JORNADA TÉCNICO-CIENTÍFICA
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Betaglucano:
nuevo ingrediente funcional en el control del colesterol

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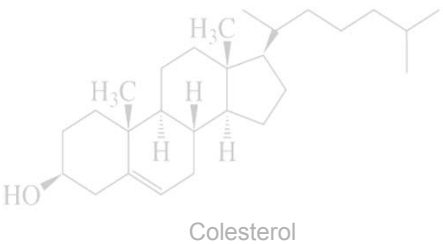
El problema



Colesterol

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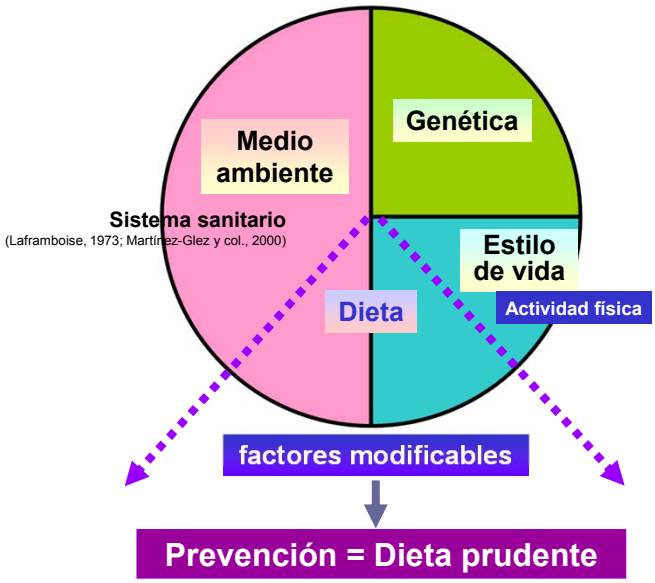
Dieta-Salud-Enfermedad

Enfermedades crónicas (ECV, Cáncer, Diabetes, Obesidad, ...)



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(Isaksson, 1988; 5th ENC; Ferro-Luzzi y James, 1997; Doll y Peto, 1981)

La prevención es posible

Cambios en la dieta
Peso corporal adecuado
Incremento actividad física
Dejar de fumar

Prevención:
≈ 80% ECV - EC
90% DM2
33% Cáncer

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Strong y col. Lancet 2005;366:1758; Epping-Jordan y col. Lancet 2005;366:1667; WHO, 2003

Enfermedad cardiovascular (ECV)

Algunos datos (2008):

- Primera causa de muerte en Europa y en España
- Unión europea: 42% de la mortalidad
- España: 30-35%
- Disminución (26%) desde 1986 → 43,8% de todas las defunciones
- Importantes diferencias entre países europeos y también dentro de España (Andalucía, Murcia, Comunidad Valenciana, Baleares y Canarias: mayor mortalidad por ECV)
- Causa importante de morbilidad
- Alta prevalencia de factores de riesgo

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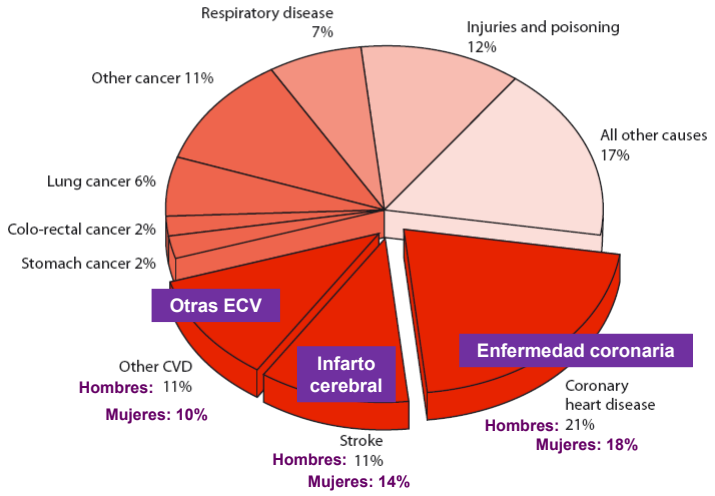
Figure 1.1a Deaths by cause, latest available year, (2001-2006)
Europe



European Cardiovascular Disease Statistics 2008

http://www.ehnheart.org/files/statistics%202008%20web-161229A.pdf

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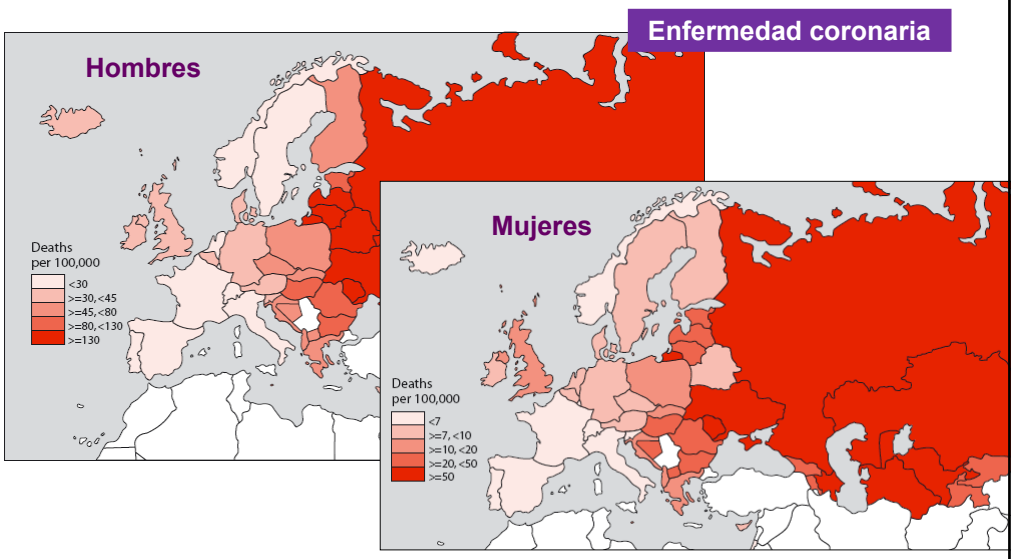
Figure 1.4a Age-standardized death rates from CHD, aged 0 to 64, latest available year (2001-2006)



European Cardiovascular Disease Statistics 2008
http://www.ehnheart.org/files/statistics%202008%20web-161229A.pdf

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Enfermedades del corazón

No modificables

Hª familiar
Edad
Género

Modificables = **Prevención**

- Dislipemia:
  - ↑ **Colesterol total**
  - ↑ **LDL-col**
- HTA
- Diabetes Mellitus
- Obesidad (obesidad abdominal)

Las dislipipemias juegan un papel principal
(Steinberg. J. Lipid Res. 2005 46: 179-190)

↑ 10 mg/dL LDLc → ↑ 12% riesgo
(Howard y col., 2000)

90% del riesgo se atribuye a estos factores + tabaquismo
(Khot y col., Circulation 2003;290:891-897)

Primer objetivo: reducir LDL-col
(NCEP ATP III, 2002)

