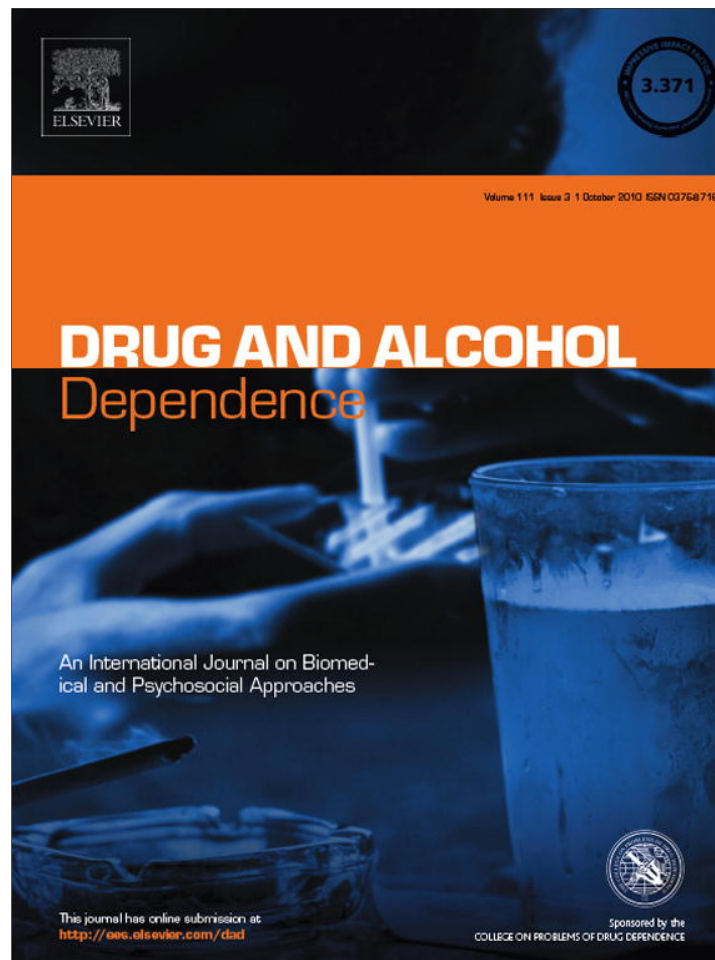


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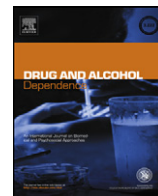
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Short communication

Assessment of addiction severity among ritual users of ayahuasca[☆]

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ABSTRACT

Ayahuasca is a psychoactive beverage used for magico-religious purposes in the Amazon. Recently, Brazilian syncretic churches have helped spread the ritual use of ayahuasca abroad. This trend has raised concerns that regular use of this N,N-dimethyltryptamine-containing tea may lead to the medical and psychosocial problems typically associated with drugs of abuse. Here we assess potential drug abuse-related problems in regular ayahuasca users. Addiction severity was assessed using the Addiction Severity Index (ASI), and history of alcohol and illicit drug use was recorded. In Study 1, jungle-based ayahuasca users ($n = 56$) were compared vs. rural controls ($n = 56$). In Study 2, urban-based ayahuasca users ($n = 71$) were compared vs. urban controls ($n = 59$). Follow-up studies were conducted 1 year later. In both studies, ayahuasca users showed significantly lower scores than controls on the ASI Alcohol Use, and Psychiatric Status subscales. The jungle-based ayahuasca users showed a significantly higher frequency of previous illicit drug use but this had ceased at the time of examination, except for cannabis. At follow-up, abstinence from illicit drug use was maintained in both groups except for cannabis in Study 1. However, differences on ASI scores were still significant in the jungle-based group but not in the urban group. Despite continuing ayahuasca use, a time-dependent worsening was only observed in one subscale (Family/Social relationships) in Study 2. Overall, the ritual use of ayahuasca, as assessed with the ASI in currently active users, does not appear to be associated with the deleterious psychosocial effects typically caused by other drugs of abuse.

