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Human Psychopharmacology of Hoasca, A Plant Hallucinogen Used in Ritual Context in Brazil

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A multinational, collaborative, biomedical investigation of the effects of hoasca (ayahuasca), a potent concoction of plant hallucinogens, was conducted in the Brazilian Amazon during the summer of 1993. This report describes the psychological assessment of 15 long-term members of a syncretic church that utilizes hoasca as a legal, psychoactive sacrament as well as 15 matched controls with no prior history of hoasca ingestion. Measures administered to both groups included structured psychiatric diagnostic interviews, personality testing, and neuropsychological evaluation. Phenomenological assessment of the altered state experience as well as semistructured and open-ended life story interviews were conducted with the long-term use hoasca group, but not the hoasca-naive control group. Salient findings included the remission of psychopathology following the initiation of hoasca use along with no evidence of personality or cognitive deterioration. Overall assessment revealed high functional status. Implications of this unusual phenomenon and need for further investigation are discussed.

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Hoasca is a hallucinogenic concoction of potent psychoactive plants that are indigenous to the Amazon basin of South America. It has been known under a variety of names, including ayahuasca, caapi, yage, mihi, dapa, natema, pinde, daime, and vegetal. Hoasca is the Portuguese transliteration for ayahuasca and is the accepted term utilized throughout Brazil. Prior to the European conquest, domination, and acculturation of South America, beginning in the 16th century, hoasca was widely used by the native peoples for purposes of magic and religious ritual, divination, sorcery, and the treatment of disease (Dobkin de Rios, 1972). In spite of prolonged and savage attempts by the European conquerors to repress and eradicate native culture and belief systems (Taussig, 1986), sacramental and medicinal use of hoasca remained extant.

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Scientific study of hoasca began with the renowned English botanist Richard Spruce, who from 1849 to 1864 traveled extensively throughout the Brazilian, Venezuelan, and Ecuadorian Amazon to compile an inventory of the varieties of plant life found there (Schultes and Raffauf, 1992). Spruce made a number of valuable discoveries, including Hevea, the genus of the rubber tree, and cinchona, from which quinine is derived. He also identified one of the primary sources of a powerful hallucinogenic brew used by the Mazan and Zaparo Indians, called ayahuasca (Quechua for "vine of the souls" or "vine of the dead"), and previously described by the Ecuadorian Manuel Villavicencio (1858), as a large woody vine that would later be given the formal botanical designation of Banisteriopsis caapi (Ott, 1994; Spruce, 1908). Subsequent laboratory analysis would reveal the presence of the psychoactive beta-carboline alkaloids harmine, harmaline, and tetrahydroharmine, although when first isolated during the early 20th century they would receive the rather exotic appellation of telepathine. As identified by early field observers of hoasca use, additional psychoactive admixtures were often added to the cooking B. caapi preparations, most notably highly potent and hallucinogenic tryptamine-containing plants, including, such vision-inducing plants as Psychotria viridis (McKenna and Towers, 1984).

Throughout the Amazon basin, the use of hoasca remained so deeply rooted in tribal mythology and philosophy that modern investigators have been able to confidently conclude that its use extended back to the earliest aboriginal inhabitants of the region (Schultes and Hofmann, 1992). They have recorded the tradition of hoasca use by the indigenous peoples of the region for the purpose of freeing the soul from corporeal confinement and facilitating access to realms of alternate reality, allowing for a variety of magical experiences, including accessing communication with the spirits of the ancestors. Anthropologists who have conducted ethnographic studies of the native inhabitants of the Amazon Basin have described such common hoasca-induced phenomena as visions of jaguars, snakes and other predatory animals, visions of distant persons, "cities" and landscapes, the sensation of "seeing" the detailed enactment of recent mysterious events, and the sense of contact with the supernatural (Harner, 1973).