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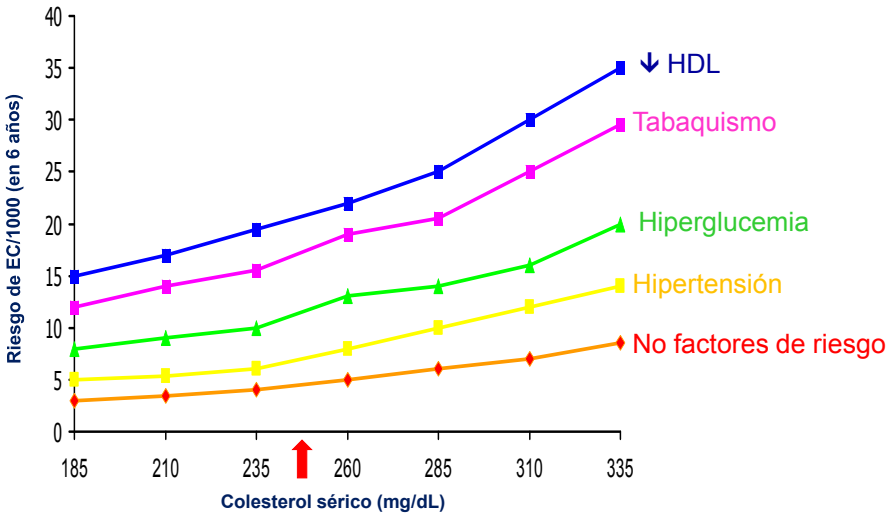
Efecto del aumento de los niveles de colesterol sobre el riesgo de EC en presencia de otros factores de riesgo



Schaefer EJ, adaptado del Framingham Heart Study

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Enfermedades del corazón

No modificables

Hª familiar
Edad
Género

Modificables = Prevención

- Dislipemia:
  - ↑ **Colesterol total**
  - ↑ **LDL-col**
- HTA
- Diabetes Mellitus
- Obesidad (obesidad abdominal)
- **Dieta**
- **Actividad física**
- **Tabaquismo**

Expert Panel. JAMA 2001;285:2486-2497

Hasta un 80% de la EC podría prevenirse con cambios en la dieta y en el estilo de vida

Willett WC. Public Health Nutr 2006;9/1A:105-110.

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Sociedad Española de Arteriosclerosis (2003):

"Aproximadamente la mitad de la población española presenta valores de colesterol en sangre elevados, aunque la mayoría desconoce este hecho, e incluso la mayoría de los que tienen alto riesgo cardiovascular no recibe tratamiento hipolipemiante".

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Población española con hipercolesterolemia

	Total	Hombres	Mujeres	35 – 64 años
≥200 mg/dL **Riesgo intermedio**	**46,6 %**	**48,7%**	**40,6%**	**57,8%**
≥240 mg/dL **Riesgo alto**	15,1%	16,9%	10,2%	18%

Sánchez-Chaparro y col, 2006; SEA, 2003
216.914 trabajadores (16-74 años) (73% hombres)

Medrano y col. (2006):
>20% población adulta: ≥250 mg/dL (Riesgo alto)

Una disminución de 1-2% en los niveles de colesterol puede reducir la mortalidad coronaria en 2-4% (Willett, 2006)

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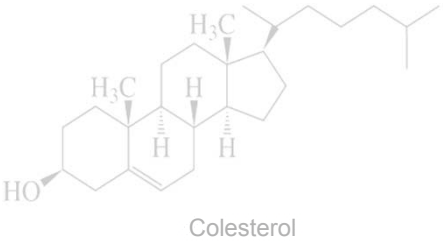
La solución



Colesterol

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¿Qué podemos hacer para controlar el colesterol?

1. Modificar hábitos alimentarios y
2. Cambios en el estilo de vida:
   - Actividad física moderada regularmente
   - Conseguir y mantener un peso adecuado (IMC<25 kg/m^2)
   - Evitar el uso y la exposición al tabaco

Primera línea de intervención
Debe iniciarse **en etapas tempranas** y debe ser **para toda la vida**

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Dieta "cardiosaludable"

↓↓	Grasa total Grasa saturada Colesterol AG *trans*	↑↑	AGM AGP, n-3 Vitaminas Antioxidantes Fibra Frutas y hortalizas Cereales integrales

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Cambios terapéuticos de estilo de vida

Therapeutic **L**ifestyle **C**hanges (TLC)

Nutrient Composition of TLC Diet

Nutrient	**Recommended Intake**
• Saturated fat	< 7% of total calories
• Polyunsaturated fat	< 10% of total calories
• Monounsaturated fat	Up to 20% of total calories
• Total fat	25–35% of total calories
• Carbohydrate	50–60% of total calories
• Fiber	20–30 grams per day
• Protein	≈ 15% of total calories
• Cholesterol	Less than 200 mg/day
• Total calories (energy)	Balance energy intake and expenditure to maintain desirable body weight/ prevent weight gain

NCEP ATP III 2002

Lichtenstein et al. AHA Diet and Lifestyle Recommendations. *Circulation. 2006;114:82-96*

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Dieta "cardiosaludable"

↓↓		↑↑	
	Grasa total Grasa saturada Colesterol AG *trans*		AGM AGP, n-3 Vitaminas Antioxidantes Fibra Frutas y hortalizas Cereales integrales **Ingredientes funcionales**

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Fibra viscosa (soluble) = Betaglucano de avena *("oat gum")*

Beneficios para la salud:

- Reduce los niveles de colesterol total y LDL-col → previene la EC.
- Reduce la tasa de absorción de glucosa y regula la glucemia y la insulinemia postprandial.
- Regula la presión arterial.
- Regula el apetito y ayuda a controlar el peso corporal.
- Mejora la salud gastrointestinal (efecto prebiótico).

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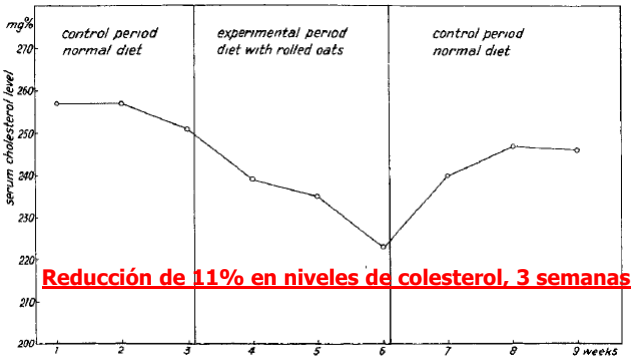
CHOLESTEROL-LOWERING EFFECT OF ROLLED OATS

21 hombres
30-50 años
140 g de avena
3 semanas



Reducción de 11% en niveles de colesterol, 3 semanas

Mean serum-cholesterol level in 21 male volunteers.

B-glucano → fibra viscosa (soluble) de la avena

de Groot AP, Luyken R, Pikaar NA. Cholesterol-lowering effect of rolled oats. Lancet 1963;2:303–304.

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¿Qué es el β-glucano?

Fibra insoluble	Fibra soluble
-Celulosa -Hemicelulosas -Lignina	-Pectinas -Mucílagos -Gomas: - **B-glucano (viscosa)** - Pentosanos, etc.