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1. Introduction

Ayahuasca is a psychoactive plant tea originally used by Amazonian indigenous groups for medicinal and magico-religious purposes (Schultes and Hofmann, 1979). The tea is typically obtained from *Banisteriopsis caapi* and *Psychotria viridis* (Schultes and Hofmann, 1979). *B. caapi* contains beta-carboline alkaloids with MAOI (monoamine oxidase inhibitor) action; whereas *P. viridis* contains the hallucinogen N,N-dimethyltryptamine (DMT)

(McKenna, 2004). DMT is not active orally because it is enzymatically destroyed, but its combination with the MAOIs from *B. caapi* renders it orally active (Riba, 2003; Riba et al., 2003).

In recent years, Brazilian churches, such as the Santo Daime and the União do Vegetal, which use ayahuasca in their rituals (MacRae, 1998), have expanded to Europe and North America (Tupper, 2008). This has led to legal processes against several of these churches due to the controlled substance status of DMT (Bullis, 2008; Tupper, 2008; US Supreme Court, 2006).

However, neurobiological evidence on medical and sociopsychological problems related to addiction raise interesting questions about the abuse potential of ayahuasca. Drugs of abuse typically show dopaminergic effects, activating the striatum and the ventral-tegmental area, within the so-called "neural reward circuit" (Camí and Farré, 2003). Drug-induced functional changes at this level are thought to lead to the adverse consequences caused by these substances (McLellan et al., 2006).

[☆] Supplementary data tables are available with the online version of this article. See Appendix.

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DMT, on the other hand, interacts with serotonergic neurotransmission, binding to 5-hydroxytryptamine_{2A} receptors (for a review see Riba, 2003). Though there is evidence that some hallucinogens may act also on the dopaminergic system (Nichols, 2004; Passie et al., 2008; Vollenweider et al., 1999), a recent study using the neuroimaging technique SPECT (Single Photon Emission Computerized Tomography) did not find any changes in reward-related regions such as the striatum or the ventral-tegmental area (Riba et al., 2006).

Ethnographic research (Furst, 1972; Labate and Araújo, 2004) also challenges the classification of ayahuasca as an addictive drug, i.e., a substance capable of inducing pleasant states followed, after continued use, by adaptive changes in the central nervous system leading to tolerance, physical dependence, sensitization, craving and relapse (Camí and Farré, 2003). Furthermore, the therapeutic use of ayahuasca in indigenous traditional medicine is socially sanctioned and politically tolerated in Bolivia, Ecuador, and Colombia. And in Peru, it has recently been declared part of the national cultural heritage (Instituto Nacional de la Cultura, 2008).

Despite the growing use of ayahuasca worldwide, few studies have been conducted to assess the impact of long-term regular use of ayahuasca on mental health (Da Silveira et al., 2005; Doering-Silveira et al., 2005; Grob et al., 1996; Halpern et al., 2008). In this paper we report the results of two studies specifically designed to assess any adverse medical and psychosocial consequences related with continued ayahuasca consumption.

2. Methods

2.1. Participants

Participants belonging to several Brazilian ayahuasca churches were enrolled. Control subjects were recruited to match the age, sex and educational level of ayahuasca users. Participants were distributed as follows.

2.1.1. Study 1 (jungle-based community context). Group 1. Ayahuasca users from a community within the Amazon rain forest.

This group was recruited from Céu do Mapiá, a community of religious ayahuasca users in the Brazilian State of Amazonas. Céu do Mapiá is the headquarters of the Centro Eclético da Fluente Luz Universal Raimundo Irineu Serra (CEFLURIS), an important ayahuasca church within the Santo Daime movement, with branches throughout South-America, the US, Canada, Europe and Japan. The mean frequency of ritual attendance was about six times per month.

Group 2. Céu do Mapiá comparison group.

A sample of non-ayahuasca users was recruited from Boca do Acre, the nearest town to the Céu do Mapiá community. Boca do Acre is a small Amazonian town of about 7000 inhabitants.