Hoasca, as is the case with other plant hallucinogens, has a prehistoric tradition of use by native aboriginal peoples as shamanic sacraments or catalysts (Bravo and Grob, 1989; Furst, 1976). It is considered a "great medicine" and is used to both diagnose and treat illness (Schultes and Hofmann, 1992). Its use is fully sanctioned by societal customs and laws and, in fact, is the core experience upon which tribal and collective consciousness rests. Utilization of such potent plant hallucinogens as hoasca typically occurs within a ritualized context, including the traditional rites of initiation (Grob and Dobkin de Rios, 1992). The powerful hypersuggestible effects induced by the hallucinogenic plant drug reinforce collective belief systems, strengthen group cohesion, and facilitate culturally conditioned and syntonic visions which provide revelation, blessing, healing, and ontological security (Dobkin de Rios and Grob, 1994).

Use of hoasca for purposes of healing and religious sustenance has, during the centuries of European acculturation of Amazonia, emerged from the exclusive tribal domains of the rain forest and been incorporated into the contemporary fabric of rural and urban society, particularly among the indigenous Mestizo populations of Peru, Colombia, and Ecuador. Identified as a valuable adjunct to folk healing practices, hoasca is ritually administered by "ayahuasqueros" to carefully selected groups

of patients (Dobkin de Rios, 1972). Scrupulously adhering to the shamanic models practiced by the aboriginal peoples, these folk healers similarly use the sacramental hoasca for purposes of medical diagnosis and healing, divination, and as a path of access to the realms of the supernatural.

During the 20th century, the use of hoasca within the context of modern syncretic religious movements, particularly in Brazil, has arisen. One such church, and the object of the current study, is the Uniao do Vegetal (UDV), whose translation from the Portuguese means "union of the plants." The UDV originated in the early 1950s when its founder, Gabriel de Costa, a rubber tapper who had first experienced the effects of hoasca with the native Indians of Bolivia, returned to the rapidly expanding Brazilian Amazon settlement of Rio Branco with his visions of spiritual revelation and personal mission. Gathering a group of loyal followers, Maestre Gabriel, as he came to be known, elaborated a mythology and structure for his new religion. Spreading first through the Brazilian Amazon and then to the more densely populated and urbanized South, the UDV grew over the subsequent four decades to achieve an eventual size of approximately 7000 members nationwide, drawing adherents from across the socioeconomic and professional spectra. Organized along the lines of an early Christian parish, local "nucleos," or congregations, are centers where sacramental hoasca is consumed in large bimonthly ritual ceremonies which are presided over by local "maestres," leaders of the religious sect. Although not the only Brazilian syncretic church to use hoasca as a ritual sacrament, the Santo Daime sect being the largest and most widely known, the UDV does have the strongest organizational structure as well as the most highly disciplined membership. Of all the hoasca churches in Brazil, the UDV was also most pivotal in convincing the government narcotics commission to remove hoasca from the list of banned drugs, which was accomplished in 1987 for use within religious ceremonial contexts.

Although achieving some attention and even notoriety in North American literature and the popular press, most notably the work of William Burroughs and Allen Ginsberg (1963), the psychological pheno menon induced by hoasca has been subjected to virtually no rigorous study. Various travelers to the Amazon Basin have reported their own first-hand accounts of experiences with hoasca (Weil, 1980), while both formal and informal anthropological narratives have excited the public imagination (Lamb, 1971; Luna and Amaringo, 1991). Indeed, interest in the exotic Amazonian traditions and effects of hoasca have sparked a steady stream of North American tourists, often attracted by articles and advertisements in popular and New Age magazines (Krajick, 1992; Ott, 1993). Concern over possible adverse psychological health effects incurred by such naive travelers has also been raised by a noted anthropological authority of hoasca use in the Amazon (Dobkin de Rios, 1994). Contrasted with testimonials of improved psychological and moral functioning by adherents of the syncretic hoasca churches in Brazil, a formal study exploring the effects of long-term use of this unusual hallucinogenic beverage would appear to be indicated.