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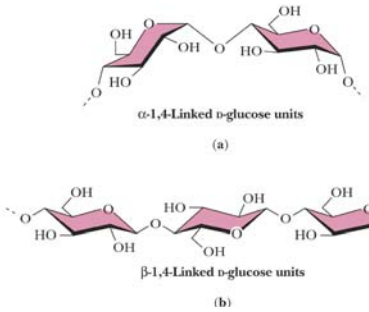
Glucanos = polímeros de glucosa



Alfa-glucanos:
Ej. Almidón, … (enlaces alfa = digerible)

Beta-glucanos:
Ej. Celulosa, β-glucano, ..
(enlaces beta = NO digerible → fibra dietética)

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β-glucano

Avena = 3-10% β-glucano
Cebada = 3-10%
Centeno = 2-2.5%
Trigo = <1%
Maíz, arroz, sorgo y millo

Paredes celulares de levaduras (*Saccharomyces cerevisae*) (baja viscosidad y baja solubilidad en agua)
Hongos, setas, algas y ciertas bacterias

(Theuwissen y Mensink, 2008; Sadiq Butt y col., 2008; Chen y Seviour, 2007; Brennan y col., 2005; McIntosh y col., 2005)

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β-glucano de Avena común

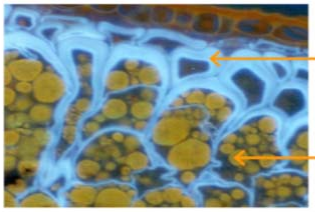
Avena sativa L.

Gachas, *Porridge*

≈ 50% de la fibra es β-glucano

Grano de avena = 3-5%
Salvado de avena = 6-10%

(Theuwissen y Mensink, 2008; Sadiq Butt y col., 2008; Chen y Seviour, 2007; Brennan y col., 2005; McIntosh y col., 2005)



(Poutanen K, 2006)

Lawther y Kvist (Bio Velop)

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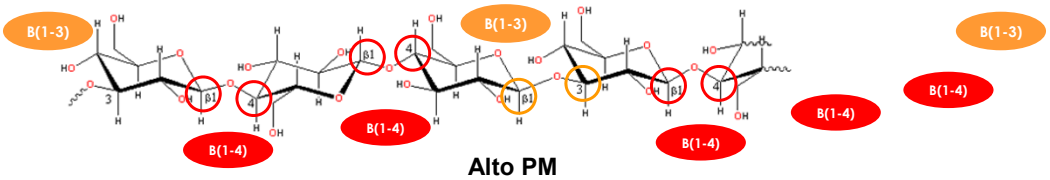
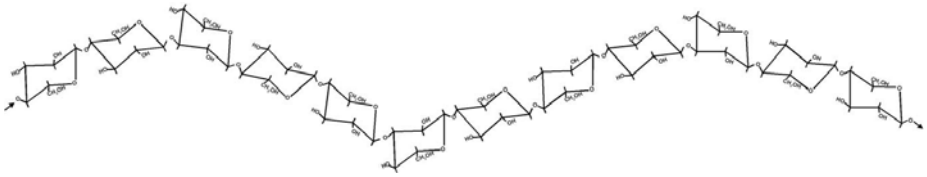
β-glucano = (1→3), (1→4)-β-D-glucano



Alto PM



β(1→3) = Irregular y Flexible = ↑ **solubilidad en agua y viscosidad**
Avena = 30% de las uniones son β(1→3)

Viscosidad → Efecto sobre el metabolismo de HdC y lípidos

Depende de: PM, Estructura, Solubilidad, Concentración (Butt y col., 2008)

La fibra de avena consigue la mayor viscosidad a la menor concentración (1%)

(Wursch y Pi-Sunyer, 1997; Sadiq Butt y col., 2008)

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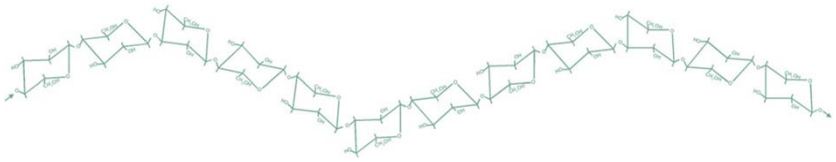
β-glucano, Colesterol y Corazón



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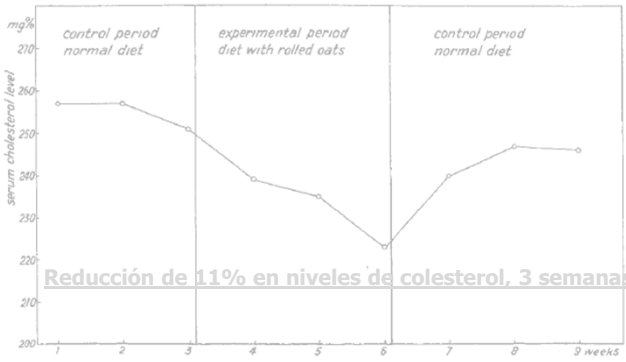
CHOLESTEROL-LOWERING EFFECT OF ROLLED OATS



Reducción de 11% en niveles de colesterol, 3 semanas

Mean serum-cholesterol level in 21 male volunteers.

de Groot AP, Luyken R, Pikaar NA. Cholesterol-lowering effect of rolled oats. Lancet 1963;2:303–304.

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2 meta-análisis , 2 revisiones y centenares de estudios

Ripsin y col. Oat products and lipid lowering. A meta-analysis.
J Am Medical Assoc 1992;267:3317–25.

Glore y col. Soluble fiber and serum lipids: a literature review.
J Am Diet Assoc 1994;94:425–36.

Brown y col. Cholesterol-lowering effects of dietary fiber: a meta-analysis.
Am J Clin Nutr 1999;69:30–42.

van Horn y col., J Am Diet Assoc 2008;108:287-331.

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Review

JAMA. 1992;267(24):3317-25.

Oat Products and Lipid Lowering

A Meta-analysis

Cynthia M. Ripsin, MS, MPH; Joseph M. Keenan, MD; David R. Jacobs, Jr, PhD; Patricia J. Elmer, PhD; Robert R. Welch, PhD; Linda Van Horn, PhD, RD; Kiang Liu, PhD; Wilfred H. Turnbull, PhD; Forrest W. Thye, PhD; Mark Kestin, PhD, MPH; Maren Hegsted, PhD; Dennis M. Davidson, MD; Michael H. Davidson, MD; Lynn D. Dugan, MS, RD; Wendy Demark-Wahnefried, PhD, RD; Stephanie Beling, MD

Objectives.—To test the a priori hypothesis that consumption of oats will lower the blood total cholesterol level and to assess modifiers and confounders of this association.

Data Sources.—A computerized literature (MEDLINE) search and the Quaker Oats Co identified published and unpublished trials as of March 1991. Raw data were requested for all trials.

Study Selection.—Trials were included in summary effect size estimates if they were randomized and controlled, if a formal assessment of diet and body weight changes occurred, and, if raw data were not received, if there was enough information in the published report to perform calculations.

Data Synthesis.—Twenty trials were identified. Using the methods of DerSimonian and Laird, a summary effect size for change in blood total cholesterol level of −0.13 mmol/L (−5.9 mg/dL) (95% confidence interval [CI], −0.19 to −0.017 mmol/L [−8.4 to −3.3 mg/dL]) was calculated for the 10 trials meeting the inclusion criteria. The summary effect size for trials using wheat control groups was −0.11 mmol/L (−4.4 mg/dL) (95% CI, −0.21 to −0.01 mmol/L [−8.3 to −0.38 mg/dL]). Calculation of Keys scores demonstrated that substituting carbohydrates for dietary fats and cholesterol did not account for the majority of blood cholesterol reduction. Larger reductions were seen in trials in which subjects had initially higher blood cholesterol levels (≥5.9 mmol/L [≥229 mg/dL]), particularly when a dose of 3 g or more of soluble fiber was employed.

