentration greater than 0.5 mM in drinking waters has been suggested that show some protection against Alzheimer's disease. Bioavailable silicon is depleted from the most of products in our diet; also waters we drink usually have very low Si concentration of about 0.1 mM. Naturally Si-rich (fresh and medicinal) groundwater are locally used, but therapeutic potential of such waters is still underrated. Studied groundwater of Gran Canaria, which have silicic acid concentration much higher than 0.5 mM level, seem to be ideal for testing the health benefits of such waters to humans.

**Keywords:** Geochemical Modelling, Silicon-Rich Water, Groundwater Geochemistry, Volcanic Aquifer, Gran Canaria

# Balneological use of thermal water in South Africa

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## Introduction and Objectives

Of the 75 thermal springs in South Africa, only 23 have been developed. These resources have been developed for leisure and tourism, with none offering spa facilities for therapeutic purposes. Although the art and science of balneology is not currently well known in South Africa, many thermal springs were used in the past for their purported curative properties. There is some evidence that African traditional healers also use geothermal waters for medicinal purposes. This poster presents an overview of the history of balneology in South Africa and attempts to link specific applications to the thermal characteristics and the chemical composition of the waters.

## Materials and Methods

A literature survey was conducted to identify those minerals of balneological importance. Interviews were held with traditional African healers at selected thermal springs. Waters samples were collected from these springs and analyzed for therapeutic minerals. Springs of historical balneological importance are discussed and illustrated in this poster

## Results

Around twenty thermal springs were historically used for therapeutic purposes. Most of these are located in the Cape Province (now Western Cape) and used for illnesses ranging from rheumatism to wound healing – especially warts and bullet wounds. Some were used exclusively for diabetes (Tshipise thermal spring), treatment of corns (Eendvoëlvallei Spring), sarcoma, tuberculosis (Citrusdal thermal spring), rheumatic fever (Goudini) and against snake poison at Calitzdorp bath. In addition, traditional African healers use spring waters enriched with lithium to ‘treat patients’ with mental diseases.

## Conclusions

There is evidence that some waters contain elements that are now proven to be beneficial. This paper serves as a first step in a research project aimed at re-establishing South Africa as a centre of African balneology.

**Keywords:** Thermal Spring Waters, South Africa, Traditional Healers, Historical Balneological Uses

# Traffic evolution of the website of SEHM (2000-2010)

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## Introduction and Objectives

From the Internet appearance the panorama of the communications has reached a global dimension that favors the exchange of ideas and the diffusion of the knowledge practically of instantaneous form. The Medical Hydrology has not been foreign to such a development and from the year 2000 the SEHM created and put his web page at the disposal of the partners and all that person been interested in the matter.

To develop the evolution of the web page of the SEHM from his creation in the year 2000 until the year 2010 demonstrating the enormous acceptance, reception and follow-up that has had, appearing as a very powerful way for the spreading and development of our speciality

## Materials and Methods

There was studied the information obtained thanks to the book-keeper of the web page [www.hidromed.com](http://www.hidromed.com) lodged at the direction [http:// webstats.motigo.com](http://webstats.motigo.com).

## Results

On going indexes

Conclusions

The web page of the SEHM has been revealed how an indispensable instrument for the spreading of knowledge, contact between professionals, expansion and development of our medical speciality, must promote his utilization to continue advancing to all the levels and areas of the knowledge.

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**Keywords:** Traffic, Web Page, SEHM

# **Thermal therapy in health: categorization of therapeutic indications for natural mineral waters in the region of Beira interior of Portugal**

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Portugal is one of Europe's richest countries in thermal waters [1], and the majority of Portuguese thermal resorts are distributed by northern and central regions. The thermalism comprises the use of natural mineral water and other complementary means for prevention, treatment, rehabilitation or wellness [2]. The use of such water, also known as mineral-medicinal water, for therapeutic purposes has always been aroused a continuous interest in carrying out the characterization of this type of waters and the establishment of an eventual relationship for the treatment of a specific pathological condition. Thermal waters can be defined by waters from the subsoil, which are generated in specific geologic conditions and presenting "physico-chemical dynamism" [3,4]. Thermal mineral water has three fundamental characteristics: it originates naturally from the earth, it is bacteriologically pure and has therapeutic potential [3,4]. Most thermal waters are originated from the water resulting from precipitation, and with its infiltration in depth, they acquire particular physico-chemical characteristics, depending on the mineralogical composition of the geological formations through the water flows [1]. In fact, the geological variability in Portugal enables the occurrence of thermal waters with a high diversity in terms of physico-chemical composition [4].

Thermal waters are classified according to parameters such as temperature, osmotic pressure, radioactivity, chemical composition and mineralisation, being the latter two considered of greater importance [5].

The various therapeutic effects described with thermal therapy have been attributed to its physico-chemical composition, being classified as bicarbonated, sulfated, chlorided, sulphurous, hiposaline and gasocarbonic waters, and this correlation has been the basis for the indication of the different thermal resorts for different disorders of several vital systems of the body, and it is precisely in this context that the existing data are more controversial. From a simplistic and reductionist point of

view, most Portuguese thermal waters are described as weakly mineralized, sulphurous, bicarbonated or chlorinated and sodium type waters.

In the present work, a literature review was undertaken in order to create an index of information of physico-chemical composition of thermal waters of the Beira Interior region and its therapeutic indications, followed by an exhaustive statistical analysis to assess the correlation between the different physico-chemical parameters and the therapeutic indications described for that thermal waters.

The results obtained allow us to demonstrate the role of the major components of the thermal waters to a particular therapeutic effect and hence to create a useful tool for regional typology of the thermal waters in Portugal as a valuable alternative of the therapeutic armamentarium for well and specific-oriented pathological disturbs.

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**Keywords:** Portuguese Thermal Water; Physico-Chemical Composition; Therapeutic Effects



# Recent contributions of the Geological Survey of Spain (IGME) in mineral water

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The Spanish Region of Galicia has been gifted with a long variety of mineral and thermal waters, which have been used in its territory since the Roman domination, several centuries ago. During the 21st century the interest in these waters has led to both the Geological and Mining Survey of Spain (IGME) and the Government of Galicia (Xunta de Galicia) to develop the research project “Historia y evolución científica y técnica del conocimiento de las aguas minerales de Galicia”.

This project covers the study of many aspects of mineral and thermal waters of this Region, from legislation and history to hydrochemistry. In a previous research the Spanish territory was divided into 19 hydro-mineral domains, which are zones with a similar geology, hydrogeology and stratigraphy, which cause certain physical and chemical characteristics of mineral and thermal waters. One of the main results of this project has been to achieve a deeper knowledge of the Hercynian Massif Domain, which has been divided into 10 hydro-mineral sub-domains in Galicia.

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