During the summer of 1993 a multinational group of biomedical researchers from the United States, Finland, and Brazil met in Manaus, the capital city of the Brazilian state of Amazonia, to conduct an examination of the psychological and biochemical effects of hoasca. Prior to the actual performance of the study, an invitation had been extended by the Uniao do Vegetal to conduct an investigation of the toxicity of their hoasca "tea." Given the long history of repression of their religious movement and use of the hoasca sacrament prior to government sanction in 1987, the leaders of the UDV had surmised that the

conclusions of a fair and objective scientific study might be of some protective value in the future if the political winds in Brazil were to shift. Consequently, and upon consultation with the North American research group, a decision was made to utilize the oldest nucleo outside of Rio Branco, in Manaus, where a large percentage of the membership had been ritually consuming hoasca on a regular basis for more than 10 years. Given the complicated logistics and demands placed upon subjects in this study, the tightly organized structure of the UDV and its highly disciplined membership proved to be invaluable in the successful completion of the project's goals. Part 1 of this report will detail the results of our investigation of the effects of the hoasca tea on psychological function and Part 2 will discuss our examination of the effects of hoasca on human biochemistry. conditions as well as limitations of time, it was not feasible to completely analyze all demographic data until after initiation of the actual study. At that time it was also identified that control subjects had significantly higher yearly incomes than experimental subjects. In endeavoring to explain this discrepancy we noted that the method of control subject recruitment had called for each of the experimental subjects to provide for the study a close friend or associate who had never participated in UDV ceremonies nor had consumed hoasca under any other circumstances. It was noted in retrospect that several experimental subjects had asked their supervisors at their places of employment to volunteer for the study.

Methods

Fifteen members of the syncretic church, Uniao do Vegetal, living in the Brazilian Amazon city of Manaus, were randomly selected from a larger group of volunteers. Criteria for inclusion into the study included membership in the UDV for at least 10 years. Members of the UDV participate in church rituals utilizing hoasca as a psychoactive sacrament a minimum of twice monthly, but often as frequently as several times per week, although always within ritual context. In addition to regular participation in ceremonial consumption of hoasca, the UDV requires of its membership complete abstinence from all other psychoactive substances, including alcohol, tobacco, marijuana, cocaine, and amphetamines.

Fifteen control subjects who had never consumed hoasca were also recruited, with the objective of matching them on all demographic parameters. Because of the relatively small sample size, and the need to limit the number of variables, all experimental and control subjects were men. Controls were compatibly matched to experimental subjects along the parameters of age, ethnicity, marital status, and level of education. Although attempts were made to control for diet and current consumption of alcohol, complete compliance was not possible to achieve. Because of difficult field

A variety of parameters were utilized to assess past and current levels of psychological function. Both experimental and control subject groups were administered structured psychiatric diagnostic interviews (Composite International Diagnostic Interview [CIDI]), personality testing (Tridimensional Personality Questionnaire [TPQ]), and neuropsychological testing (WHO-UCLA Auditory Verbal Learning Test). Experimental subjects, but not control subjects, were asked to fill out an additional questionnaire (Hallucinogen Rating Scale [HRS]) following a hoasca session. Each of the experimental subjects was also interviewed in a semistructured format designed to ascertain their life stories.

All subjects were monolingual speakers of Portuguese. Portuguese versions of the CIDI and the TPQ were readily

available for this study, having been translated previously and validated in Portuguese by the creators of these instruments. Portuguese versions of the WHO-UCLA Auditory Verbal Learning Test and the HRS were developed for this study by Brazilian collaborators, who translated the instruments first into Portuguese, then back into English, and finally back once again into Portuguese. The CIDI and the WHO-UCLA Auditory Verbal Learning Test sessions were conducted by collaborating Brazilian mental health professionals instructed in their administration. The TPQ and HRS are self-report questionnaires. The semistructured life story interviews were conducted by an English-speaking psychiatrist assisted by an interpreter fluent in both English and Portuguese. All life story interviews were audiotaped.

Composite International Diagnostic Interview

The CIDI is a comprehensive, fully standardized diagnostic interview for the assessment of mental disorders according to the definitions and criteria of ICD-10 and DSM-III-R (Robbins et al., 1988). The CIDI was conceived for use in a variety of cultures and settings. Although its primary application has been for epidemiological studies of mental disorders, the CIDI has also been utilized for clinical and research purposes. In the course of its development, the CIDI was subjected to a variety of tests in different settings, countries, and cultures for feasibility, diagnostic coverage, test-retest reliability, and procedural reliability (Wittchen et al., 1991).