Conclusion.—This analysis supports the hypothesis that incorporating oat products into the diet causes a modest reduction in blood cholesterol level.

(*JAMA*. 1992;267:3317-3325)

paring oat bran with wheat bran and demonstrated a net total cholesterol reduction of 9% for the oat bran group.[6] Although many metabolic ward studies have shown rather impressive lipid reductions,[1,3-6] trials of free-living subjects have reported considerably more variability in lipid response.[7-23] A few have demonstrated virtually no benefit,[12,13] while others have shown reductions greater than 10%.[11]

At least some of the variability can be accounted for by differences in study subjects and protocols. Various oat preparations have been used, including cereals, muffins, breads, and entrees. Some trials have employed oat bran as the intervention while others have used oatmeal, and doses have differed from trial to trial. Some have enrolled an all-male cohort of subjects and others have used various combinations of younger and older men and women. The initial serum cholesterol level of subjects also has varied from trial to trial, with some including normocholesterolemic subjects and others enrolling only those with hypercholester-

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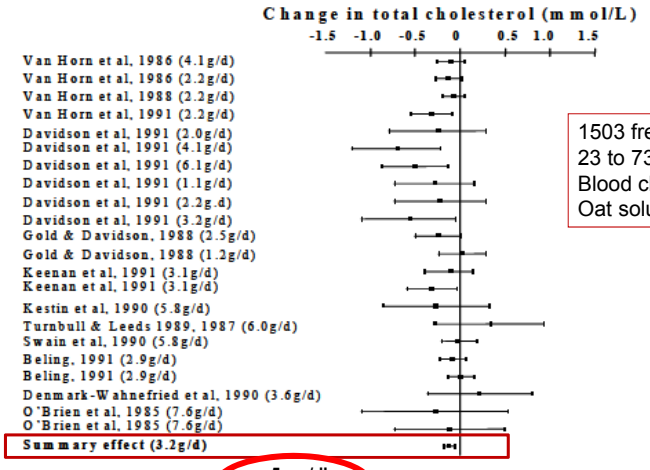
The effect of oat soluble fibre on blood total cholesterol



1503 free-living subjects
23 to 73 years
Blood cholesterol levels = 178 – 275 mg/dL
Oat soluble fibre = 3.2 g (1.1 - 6.1 g/d)

–5 mg/dL

Overall summary effect -0.13mmol/L, 95% CI, -0.19, -0.07, with average dose of 3.2 g/d (range 1.1-7.6 g/d) oat soluble fibre (with the extended inclusion criteria, i.e. no lead-in period for the low fat low cholesterol background diets)

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Ripsin CM, Keenan JM, Jacobs D, y col. Oat products and lipid lowering: a meta-analysis. *JAMA*. 1992;267(24):3317-25.

Table 4.—Effect Sizes for Change in Total Cholesterol Level by Dose and Initial Cholesterol Level

(18 días - 3 meses)

Intervention Dose	Effect Size, mmol/L (mg/dL)*	
	Initial Cholesterol Level <5.9 mmol/L (<229 mg/dL)	Initial Cholesterol Level ≥5.9 mmol/L (≥229 mg/dL)
<3.0 g of soluble fiber from oats	–0.09±0.10 (–3.4±3.8)†	–0.27±0.04 (–10.5±1.6)‡
≥3 g of soluble fiber from oats	–0.13±0.12 (–5.2±4.8)§	–0.41±0.21 (–16.0±8.3)‖

*Values are mean±SD.
†There were six effect sizes.
‡There were four effect sizes.
§There were three effect sizes.
‖There were six effect sizes.

↓ 3 - 7 %

El consumo de >3 g/día de betaglucano reduce los niveles de colesterol total y LDL-colesterol en > 5%

- En algunos estudios se han observado reducciones de hasta el 20%.
- El efecto es mayor en personas hipercolesterolémicas.
- El efecto es rápido.
- No hay riesgo con ingestas altas.
- No compromete la absorción de micronutrientes.
- Posible relación dosis respuesta → confirmar.
- TG y HDL-col no se ven afectados.

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Cholesterol-lowering effects of dietary fiber: a meta-analysis[1,2]

Lisa Brown, Bernard Rosner, Walter W Willett, and Frank M Sacks

Am J Clin Nutr 1999;69:30–42.

See corresponding editorial on page 1.

ABSTRACT

Background: The effects of dietary soluble fibers on blood cholesterol are uncertain.

Objective: This meta-analysis of 67 controlled trials was performed to quantify the cholesterol-lowering effect of major dietary fibers.

Design: Least-squares regression analyses were used to test the effect on blood lipids of pectin, oat bran, guar gum, and psyllium. Independent variables were type and amount of soluble fiber, initial cholesterol concentration, and other important study characteristics.

Results: Soluble fiber, 2–10 g/d, was associated with small but significant decreases in total cholesterol [-0.045 mmol·L^{-1}·g soluble fiber^{-1} (95% CI: -0.054, -0.035)] and LDL cholesterol [-0.057 mmol·L^{-1}·g^{-1} (95% CI: -0.070, -0.044)]. The effects on plasma lipids of soluble fiber from oat, psyllium, or pectin were not significantly different. We were unable to compare effects of guar because of the limited number of studies using 2–10 g/d. Triacylglycerols and HDL cholesterol were not significantly influenced by soluble fiber. Lipid changes were independent of study design, treatment length, and background dietary fat content.

Conclusions: Various soluble fibers reduce total and LDL cholesterol by similar amounts. The effect is small within the practical range of intake. For example, 3 g soluble fiber from oats (3 servings of oatmeal, 28 g each) can decrease total and LDL cholesterol by ≈0.13 mmol/L. Increasing soluble fiber can make only a small contribution to dietary therapy to lower cholesterol. *Am J Clin Nutr* 1999;69:30–42.

Dietary fiber is a collective term for a variety of plant substances that are resistant to digestion by human gastrointestinal enzymes (9). Dietary fibers can be classified in 2 major groups depending on their solubility in water. In humans, the structural or matrix fibers (lignins, cellulose, and some hemicelluloses) are insoluble, whereas the natural gel-forming fibers (pectins, gums, mucilages, and the remainder of the hemicelluloses) are soluble. Studies have focused on soluble fibers such as oats, psyllium, pectin, and guar gum, and qualitative reviews suggested that these fibers lower total and LDL cholesterol (10, 11). Water-insoluble wheat fiber and cellulose have no effect unless they displace foods supplying saturated fats and cholesterol (12).

There is debate as to the degree of cholesterol reduction caused by soluble fibers. The range of effects on total cholesterol varies from −18% to 0% in trials of oat products, from −17% to 3% for psyllium, from −16% to −5% for pectin, and from −17% to 4% for guar gum (12). Reasons for such large variations include small sample sizes, different dosages of fiber, different background diets, concurrent changes in body weight, varying dietary control, and different types of subjects. It is also possible that certain fibers lower cholesterol more effectively than others. For example, Bell et al (13) examined the hypocholesterolemic effects of psyllium-and pectin-enriched cereals in a randomized, controlled study. They found that the psyllium-enriched cereal lowered cholesterol more effectively than the pectin-enriched cereal. Also, trials of oat products suggested that hypercholesterolemic patients are more responsive than normolipidemic persons (14, 15).

