

Herbal Intoxication

Psychoactive Effects From Herbal Cigarettes, Tea, and Capsules

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• Herbal preparations, designed to be smoked or ingested for "health and happiness," are promoted as legal hallucinogens, euphorants, and marijuana substitutes. A total of 25 psychoactive substances have been identified in these products, and a number of intoxications have resulted from their short- or long-term use. Physicians should be alerted to the nature of these effects when taking drug histories, and their possible role in the causation of medical complaints should be considered.

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RECENTLY, there has been a substantial increase in both the medical and nonmedical use of herbal products, including cigarettes, smoking mixtures, tea, and capsules. These products are often advertised as "natural and legal drugs"¹ or "herbal highs,"^{2,3} and are readily available in health food stores and markets, as well as by direct mail order from suppliers and importers. Many preparations contain substantial amounts of psychoactive substances,⁴ and their use has resulted in a number of intoxications requiring clinical attention. The Table lists psychoactive substances that are found in these preparations, together with the name used in package labeling, pharmacological principle, suggested use, and effects

reported by users. The illustrative cases reported here were all seen by me at the Neuropsychiatric Institute of the University of California at Los Angeles.

CIGARETTES

There are presently 192 distinct herbs commercially available and used as smoking substances. These substances are available in bulk or in 18 different preparations consisting of rolled cigarettes or blended smoking mixtures. Such preparations contain numerous nonpsychoactive ingredients, of which the most common are yerba santa, rosemary, thyme, mullein, and spearmint. Some mixtures contain substantial amounts of various obscure herbs that are alleged to mimic the effects of marijuana. For example, *Damiana* (*Turnera diffusa*) is advertised as producing a marijuana-like euphoria lasting 60 to 90 minutes, but such effects are little more than anecdotal at this time.

However, 44.4% of these preparations do contain plants with known psychoactive effects (Table), and the packaging information usually lists the ingredients, if at all, in terms of common names rather than botanical or pharmacological nomenclature. The use of these smoking substances has resulted in a number of intoxications.

CASE 1.—A 30-year-old man was brought to the hospital in a confused state. His pupils were extremely dilated and reacted minimally to light. His mouth and throat were dry and his speech slurred and hesitant. He had mild ataxia and complained of poor motor coordination, blurred vision, difficulty in concentration, and a pervasive "spaced-out" sensation that he likened to a hashish intoxication. He explained that he quit smoking marijuana and tobacco cigarettes about a month before and started using a nontobacco smoking substitute called "Mint Bidis." At first, he smoked two to three Bidis cigarettes each day, but had increased his use during the past week to six to eight cigarettes each day. During the last two days he had experienced complex hallucinations of recognizable people and places and had suffered from severe dissociative reactions. He became anxious and discontinued use of the cigarettes the day before, but the symptoms persisted. He left the hospital that day but did not recover for another 48 hours.