Tridimensional Personality Questionnaire

The TPQ is a 100-item, self-administered, paper-and-pencil, true/false instrument which takes approximately 15 minutes to complete (Cloninger, 1987a). The questionnaire measures the three higher order personality dimensions of novelty seeking, harm avoidance, and reward dependence, each of which measures four lower order dimensions
(Cloninger, 1987b). The novelty seeking domain measures the spectrums of exploratory excitability versus stoic rigidity (9 items), impulsiveness versus reflection (8 items), extravagance versus reserve (7 items), and disorderliness versus regimentation (10 items). The harm avoidance domain measures the spectrums of anticipatory worry versus uninhibited optimism (10 items), fear of uncertainty versus confidence (7 items), shyness with strangers versus gregariousness (7 items), and fatigability and asthenia versus vigor (10 items). The reward dependence domain measures the spectrums of sentimentality versus insensitiveness (5 items), persistence versus irresoluteness (9 items), attachment versus detachment (11 items), and dependence versus independence (5 items). The TPQ is based on a unified biosocial model of personality integrating concepts focused on the neuroanatomical and neurophysiological basis of behavioral tendencies, styles of learning, and the adaptive interaction of the three personality dimensions (Cloninger et al., 1991).

WHO-UCLA Auditory Verbal Learning Test

The WHO-UCLA Auditory Verbal Learning Test is a simple list-learning task similar to the Rey Auditory Verbal Learning Test (Rey, 1964), but which also is suitable for use in cross-cultural contexts and is sensitive to mild degrees of cognitive dysfunction. To be familiar to a variety of cultures, the test comprises a list of items carefully selected from categories such as parts of the body, tools, household objects, and common transportation vehicles (Maj et al., 1993). Subjects are read a list of 15 items at the rate of approximately one word per second, following which they are asked to recite as many words as they can recall. The same list is read to subjects a total of five

successive times, and on each occasion subjects are asked to recite as many words as they can remember. This is followed by an interference test where subjects are read 15 words from a second list and asked to recite as many as they can from the second list, following which they are asked to again recall the words from the first list. For the final trial, subjects are read from a list of 30 words, half of which (in random order) are from the original list. Subjects then are asked to indicate after each word whether they recognize it as part of the original list of 15 words.

Hallucinogen Rating Scale

The HRS is a 126-item questionnaire originally developed to assess the range of effects induced by intravenous administration of synthetic dimethyltryptamine (Strassman et al., 1994). A 0 to 4 scale is utilized for most questions, with 0 = not at all, 1 = slightly, 2 = moderately, 3 = quite a bit, and 4 = extremely. Responses to items are analyzed according to six conceptually coherent "clusters": somesthesia (interoceptive, visceral, and cutaneous/tactile effects), affect (emotional/affective responses), perception (visual, auditory, gustatory, and olfactory experiences), cognition (alterations in thought processes or content), volition (a change in capacity to willfully interact with themselves, the environment, or certain aspects of the experience), and intensity (strength of the various aspects of the experience).

Life Story Interview

Each of the 15 experimental subjects agreed to submit to an approximate hour-long interview conducted by a psychiatrist (C. S. G.). The interview addressed various facets of their lives related to their experience as members of the Uniao do Vegetal and their frequent participation in rituals utilizing the psychoactive sacrament, hoasca. The interviews were conducted, with the aid of a translator, in a semistructured and open-ended manner. Each subject was asked to "tell the story of your life from the time before you first drank the hoasca tea... to how you first became acquainted with the UDV and the effects of the hoasca... to how your life has developed since the time you became a part of the UDV."