Concurrent changes in fat and cholesterol caused by inadequate dietary control can confound the relation between

The American Journal of Clinical Nutrition

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Brown et al., Cholesterol-lowering effects of dietary fiber: a meta-analysis. AJCN, 1999

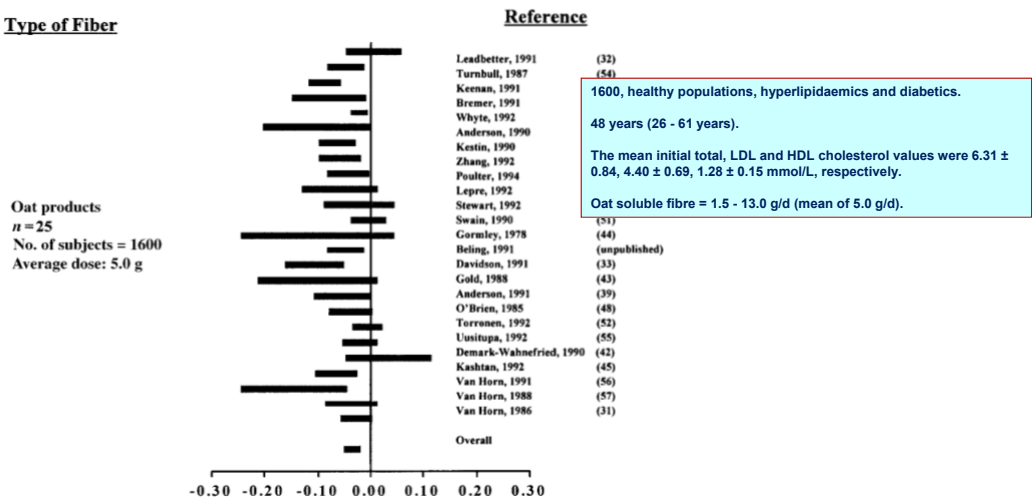

FIGURE 2. Net change in total cholesterol. The net effect of consumption of different dietary fibers on total cholesterol concentrations for oat products, psyllium, pectin, and guar gum. Note that one guar study (85) did not include measures for total cholesterol. The bars represent the width of the 95% CIs for each study. The overall effect estimates and 95% CI are provided for each fiber.

Reducción de 1.4 mg/dL LDL-col por gramo de FS de salvado de avena

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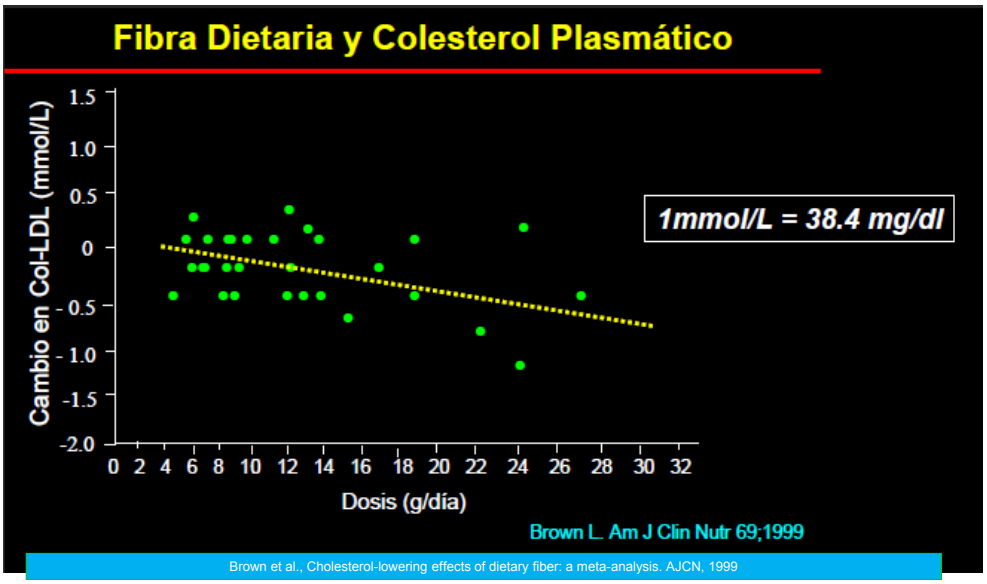

Brown et al., Cholesterol-lowering effects of dietary fiber: a meta-analysis. AJCN, 1999

http://www.sochinut.cl/pdf/Mesa_redonda_Apoyo_nutricional_en_el_paciente_cronico/Dieta_y_enfrentamiento_en_dislipidemias.pdf

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ADA's Evidence Analysis Library (EAL)

Use of systematically reviewed scientific evidence in making food and nutrition practice decisions by integrating best available evidence with professional expertise and client values to improve outcomes.

Consuming diets high in total fiber (17-30 g/d) and soluble fiber (7-13 g/d) as part of a diet low in SFA and cholesterol can further ↓ TC by 2%-3% and LDL cholesterol up to 7%

(van Horn y col., J Am Diet Assoc 2008;108:287-331)

Grade I: Good

The evidence consists of results from studies of strong design for answering the question addressed. The results are both clinically important and consistent. The results are free of serious doubts. Studies with negative results have sufficiently large sample sizes to have adequate statistical power.

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Health Claims de avena, betaglucano y colesterol

EEUU (FDA, 21-enero-1997)

(US FDA final rule for federal labelling: health claims: oats and coronary heart disease. Fed Regist 1997;62:3584-681).
http://www.cfsan.fda.gov/~lrd/fr970331.html

"Una dieta alta en fibra soluble de avena integral y baja en grasa saturada y colesterol puede reducir el riesgo coronario"

- Consumo de 4 raciones diarias (0,75 g/ración: 3 g/día) ➔ reduciría un 5% los niveles de colesterol → riesgo coronario

Canada (2006)

Ames N. Cereal Research Centre. Winnipeg, Code of Federal Regulations 21 CFR 101.81 (2)(i)(G)(1)

- 3 g or more per day of β-glucan soluble fiber from either whole oats or barley, or a combination of whole oats and barley

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Health Claims de avena, betaglucano y colesterol

Reino Unido (JHCI, Mayo de 2004)

"The inclusion of oats as part of a diet low in saturated fat and a healthy lifestyle can help reduce blood cholesterol".
'One 30 g serving provides 0.75 g of betaglucan soluble fibre from whole oats, which is one quarter of 3 g, the suggested daily intake'.
http://www.jhci.org.uk/approv/oats.htm

Finlandia (Finnish National Food Agency, 2000)

"Soluble fibre helps control blood cholesterol. X oat bran/ rolled oats is rich in soluble fibre." The required beta-glucan level is 5g/100g a product.
http://www.evira.fi/portal/en/

Suecia (Swedish Code of Practice, 2004)

"A nutritionally balanced diet high in soluble fibres from oats (beta-glucans) can contribute to lower cholesterol levels in the blood and thereby to a reduced risk of cardiovascular disease/ atherosclerosis /hardening of the arteries. Product Z is high in soluble oat fibres (beta-glucans)."
http://www.snf.ideon.se/snf/en/rh/Generic_claims.htm

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Health Claims de avena, betaglucano y colesterol

Suiza, BAG, 2006
'Oat bran favorably impacts cholesterol levels'

Francia, AFSSA, 2008
The AFSSA considers that it is in the interest of the general public to consume oat soluble fibers (oat beta-glucan) as they contribute to the reduction of blood cholesterol levels.
http://www.oatwell.com/fileadmin/template/creanutrition/files_redakteur/news_internet/AFSSA__AVIS.pdf

Brasil, 2005
Beta-glucan—helps reduce absorption of cholesterol
http://siteresources.worldbank.org/INTARD/Resources/Health_Enhacing_Foods_ARD_DP_30_final.pdf (pag 32)

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Health Claims de avena, betaglucano y colesterol

Unión Europea, EFSA EFSA Journal 2009; 7(9):1254

On the basis of the data available, the Panel concludes that a cause and effect relationship has been established between the consumption of oat beta-glucans and the reduction of blood cholesterol concentrations. The following wording reflects the scientific evidence:

"Regular consumption of oat beta-glucans contributes to maintenance of normal blood cholesterol concentrations".