CASE 2.—A 28-year-old man was brought

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Psychoactive Substances Used in Herbal Preparations				
Labeled Ingredient	Botanical Source	Pharmacologic Principle	Suggested Use	Reported Effects
African Yohimbe Bark; Yohimbe	<i>Corynanthe yohimbe</i>	Yohimbe	Smoke or tea as stimulant	Mild hallucinogen
Broom; Scotch Broom	<i>Cytisus</i> spp	Cytisine	Smoke for relaxation	Strong sedative-hypnotic
California Poppy	<i>Eschscholtzia californica</i>	Alkaloids & glucosides	Smoke as marihuana substitute	Mild euphoriant
Catnip	<i>Nepeta cataria</i>	Nepetalactone	Smoke or tea as marihuana substitute	Mild hallucinogen
Cinnamon	<i>Cinnamomum camphora</i>	?	Smoke with marihuana	Mild stimulant
Damiana	<i>Turnera diffusa</i>	?	Smoke as marihuana substitute	Mild stimulant
Hops	<i>Humulus lupulus</i>	Lupuline	Smoke or tea as sedative and marihuana substitute	None
Hydrangea	<i>Hydrangea paniculata</i>	Hydrangin, saponin, cyanogenes	Smoke as marihuana substitute	Stimulant
Juniper	<i>Juniper macropoda</i>	?	Smoke as hallucinogen	Strong hallucinogen
Kavakava	<i>Piper methysticum</i>	Yangonin, pyrones	Smoke or tea as marihuana substitute	Mild hallucinogen
Kola Nut; Gotu Kola	<i>Cola</i> spp	Caffeine, theobromine, kolanin	Smoke, tea, or capsules as stimulant	Stimulant
Lobelia	<i>Lobelia inflata</i>	Lobeline	Smoke or tea as marihuana substitute	Mild euphoriant
Mandrake	<i>Mandragora officinarum</i>	Scopolamine, hyoscyamine	Tea as hallucinogen	Hallucinogen
Mate	<i>Ilex paraguayensis</i>	Caffeine	Tea as stimulant	Stimulant
Mormon Tea	<i>Ephedra nevadensis</i>	Ephedrine	Tea as stimulant	Stimulant
Nutmeg	<i>Myristica fragrans</i>	Myristicin	Tea as hallucinogen	Hallucinogen
Passion Flower	<i>Passiflora incarnata</i>	Harmine alkaloids	Smoke, tea, or capsules as marihuana substitute	Mild stimulant
Periwinkle	<i>Catharanthus roseus</i>	Indole alkaloids	Smoke or tea as euphoriant	Hallucinogen
Prickly Poppy	<i>Argemone mexicana</i>	Protopine, bergerine, isoquinilines	Smoke as euphoriant	Narcotic-analgesic
Snakeroot	<i>Rauwolfia serpentina</i>	Reserpine	Smoke or tea as tobacco substitute	Tranquilizer
Thorn Apple	<i>Datura stramonium</i>	Atropine, scopolamine	Smoke or tea as tobacco substitute or hallucinogen	Strong hallucinogen
Tobacco	<i>Nicotiana</i> spp	Nicotine	Smoke as tobacco	Strong stimulant
Valerian	<i>Valeriana officinalis</i>	Chatinine, velerine alkaloids	Tea or capsules as tranquilizer	Tranquilizer
Wild Lettuce	<i>Lactuca sativa</i>	Lactucarine	Smoke as opium substitute	Mild narcotic-analgesic
Wormwood	<i>Artemisia absinthium</i>	Absinthine	Smoke or tea as relaxant	Narcotic-analgesic

to the hospital by his wife who claimed he had become distant and irrational while eating dinner and smoking Mint Bidis. The wife puffed briefly on a single cigarette, while the husband smoked about ten cigarettes over a three-hour period. They had each consumed one glass of wine as well. The husband had become increasingly talkative and giddy, but often mumbled unintelligibly and laughed at minimal stimuli. At times he would stare vacantly into the distance and was unresponsive to his wife's questions or physical nudging. He felt "sick" and attributed his strange behavior to something wrong with the food. When he was seen at the hospital, his face was flushed, his pupils were dilated, his skin and mucous membranes were dry,

and his pulse was rapid. He appeared disoriented and frequently had hallucinations of little animals and insects moving about the examination room. Within 24 hours he was free of symptoms and left the hospital.

Samples of the Mint Bidis cigarettes were obtained and assayed. Mint Bidis are hand-rolled cigarettes imported from India and widely distributed throughout the United States as "nontobacco selected fine Indian herbs," and the ingredients are listed as "Spear Mint, Gigantic Swallow Wort, Thorn Apple, Holy Basil, Marjoram, Sour Orange, Papaya [sic]." Thorn apple is a common name for *Datura stramonium*, and

we have confirmed this botanical identification and analyzed the alkaloid contents. The Mint Bidis cigarettes were analyzed by gas chromatography and mass spectrometry, and then compared with commercial stramonium cigarettes prescribed for asthma. In each case, mass spectra were obtained of the gas chromatographic peaks, eluting as trimethylsilyl derivatives, at retention times corresponding to those for authentic atropine and scopolamine. The mass spectra were in all cases the same as those of authentic alkaloids. The Mint Bidis were found to contain 16µg of atropine and 65µg scopolamine per cigarette while the stramonium ciga-

rettes each contained 250 μ g atropine and 220 μ g scopolamine. Based on these figures, patient 1 had used daily approximately 0.486 mg to 0.648 mg of total alkaloids. Patient 2 had used a total of approximately 0.810 mg of alkaloids. Although these amounts may not have been totally absorbed through the smoking route, they represent doses at which toxic stramonium symptoms have been noted.⁵⁻⁹

CASE 3.—A 20-year-old man came to the hospital after fainting after smoking one "Hare Rama Bidis" cigarette. He complained of nausea, headache, and weakness. He became anxious and decided to leave the hospital after a urine sample was obtained.