Results

Psychiatric Diagnoses

A structured psychiatric interview was conducted with each of the 15 experimental subjects and each of the 15 normal control subjects. Administration of the CIDI identified that whereas none of the UDV experimental subjects had a current psychiatric diagnosis, active diagnoses of alcohol abuse disorder and hypochondriasis were present in two of the matched control subjects. However, assessment of past (although no longer active) psychiatric diagnoses indicated that, according to ICD-10 and DSM-III-R criteria, five of the UDV experimental subjects had prior formal alcohol abuse disorders, two had past major depressive disorders, and three had past phobic anxiety disorders. On the other hand, among the 15 control subjects, only one subject had a past psychiatric disorder that was no longer present-an alcohol abuse disorder that had remitted 2 years before the study.

Personality Testing

The TPQ, measuring the three domains of novelty seeking, harm avoidance, and reward dependence, was administered to the 15 experimental long-term hoasca-drinking subjects and to the 15 hoasca-naive control subjects. Means and standard deviations and results of t-test comparisons

are shown in Table 1. Significant findings on the novelty seeking domain included UDV subjects having greater stoic rigidity versus exploratory excitability ($p < .049$) and greater regimentation versus disorderliness ($p < .016$). A trend toward group difference was found along the spectrum of greater reflection versus impulsivity ($p < .1$). No group differences were found along the spectrum of reserve versus extravagance ($p < .514$). Summation of all four spectrums of the novelty seeking domain identified a highly significant difference between the two groups ($p < .0054$).

Analysis of the harm avoidance domain of the TPQ also identified significant differences between the two groups. The UDV experimental subjects were found to have significantly greater confidence versus fear of uncertainty ($p < .043$) with a trend toward greater gregariousness versus shyness with strangers ($p < .067$) and greater uninhibited optimism versus anticipatory worry ($p < .098$). Totaling the four spectrums of the harm avoidance dimension yielded a significant difference between the two groups ($p < .011$).

Analysis of the final TPQ domain of reward dependence did not demonstrate any significant difference between the two groups in total score and any of the subdomain scores.

Neuropsychological Testing

All 15 experimental subjects and 15 control subjects were administered the WHO-UCLA Auditory Learning Verbal Memory Test (Table 2). Experimental subjects performed significantly better than control subjects on their recall of words on the fifth learning trial ($p < .038$). Experimental subjects also performed better than control subjects, although to a non-statistically significant degree, on the following tests: number of words recalled ($p < .253$), delayed recall ($p < .248$), and words recalled after interference ($p < .158$). There was no difference between the two groups in their collective capacities on the test involving the number of false-positive errors on the recognition task ($p < .602$).

Phenomenological Assessment

The Hallucinogen Rating Scale was completed by each of the 15 UDV subjects within 1 hour following the close of the experimental hoasca session, where a variety of medical and biochemical parameters had been assessed. Analysis of the 126-item HRS yielded findings placing the hoasca experience in the mild end of the spectrum when contrasted to the highly potent, short-acting intravenous dimethyltryptamine (DMT) experience. Whereas the highly intense DMT experience is over in less than 30 minutes, the full hoasca experience lasts on average 4 hours. The analysis of data revealed that the clinical clusters of the HRS for the hoasca subjects scored in the relatively mild range when contrasted with prior investigations of the effects of intravenous DMT (Strassman et al., 1994). The clusters of intensity (1.633 ±.533), affect (.947 ±.229), cognition (.908 ±.494), and volition (1.309 ±.429) were compatible to an intravenous DMT experience between a dosage level of.1 and.2 mg/kg, whereas the cluster of perception (.484 ±.501) was comparable to an intravenous DMT experience of.1 mg/kg and the cluster of somatesthesia (.367 ±.256) was less appreciable than the lowest intravenous DMT dose (.05 mg/kg) used.

Life Story Interviews

All 15 experimental subjects provided detailed information about their personal histories, with particular emphasis on how their involvement with the UDV and experience with hoasca had impacted the course of their lives. Their age range at the time of the study was from 26 to 48 years,

with a mean age of 37. Two had been born into the UDV, whereas the other 13 had formally been members for 10 to 18 years, with a mean duration of membership of 14 years. Three were currently maestres (church leaders), two were sons of senior maestres, and one was the son-in-law of a senior maestre.