In order to bear the claim, foods should provide at least 3 g/d of beta-glucans from oats in one or more servings. The target population is adults with normal or mildly elevated blood cholesterol concentrations.

http://www.efsa.europa.eu/cs/BlobServer/Scientific_Opinion/nda_op_ej1254_art13(1)_beta_glucans_related_claims_en,0.pdf?ssbinary=true

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Las declaraciones de propiedades saludables de los alimentos solamente pueden autorizarse después de efectuar una evaluación científica del nivel más elevado posible. Reglamento (CE) Nº 1924/2006 del Parlamento Europeo y del Consejo, de 20 diciembre 2006, relativo a las declaraciones nutricionales y de propiedades saludables en los alimentos.

Position of the American Dietetic Association: Functional Foods

ADA. 2004;104/5:814-826

Table. Strength of evidence for functional foods currently on the US market[a,b]

Functional food	Bioactive component	Health benefit	Type of evidence	Strength of evidence	Recommended amount or frequency of intake	Regulatory status
Fortified margarines	Plant sterol and stanol esters	Reduce total and LDL[c] cholesterol (43)	Clinical trials	Very strong	1.3 g/d for sterols 1.7 g/d for stanols	Health claim
Psyllium	Soluble fiber	Reduce total and LDL cholesterol (38)	Clinical trials	Very strong	1 g/d	Health claim
Soy	Protein	Reduce total and LDL cholesterol (22,42)	Clinical trials	Very strong	25 g/d	Health claim
Whole oat products	β-glucan	Reduce total and LDL cholesterol (38)	Clinical trials	Very strong	3 g/d	Health claim
						Conventional food

[a]Foods that have a Food and Drug Administration-approved health claim (sterol/stanol esters, oats, psyllium, soy) generally are supported by two dozen or more well-designed published clinical trials. For example, the soy health claim petition contained more than 40 clinical trials, whereas there are only a few clinical trials on cranberry juice and urinary tract infections.
[b]Reprinted with permission and adapted from the American Council on Science and Health: From: Hasler CM. *J Nutr.* 2002;132:3772-3781.
[c]LDL=low-density lipoprotein.
[d]TG=triglyceride.
[e]EPA=eicosapentaenoic acid.
[f]DHA=docosahexaenoic acid.
[g]CLA=conjugated linoleic acid.
[h]GI=gastrointestinal.

2009: http://www.eatright.org/ada/files/FunctionalFnp.pdf

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National Cholesterol Education Program (NCEP), Adult Treatment Panel III (ATP III) (*Circulation, 2002*):

"Cambios terapéuticos de estilo de vida" para reducir LDL-col. (***T**herapeutic **L**ifestyle **C**hanges* (TLC)):

Un incremento de 5-10 gramos/día de fibra viscosa reduce en un 5% LDL-colesterol. Incluso cantidades de 10-25 g/día pueden ser beneficiosas

Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) Final Report
http://www.nhlbi.nih.gov/guidelines/cholesterol/atp3full.pdf

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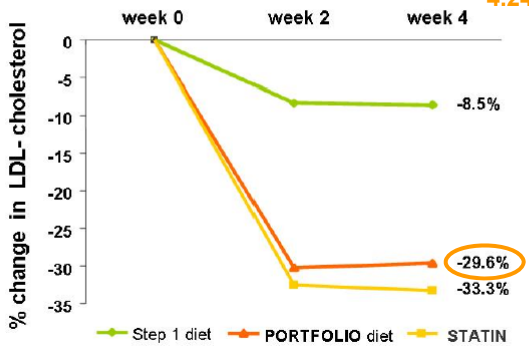
Jenkins y col. Am J Clin Nutr 2005;81:380-7
The portfolio diet: cholesterol lowering foods compared with a statin in hypercholesterolemic participants

A "Portfolio" diet* effectively reduces LDL cholesterol levels

*dietary portfolio = plant sterols, soy protein, viscous dietary fibre, nuts (almonds)

4.24 g de fibra de avena



"It is possible to achieve as great an effect (↓25-30%) with food components as with low dose statin treatment"

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Posibles mecanismos de acción de β-glucano para reducir LDL-colesterol

- Viscosidad (solubilidad) (90% de efectos)
- Capacidad de "secuestrar" ácidos biliares
- Fermentabilidad (efecto prebiótico)

1. Reduce la reabsorción de ácidos biliares
2. Reduce la absorción de colesterol
3. Reduce la síntesis hepática de colesterol

Efectos locales
Efectos sistémicos

- Capacidad para fijar ácidos biliares en el intestino delgado → aumenta su excreción fecal → **↓ LDL-col en sangre**
- Mayor viscosidad en el ID y mayor resistencia de la capa acuosa ("unstirred water layer") próxima a la mucosa → limita la absorción de colesterol → **mejora la lipemia postprandial**
- Reduce la tasa de absorción de glucosa → ↓insulinemia → ↓síntesis hepática de colesterol → **↓ LDL-col en sangre**
- Fermentación de la fibra soluble en el colon → AGCC → ↓síntesis hepática de colesterol → **↓ LDL-col en sangre**