2.1.2. Study 2 (urban context). Group 3. Urban-based ayahuasca users.

This group consisted of members of another ayahuasca religious group called *Barquinha*, located in the city of Rio Branco. The city of Rio Branco, the capital of the State of Acre, has about 150,000 inhabitants. The frequency with which Barquinha members attended rituals in our sample was about eight times per month.

Group 4. Urban-based comparison group.

Subjects with no history of ayahuasca use were recruited in the city of Rio Branco as a comparison group.

The main inclusion criterion for participants in the ayahuasca groups was to have been taking ayahuasca for a minimum of 15 years with a frequency of at least twice a month.

Both studies were conducted in accordance with the Declarations of Helsinki, as amended in Edinburgh 2000, and subsequent updates. All subjects signed an informed consent prior to participation. The study was approved by the human research committee of UNINORTE University (Rio Branco, Acre State, Brazil).

2.2. Study variables

2.2.1. Sociodemographic variables. Age (years), sex (male/female) and years of education were used to match study and control groups. Additional sociodemographic indicators such as employment status (according to Hollingshead's categories), race, marital status and religion were recorded for comparison purposes.

2.2.2. Addiction Severity Index. The Brazilian Portuguese version of the 5th Edition of the Addiction Severity Index (ASI) (McLellan et al., 1992) was administered on two separate occasions with an interval of 8–12 months, according to a longitudinal study approach. The ASI is a semi-structured interview designed to assess the

impact of drug use in a multi-dimensional fashion. It assesses the participant's Medical Status, Employment/Support, Drug and Alcohol Use, Legal Status, Family/Social Relationships, and Psychiatric Status. It provides general information on the participant's current condition and his/her level of deterioration. The composite measures range from 0 to 1 (a higher score indicating greater severity) and provide an index of severity of problems in the last 30 days.

2.2.3. History of alcohol and illicit drug use. We recorded use of alcohol and nine different psychotropic drug categories in participants' lifetime and in the last month.

2.3. Statistical analysis

2.3.1. Sociodemographic variables and history of alcohol and illicit drug use. Gender, race, marital status, religion and frequency of alcohol and illicit drug use were compared between ayahuasca users and controls in each study by means of χ^2 . Age, years of education, employment status and income were compared between groups within each study by means of unpaired Student's *t*-test.

2.3.2. ASI variables. Individual and group scores were obtained for the seven ASI composite subscales. Group differences within each study were analyzed for each variable using unpaired Student's *t*-tests at both baseline and at 1-year follow-up.

To test for significant differences in time-dependent variations in ASI scores, we performed analyses of variance (ANOVAs) with repeated measures on the different ASI subscale scores at baseline and at 1 year. Thus, a within-subjects factor was defined: *timepoint* (pre vs. post) and two between-subjects factors: *study* (Study 1 vs. Study 2) and *group* (ayahuasca users vs. controls). Interactions of interest were *group by timepoint* and *study by group by timepoint*.

Since both studies were longitudinal, there was an experimental mortality between the first and second assessment. Statistical analyses were performed using the computerized package SPSS 17.0.

3. Results

3.1. Study 1

3.1.1. Demographics. Fifty-six regular ayahuasca users and 56 non-users were assessed at baseline. There were no statistical differences between groups in sex, age, years of education, or income (see Table 1). However, a statistical difference was noted in employment. The comparison group was more qualified according to the Hollingshead categories. Thirty-nine volunteers from the ayahuasca group and 49 from the comparison group were assessed at 1-year follow-up. No statistical differences were found in the above variables. The number of whites was larger in the ayahuasca-use group whereas the control group was mainly composed of mestizos. The predominant marital status was "never married" in the jungle-based community, and "married" in the comparison group.