Many of the subjects reported a variety of pervasive dysfunctional behaviors prior to their entry into the UDV. Eleven subjects reported having a history of moderate to severe alcohol use prior to entering the UDV, with five of them reporting episodes of binding associated with violent behavior. Two had been jailed beacuse of their violence. Four subjects also related prior involvement with other drugs of abuse, including cocaine and amphetamine. Eight of the 11 subjects with prior histories of alcohol and other drug use and misuse were addicted to nicotine at the time of their first encounter with the UDV and ritual hoasca use. Additional self-descriptions prior to entry into their church included impulsive, disrespectful, angry, aggressive, oppositional, rebellious, irresponsible, alienated, and unsuccessful.

All 15 of the UDV subjects reported that their experience with ritual use of hoasca as a psychoactive ritual sacrament had had a profound impact on the course of their lives. For many of them, the critical juncture was their first experience under the influence of the hoasca. A common theme was the perceived belief while in the induced altered state of consciousness that they were on a self-destructive path that would inevitably lead to their ruin and even demise unless they embarked on a radical change in their personal conduct and orientation. Some examples included: "I had a vision of myself in a car going to a party. There was a terrible accident and I could see myself die." "I was at a carnival, on a carousel, going around and around and around without ever stopping. I didn't know how to get off. I was very frightened." "I could see where I was going with the life I was leading. I could see myself ending up in a hospital, in a prison, in a cemetery." "I saw myself arrested and taken to prison. They were going to execute me for a horrible crime I had committed." Subjects also reported that while in the throes of their nightmarish visionary experience, they would encounter the founder of the UDV, Maestre Gabriel, who would deliver them from their terrors: "I saw these horrible, ugly animals. They attacked me. My body was disassembled, different parts were lying all over the ground. Then I saw the Maestre. He told me what I would need to do to put all my body parts back together." "I ran through the forest terrified that I was going to die. Then I saw the Maestre. He looked at me. I was bathed in his light. I knew I would be okay." "I was in a canoe, out of control, going down the river. I thought I would die. But then I saw Maestre Gabriel in a canoe in front of me. I knew that as long as I stayed with the Maestre I was safe."

Subjects reported that since entering the UDV their lives had gone through profound changes. In addition to entirely discontinuing alcohol, cigarettes, and other drugs of abuse, subjects emphatically stated that their daily conduct and orientation to the world around them had undergone radical restructuring: "I used to not care about anybody, but now I know about responsibility. Every day I work on being a good father, a good husband, a good friend, a good worker. I try to do what I can to help others.... I have learned to be calmer, more self confident, more accepting of others.... I have gone through a transformation." Subjects emphasize the importance of "practicing good deeds," watching one's words, and having respect for nature. Finally, subjects report experiencing improvement in their memory and concentration, continual positive mood states, fulfillment in their day-to-day interactions, and a sense of meaning and coherence to their lives.

Subjects unequivocally attributed the positive changes in their lives to their involvement in the UDV and their participation in the ceremonial ingestion of hoasca. They saw the hoasca as a catalyst in their psychological and moral evolution, but were quick to point out, however, that it was not the hoasca alone that was responsible, but rather taking the hoasca within the context of the UDV ritual structure. Several of the subjects were in fact quite critical of other Brazilian groups which utilize hoasca in less controlled and less focused settings. Subjects described the UDV as a "vessel" that enables them to safely navigate the often turbulent states of consciousness induced by hoasca ingestion. The UDV is their "mother... family... house of friends," providing "guidance and orientation" and allowing them to walk the "straight path." They emphasized the importance of "uniao," or union, of the plants and of the people. Without the structure of the UDV, the subjects contended, hoasca experiences may be unpredictable and lead to an inflated sense of self. Within the "house of the UDV," however, the hoasca-induced state is controlled and directed "down the path of simplicity and humility."