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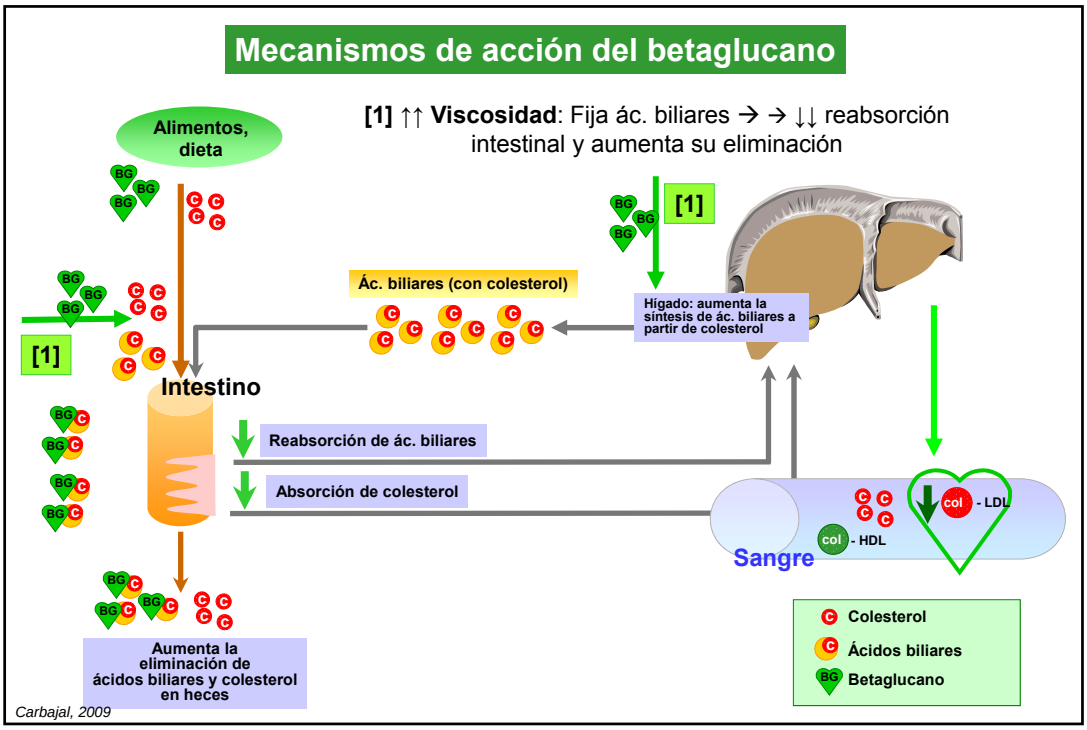
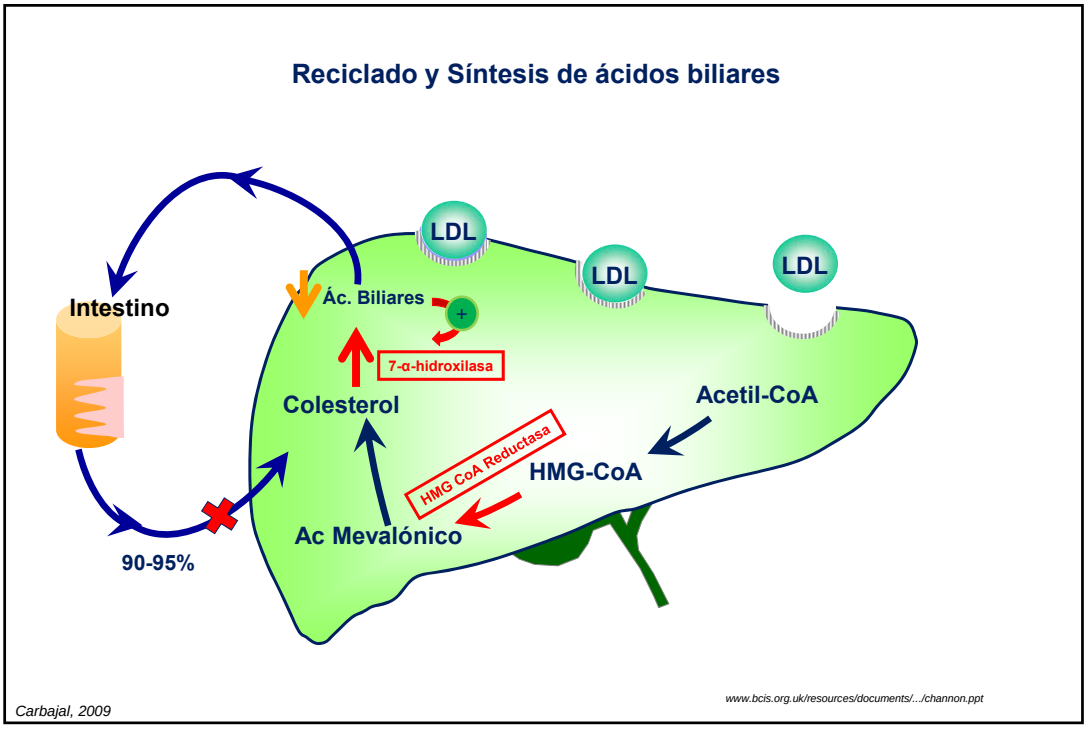
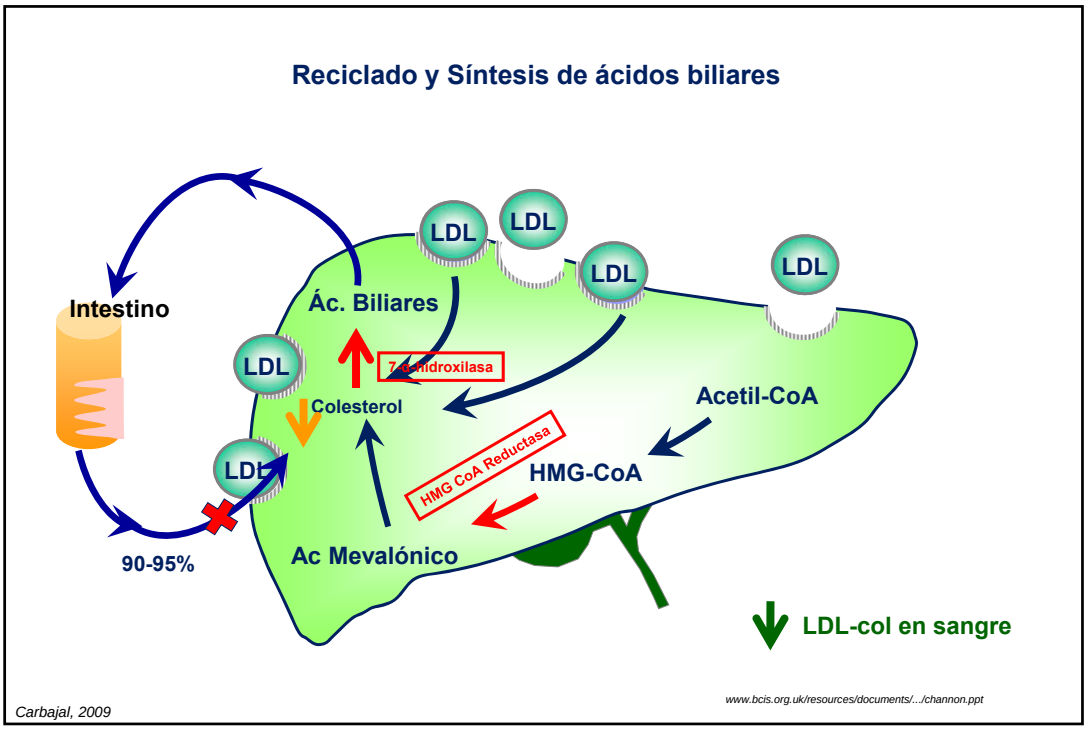

Mecanismos de acción del betaglucano
[1] ↑↑ Viscosidad: Fija ác. biliares → → ↓↓ reabsorción intestinal y aumenta su eliminación
Alimentos, dieta
[1]
Ác. biliares (con colesterol)
Hígado: aumenta la síntesis de ác. biliares a partir de colesterol
Intestino
Reabsorción de ác. biliares
Absorción de colesterol
col - LDL
col - HDL
Sangre
Aumenta la eliminación de ácidos biliares y colesterol en heces
Colesterol
Ácidos biliares
Betaglucano
Carbajal, 2009


Reciclado y Síntesis de ácidos biliares
Intestino
LDL
LDL
LDL
Ác. Biliares
7-α-hidroxilasa
Colesterol
Acetil-CoA
HMG CoA Reductasa
HMG-CoA
Ac Mevalónico
90-95%
www.bcis.org.uk/resources/documents/.../channon.ppt
Carbajal, 2009