3.1.2. ASI scores. At baseline, the ayahuasca group scored significantly lower in the Medical Status, Alcohol Use, and Psychiatric Status subscales, and significantly higher in the Drug Use subscale (see Table 2). There were no statistical differences between groups in the Employment/Support Status or Family/Social Relationships subscales. Both groups scored 0 for the Legal Status subscale. One year later the ayahuasca group scored significantly lower than the comparison group on the Alcohol Use and Psychiatric Status subscales, and significantly higher in the Drug Use subscale.

3.1.3. History of alcohol and illicit drug use. Statistically significant differences in prior illicit drug were found for several drug categories. Detailed results are available as [supplementary online material](#).

3.2. Study 2

3.2.1. Demographics. Seventy-one urban ayahuasca users (group 3) and 59 controls (group 4) were assessed at baseline. At the 1 year follow-up 39 ayahuasca users and 19 controls were assessed. No significant differences in demographics were found.

Table 1
Sociodemographic characteristics as means (standard deviation) for age, years of education, employment and income and as frequencies for race, marital status and religion. Asterisks indicate *p* values for between group (ayahuasca vs. controls) Student's *t*-tests (age, education, employment and income) and χ^2 tests (gender, race, marital status and religion) at baseline and at follow up for studies 1 and 2. Aya. = ayahuasca-using group; Comp. = comparison group.

	Study 1				Study 2			
	Mapiá Aya. (baseline)	Boca do Acre Comp. (baseline)	Mapiá Aya. (follow-up)	Boca do Acre Comp. (follow-up)	Rio Branco Aya. (baseline)	Rio Branco Comp. (baseline)	Rio Branco Aya. (follow-up)	Rio Branco Comp. (follow-up)
Matching variables								
N (men/women)	56 (29/27)	56 (24/32)	39 (19/20)	49 (19/30)	71 (33/38)	59 (31/28)	39 (21/18)	19 (7/12)
Age	36 (13.46)	33.71 (12.53)	39.21 (12.90)	34.69 (12.25)	37.32 (12.77)	38.15 (12.22)	38.82 (13.06)	40.63 (11.63)
Years education	10.55 (3.45)	10.96 (4.35)	11.08 (3.19)	11.51 (4.40)	10.27 (3.90)	11.08 (3.30)	10.87 (4.16)	12.53 (3.03)
Additional sociodemographic variables								
Employment	6.04 (1.68)	4.91 (2.58)**	5.79 (1.61)	5.08 (2.70)	5.80 (2.63)	5.73 (2.61)	5.82 (2.59)	5.32 (2.43)
Income	329.46 (414.06)	555.61 (1013.85)	519.74 (627.52)	642.96 (647.71)	738.11 (943.86)	1028.93 (1072.83)	713.95 (1001.25)	1065.95 (939.92)
Race								
White	40 (71.42%)	11 (19.64%)††	30 (76.92%)	10 (20.41%)†††	38 (53.52%)	34 (57.63%)	23 (58.98%)	11 (57.89%)
Mestizos	15 (26.78%)	45 (80.36)	9 (23.07%)	39 (79.59%)	31 (43.66%)	21 (35.59%)	15 (38.46%)	6 (31.59%)
Asian	1 (1.78%)	-	-	-	1 (1.41%)	1 (1.69%)	-	1 (5.26%)
Black	-	-	-	-	1 (1.41%)	3 (5.08%)	1 (2.56%)	1 (5.26%)
Marital status								
Married	13 (23.21%)	33 (58.93%)††	14 (35.90%)	31 (63.26%)†	25 (35.21%)	17 (28.82%)	23 (58.97%)	8 (42.1%)
Remarried	1 (1.79%)	1 (1.79%)	-	1 (2.05%)	2 (2.82%)	1 (1.69%)	1 (2.56%)	-
Separated	7 (12.5%)	2 (3.57%)	7 (17.94%)	5 (10.20%)	10 (14.08%)	9 (15.25%)	4 (10.26%)	5 (26.32%)
Divorced	4 (7.14%)	-	4 (10.26%)	-	6 (8.45%)	5 (8.47%)	-	1 (5.26%)
Never married	31 (55.36%)	20 (35.71%)	14 (35.90%)	12 (24.49%)	28 (39.44%)	27 (45.77%)	11 (28.21%)	5 (26.32%)
Religion								
Daime/Barquinha	56 (100%)	-†††	39 (100%)	-†††	71 (100%)	-†††	39 (100%)	-†††
Catholic	-	35 (62.5%)	-	33 (67.35%)	-	30 (58%)	-	12 (63.16%)
Protestant	-	15 (26.78%)	-	10 (20.41%)	-	17 (28.81%)	-	7 (36.84%)
Other	-	3 (5.36%)	-	3 (6.12%)	-	2 (3.39%)	-	-
None	-	3 (5.36%)	-	3 (6.12%)	-	10 (16.95%)	-	-