Discussion

As this investigation was a first attempt to study the phenomenon of hoasca use from a biomedical perspective, and as the setting for the study was relatively primitive (the Brazilian Amazon), these results need to be viewed as preliminary and tentative. Nevertheless, the findings presented are intriguing and to some degree unexpected. Psychiatric diagnostic assessments revealed that although an appreciable percentage of our long-term hoasca-using subjects had had alcohol, depressive, or anxiety disorders prior to their initiation into the hoasca church, all disorders had remitted without recurrence after entry into the UDV. Such change was particularly noticeable in the area of excessive alcohol consumption, where in addition to the five subjects who had CIDI diagnoses of prior alcohol abuse disorders, six additional subjects reported moderate patterns of alcohol consumption that fell short of achieving actual psychiatric diagnostic status on formal structured interview. All 11 of these subjects with prior involvement with alcohol achieved complete abstinence shortly after affiliating with the hoasca church. In addition to their chronic substance use problems, subjects were also quite emphatic that they had undergone radical transformations of their behavior, attitudes toward others, and outlook on life. They are convinced that they had been able to eliminate their chronic anger, resentment, aggression, and alienation, as well as acquire greater self-control, responsibility to family and community, and personal fulfillment through their participation in the hoasca ceremonies of the UDV. Although the salutary effects of a strong group support system and religious affiliation cannot be minimized, it is not inconceivable that the long-term use of the hoasca itself may have had a direct positive and therapeutic effect on our subjects' psychiatric and functional status. Prior biochemical analyses of hoasca preparations have identified significant monoamine oxidase inhibitor action (McKenna et al., 1984), and may be relevant to these clinical findings.

Personality evaluation utilizing the Tridimensional Personality Questionnaire revealed significant differences between the UDV subjects and normal controls on both the novelty seeking and harm avoidance domains, but not on the reward dependence domain. The UDV subjects scored significantly lower on both the novelty seeking and harm avoidance dimensions as compared with control subjects. Individuals who had relatively low scores on novelty seeking have been described in the

psychiatric literature as reflective, rigid, loyal, stoic, slow-tempered, frugal, orderly, and persistent (Cloninger, 1987b). Low novelty seeking scores are also associated with overall behaviors consistent with high social desirability and emotional maturity (Cloninger et al., 1991). Individuals with low harm avoidance scores are described as confident, relaxed, optimistic, carefree, uninhibited, outgoing, and energetic (Cloninger, 1987b). The association of low novelty seeking with low harm avoidance has been identified with the traits of hyperthymia, cheerfulness, stubbornness, and overconfidence (Cloninger, 1987b). As the personality dimensions measured on the TPQ are thought to be heritable tendencies, a pertinent question arising from these results is whether the personality attributes as measured here have been influenced by long-term ceremonial consumption of hoasca or rather are they factors predictive specifically for individuals becoming involved with such a process as the UDV?

A similar problem arises with the interpretation of the neuropsychological data. Although long-term UDV hoasca-imbibing subjects scored significantly higher on neuropsychological testing compared with their hoasca-naive controls, as measured on the WHO-UCLA Auditory Learning Verbal Memory Test, the lack of retrospective data makes it impossible to determine whether the hoasca "tea" has had a cognitive enhancing effect or not. Although our UDV subjects spoke at length of how the hoasca had improved their powers of memory and concentration, the current methodology was not designed to definitively substantiate this connection. Only with comparative evaluation to neuropsychological performance prior to their very first experience with hoasca consumption can a comprehensive understanding of the long-term effects of hoasca on cognitive status be established. Also, only by administering such measures on naive subjects, and then following them prospectively over time with serial evaluations as they became involved with the UDV and ritual use of hoasca, can we definitively ascertain whether the hoasca does indeed improve cognitive status. The methodological approach utilized for the present study was only intended to be preliminary and exploratory, and did not possess the necessary logistics which would have allowed for such a prospective study. Indications are, however, that given the presented data analyses, the long-term consumption of hoasca within the structured UDV ceremonial setting does not appear to exert a deleterious effect on neuropsychological function.