Reciclado y Síntesis de ácidos biliares
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LDL-col en sangre
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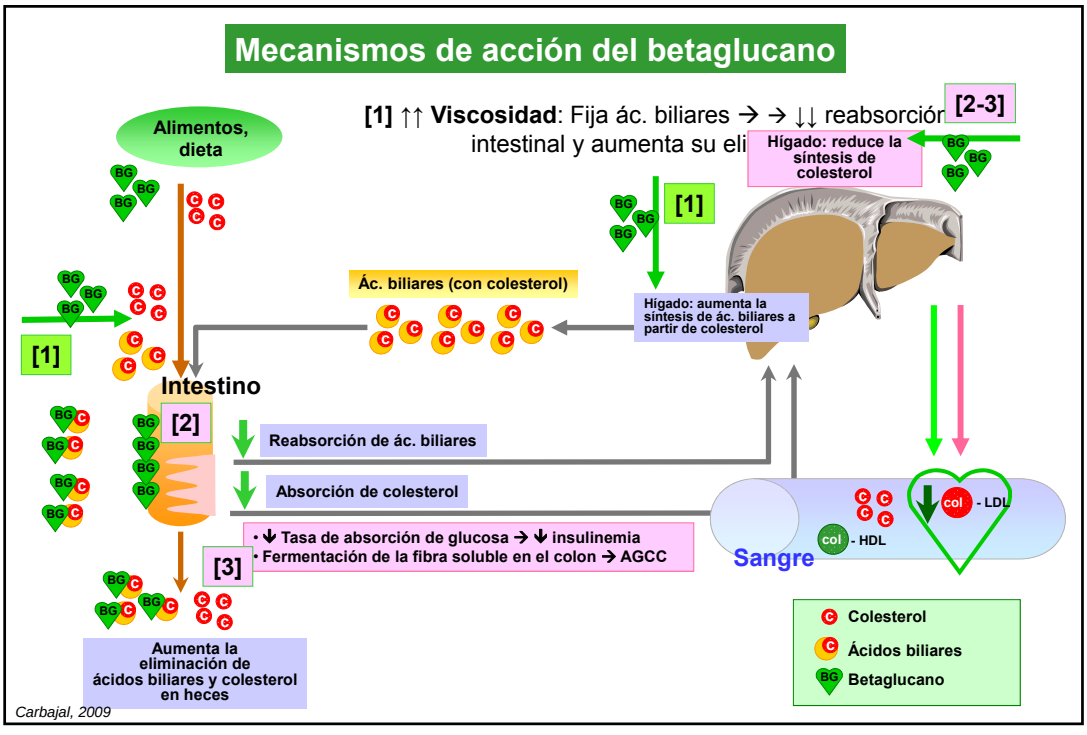
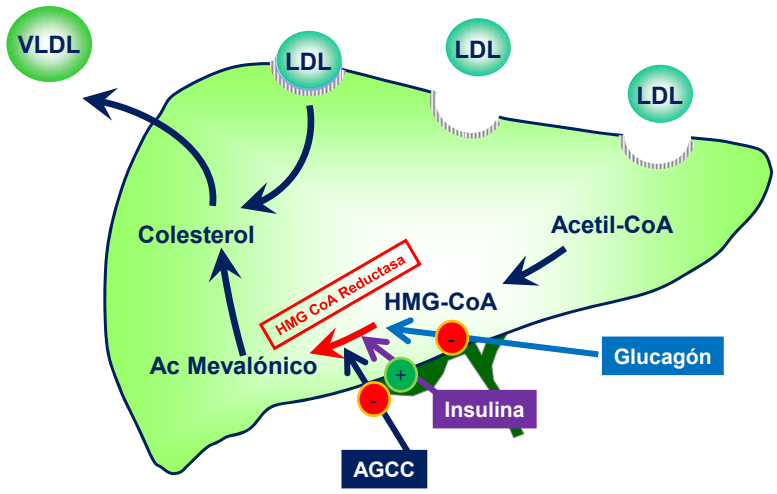
Carbajal, 2009


Mecanismos de acción del betaglucano
[1] ↑↑ Viscosidad: Fija ác. biliares → → ↓↓ reabsorción
intestinal y aumenta su eli
[2-3]
Alimentos, dieta
Hígado: reduce la síntesis de colesterol
[1]
Ác. biliares (con colesterol)
Hígado: aumenta la síntesis de ác. biliares a partir de colesterol
[1]
Intestino
[2]
Reabsorción de ác. biliares
Absorción de colesterol
• ↓ Tasa de absorción de glucosa → ↓ insulinemia
• Fermentación de la fibra soluble en el colon → AGCC
[3]
col - LDL
col - HDL
Sangre
Aumenta la eliminación de ácidos biliares y colesterol en heces
Colesterol
Ácidos biliares
Betaglucano
Carbajal, 2009

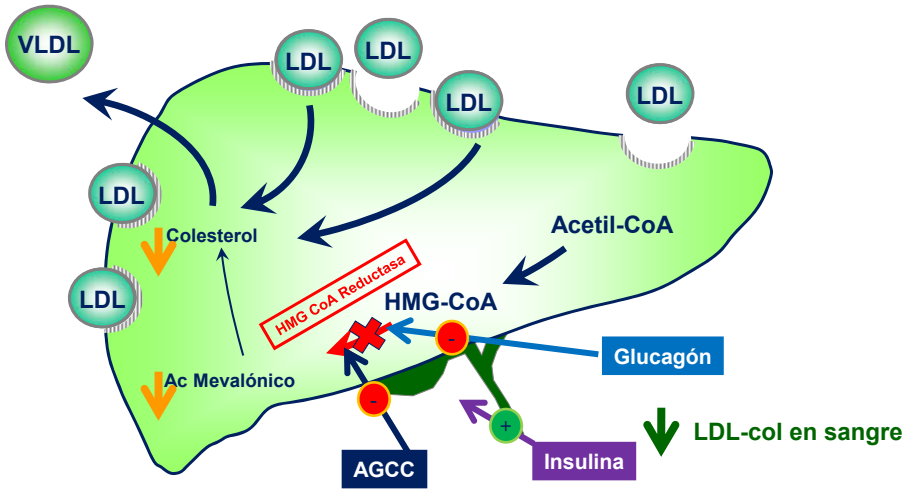
Metabolismo del colesterol – Regulación de HMG CoA Reductasa



www.bcis.org.uk/resources/documents/.../channon.ppt

Carbajal, 2009

Metabolismo del colesterol – Regulación de HMG CoA Reductasa



www.bcis.org.uk/resources/documents/.../channon.ppt

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β-glucano, Colesterol y Corazón

1) El colesterol alto es uno de los principales indicadores de riesgo de enfermedades del corazón.

2) A partir de los 40 años, más de la mitad de la población tiene hipercolesterolemia.

3) En la mayoría de los casos, el colesterol puede controlarse cuidando la alimentación y modificando algunos aspectos del estilo de vida.

4) El consumo de >3 g/día de betaglucano reduce los niveles de colesterol total y LDL-colesterol en al menos un 5%.

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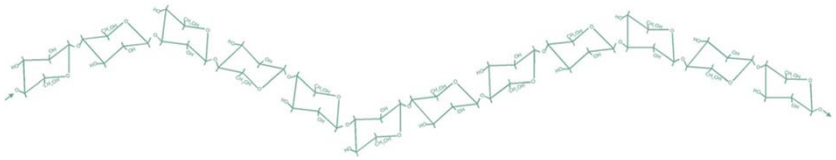
β-glucano, Colesterol y Corazón



Muchas gracias por su atención

Carbajal, 2009