** *p* < 0.01 in the Student's *t*-test.

† *p* < 0.05 in the χ^2 test (comparison includes multiple categories).

†† *p* < 0.01 in the χ^2 test (comparison includes multiple categories).

††† *p* < 0.001 in the χ^2 test (comparison includes multiple categories).

Table 2
ASI composite means (standard deviation). Asterisks indicate *p* values for between group (ayahuasca vs. controls) Student's *t*-tests at baseline and at follow up for studies 1 and 2. Aya. = ayahuasca-using group; Comp. = comparison group; Fam/Soc = Family/Social relationships; Psych = Psychiatric Status.

ASI subscale	Study 1				Study 2			
	Mapiá Aya. (baseline) <i>n</i> = 56	Boca do Acre Comp. (baseline) <i>n</i> = 56	Mapiá Aya. (follow-up) <i>n</i> = 39	Boca do Acre Comp. (follow-up) <i>n</i> = 49	Rio Branco Aya. (baseline) <i>n</i> = 71	Rio Branco Comp. (baseline) <i>n</i> = 59	Rio Branco Aya. (follow-up) <i>n</i> = 39	Rio Branco Comp. (follow-up) <i>n</i> = 19
Medical	0.11 (0.19)	0.22 (0.27)*	0.11 (0.22)	0.17 (0.21)	0.17 (0.26)	0.27 (0.32)	0.07 (0.14)	0.21 (0.24)*
Employment	0.72 (0.17)	0.65 (0.21)	0.73 (0.15)	0.66 (0.23)	0.54 (0.31)	0.40 (0.31)*	0.55 (0.28)	0.47 (0.28)
Alcohol	0.003 (0.009)	0.014 (0.018)***	0.0007 (0.001)	0.006 (0.014)**	0.001 (0.004)	0.02 (0.08)*	0.0004 (0.001)	0.004 (0.012)
Drug	0.09 (0.03)	0.00 (0.00)***	0.085 (0.029)	0.00 (0.00)***	0.025 (0.012)	0.0003 (0.002)***	0.03 (0.02)	0.00 (0.00)***
Legal	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.002 (0.014)	0.00 (0.00)	0.01 (0.06)	0.00 (0.00)	0.00 (0.00)
Fam/Soc	0.07 (0.09)	0.11 (0.18)	0.063 (0.101)	0.09 (0.14)	0.05 (0.10)	0.16 (0.18)***	0.10 (0.19)	0.08 (0.14)
Psych.	0.03 (0.07)	0.10 (0.15)**	0.02 (0.06)	0.06 (0.10)*	0.01 (0.06)	0.11 (0.15)***	0.063 (0.12)	0.14 (0.19)

* *p* < 0.05.

** *p* < 0.01.

*** *p* < 0.001.

3.2.2. ASI scores. At baseline, the ayahuasca group scored significantly lower than controls in Alcohol Use, Family/Social Relationships, and Psychiatric Status subscales, and significantly higher in the Employment/Support Status and in the Drug Use subscales (see Table 2). One year later, the ayahuasca group scored significantly lower in the Medical Status, and higher in the Drug Use subscale than the comparison group.

3.2.3. History of alcohol and illicit drug use. No statistically significant differences in prior alcohol and illicit drug were found. Detailed results are available as [supplementary materials with the online version of the article](#) (see Appendix).