This study has been an initial attempt to rigorously apply contemporary research models and tools to the little-studied phenomenon of ceremonial use of the plant hallucinogen hoasca. Although with a long tradition of use among the indigenous peoples of the Amazon Basin, widespread medicinal application by the mixed race mestizo populations, and 20th century development of the syncretic churches of Brazil, medical and psychiatric researchers have up to now failed to address the question of what are the effects of this highly unusual psychoactive botanical. Testimonials of its putative health-enhancing and restorative effects need to be explored, as do allegations of its potential for deleterious outcome. The establishment of legal sanctions within a religious context in Brazil provides an important and necessary prerequisite for future objective and comprehensive investigations. The ceremonial use of hoasca, as studied within the framework of this research project, is clearly a phenomenon quite distinct from the conventional notion of "drug abuse." Indeed, its apparent impact upon the subjects evaluated in the course of our inquiries appears to have been positive and therapeutic, both in self-report and objective testing. There is clearly a need to pursue rigorous and comprehensive follow-up studies to the preliminary explorations

reported here, not only to further elucidate the unique phenomenon of hoasca use within a highly structured ceremonial setting but also because of growing interest and use of hoasca in North America and Europe. It will be imperative to carefully delineate the potential for adverse effects as well as to establish the optimal safety parameters within which hoasca might be taken. In this light, careful study of the ceremonial structure and safe-guards of such groups could facilitate future research development. It is our hope that subsequent endeavors to investigate the hoasca phenomenon will explore these matters, and determine whether our preliminary findings can be replicated. Regardless of whether these results will ultimately be corroborated, we believe we have demonstrated that this fascinating, albeit neglected, phenomenon can be rigorously studied utilizing state of the art tools of research investigation.

TABLE 1

Personality Testing in 15 Long-Term Hoasca Users and 15 Matched Controls

TPQ	*Subjects*	*Controls*	*t*	*p*
Novelty seeking				
NS1: exploratory excitability vs. stoic rigidity	3.78+-1.12	5.00+-1.79	-2.08	0.049**
NS2: impulsiveness vs. reflection	1.57+-1.34	2.81+-2.27	-1.71	0.100*
NS3:extravagance vs. reserve	3.00+-1.30	3.36.+-1.43	-0.66	0.514
NS4: disorderliness vs.regimentation	2.00+-1.ll	3.64+-2.01	-2.59	0.016**
NS total:NS1 + NS2 + NS3 + NS4	10.36+-2.27	14.82+-4.81	-3.07	0.0054**
Harm avoidance				
HA1: anticipatory worry vs. unihibited optimism	1.21+-1.37	2.36+-1.97	-1.72	0.098*
HA2: fear of uncertainty vs. confidence	2.93+-0.73	4.09+-1.87	-2.14	0.043**
HA3: shyness with strangers vs. gregariousness	1.93+-1.77	3.27+-1.68	-1.92	0.067**
HA4: fatigability and asthenia vs. vigor	1.93.+-0.92	3.00+-2.45	-1.51	0.144
HA total: HA1 + HA2 + HA3 + HA4	8.00+-3.57	12.45+-4.55	-2.75	0.011**
Reward dependence				
RD1: sentimentality vs. insensitiveness	4.21+-0.89	3.90+-1.58	0.61	0.547
RD2: persistence vs. irresoluteness	4.43+-1.74	4.45+-1.86	-0.04	0.972
RD3: attachment vs. detachment	4.71+-1.94	4.27+-2.41	0.51	0.616
RD4: dependence vs. independence	1.93+-1.21	1.73+-1.62	0.36	0.725
RD Total: RD1 + RD2 + RD3 + RD4	15.29+-2.76	14.36+-3.91	0.69	0.496

TABLE 2

Neuropsychological Testing in 15 Long-Term Hoasca Users and 15 Matched Controls

WHO-UCLA Auditory Verbal Learning Test	Subjects	Controls	*t*	*p*
Words recalled on 5th learning trial	11.21+-1.93	9.50+-2.07	2.19	0.038**
Words recalled after interference	9.53+-2.72	8.16+-1.99	1.45	0.158
Dellayed recall	9.53+-2.64	8.41+-1.62	1.28	0.248
No. of words recalled	14.33+-0.72	13.75+-1.176	1.17	0.253
No. of false-positive errors on recognition task	1.06.+-1.10	0.083+-1.19	0.53	0.602

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