3.3. Analysis of time-dependent changes in the two studies combined

A significant study by group by timepoint was observed for the Drug Use subscale [$F(1,142) = 4.9, p = 0.028$]. Scores on this subscale showed a larger decrease (improvement) in the ayahuasca using group than in the control group, but only in Study 1. Another significant study by group by timepoint interaction was observed for the Family/Social Relationships subscale [$F(1,142) = 5.4, p = 0.022$]. Scores on this subscale showed a larger increase (worsening) in the ayahuasca using group than in the control group, but only in Study 2. All other interactions for all seven subscales were non-significant.

4. Discussion

To our knowledge, this is the first research study in which the ASI has been used to assess potential addiction-related problems derived from the regular ritual use of a hallucinogen. Results showed that both ayahuasca-using groups scored significantly lower than their respective controls on the ASI Alcohol Use and Psychiatric Status subscales. At the 1 year follow-up these differences were still significant in the jungle-based group but not in the urban group. Despite maintained ayahuasca use, significant time-dependent increases (worsenings) were only observed in the family/social relationships subscale in Study 2. This effect may not be related with ayahuasca use in itself but rather with the member's involvement with the church, as the worsening was observed in the urban but not in the more isolated jungle group. On the other hand, as shown in the [supplementary online material](#), the ayahuasca jungle-based group did not report current use of illicit drugs despite a history of a significantly higher prior use than the control group.

ASI scores in our samples were in general lower than those obtained for several groups of Brazilian (Brasiliano and Hochgraf, 2006; Mathias et al., 2009; Pechansky et al., 2003) and interna-

tional drug abusers (Carise, 2005). Although this questionnaire had not been administered to ayahuasca users before, previous studies have not found neuropsychiatric disorders in long-term users (Grob et al., 1996). Two other studies carried out in adolescents also failed to find psychiatric disorders (Da Silveira et al., 2005) and neuropsychological deficits (Doering-Silveira et al., 2005). A recent study of a US group of ritual ayahuasca users did not find evidence of psychopathology when scores were checked against normative data (Halpern et al., 2008).

The above results are in line with the data obtained in our present study for the Medical Status and Psychiatric Status subscales. Our results suggest that ayahuasca has a low abuse potential, as previously concluded by others (Gable, 2007).

In our studies, both ayahuasca groups scored worse than controls in the Drug Use subscale. This is because ayahuasca use was taken into account when computing the score in the Drug Use subscale. Additionally, the Mapiá group (Study 1) uses *Cannabis sativa*. However, if this combined use of ayahuasca and cannabis had been problematic, scores in the other subscales would have been higher (McLellan et al., 2006), which was not the case. Also, the detailed study of prior illicit drug use showed that subjects had ceased to consume barbiturates, sedatives, cocaine and amphetamines (see [supplementary online material](#)). The fact that neither group scored in the Legal subscale may also reflect a lack of social problems related to their involvement with an ayahuasca-using church. These results are analogous to those by Grob et al. (1996) who found that previously-existing addiction problems had resolved after participants began ritual use of ayahuasca.

In conclusion, the ritual use of ayahuasca, as assessed with the ASI in currently active users, does not seem to be associated with the psychosocial problems that other drugs of abuse typically cause. Future studies should further address whether this is due to the specific pharmacological characteristics of ayahuasca or to the context in which the drug is taken.

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Contributors

Josep Maria Fabregas: study design, coordination of field work, manuscript writing.

Debora Gonzalez, Sabela Fondevila, Marta Cutchet, and Paulo Cesar Ribeiro Barbosa: data collection. Xavier Fernandez: study design and data collection.

Miguel Angel Alcazar-Corcoles: study design and data analysis. Jordi Riba: data analysis and manuscript writing. Manel J. Barbanjo: data analysis and manuscript writing. Jose Carlos Bouso: study design, coordination of researchers, manuscript writing and data analysis.

Conflict of interests

None.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.drugalcdep.2010.03.024.

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