The "Hare Rama Bidis" cigarettes are also imported from India and are labeled "tobacco" and sold as class A cigarettes. We have identified the ingredients as *Nicotiana* spp, and have assayed the nicotine levels at 6.42% to 9.03% (commercially available tobacco cigarettes [*Nicotiana tabacum*] contain 0.7% to 3.0% nicotine). Patient 3 thus consumed an extremely potent nicotine preparation,¹⁰ and his urine contained large amounts of nicotine (1.5 μ g/ml).

TEA

There are presently 396 distinct herbs and spices commercially available and used either singly or in blended mixtures as herbal tea. While 43 of these contain psychoactive agents, they are present in such trace amounts that little or no behavioral effects are reported beyond the folklore that accompanies their use. Nonetheless, users do report consistent psychoactive effects from those listed as tea in the Table, and a number of clinical intoxications have resulted.

CASE 4.—A 29-year-old man came to the hospital complaining of a chronic intoxicated feeling, coupled with a loss of appetite and diarrhea. He appeared severely emaciated, his skin tone was yellow, and he had yellow banding of finger and toenails, rashes, and marked dermatoses. He had difficulty in focusing his eyes, his hearing seemed poor, and he was moderately ataxic. He explained that six months before, he had started drinking kavakava tea for its alleged euphoric and relaxing effects. Initially, he experienced a numbing of his mouth and throat which made swallowing difficult, and he believed his breathing was also impaired. After 30 minutes, these ef-

fects would disappear and he would begin to feel relaxed, but weak and "drunk," and these feelings would last approximately three hours. He continued to use kavakava tea five to six times each day for six months. During this period, he began to have difficulty in seeing and hearing and was always sleepy. He was advised to discontinue use of the tea, and most symptoms had disappeared by the time of follow-up 12 months later.

Samples of the kavakava tea were identified as the crushed roots of the kava plant (*Piper methysticum*), a shrub indigenous to many islands of the South Pacific where the tea is primarily used in religious ceremonies and to allay anxiety and reduce fatigue.¹¹ Long-term use of this tea results in symptoms virtually identical to those seen in patient 4. The yellowing skin is believed to be related to kava-pyrones deposited in keratin, while the central relaxant effects are believed to be related to dihydromethysticin, which has mild anti-convulsant properties.

CASE 5.—A 37-year-old woman drank a nutmeg tea at a party. The tea consisted of two ground nutmegs in a glass of warm water. Immediately following ingestion, she experienced a warm feeling and slight nausea followed by sweating, dryness in the mouth and throat, and an "intoxicated, drowsy feeling." She was examined four hours later and had flushed skin, a rapid pulse, incoherent speech, and was extremely giddy. Her vision was disturbed, and she had hallucinations of faces laughing at her and monsters in the bed trying to engulf her. She also complained of a slight headache and vertigo. These symptoms gradually diminished, and she fully recovered within 24 hours.

This case illustrates the prototypical symptoms of nutmeg poisoning that has been well documented in the literature.¹² The effects can be attributed to myristicin, which acts as a monoamine oxidase inhibitor and produces central nervous system depression, with periods of stimulation and associated respiratory and cardiovascular difficulties.

CASE 6.—A 19-year-old man was examined at the hospital following an alleged intoxication with "jimson weed" (*Datura stramonium*) tea. He was familiar with the folklore surrounding the use of this plant and had recently read several popular books on sorcery and witchcraft in which such tea was used. He had boiled some leaves from a *Datura* plant that he found growing wild in the Southern Cali-

fornia countryside and drank the resulting extract. Soon after ingestion, he experienced flushing, ataxia, restlessness, blurred vision, and a pronounced thirst. He drank large quantities of water and periodically collapsed on the ground only to "awaken" and continue a restless wandering. He had hallucinations with scenes of demons, devils, and voodoo people chasing him. He became disoriented and wandered in the woods for several hours, running barefoot over nettles and harsh brush that lacerated his feet, without awareness of pain. He was "scared to death" of the voodoo people who "turned people into trees," and wandered about in a confused, paranoid, and hallucinatory state for several more hours. Eventually, he was apprehended by a forest ranger and told the ranger he had set several fires in order to keep away the voodoo people. He continued to have diminishing symptoms and acute mydriasis for several days following this incident. When examined, he described a long history of recreational drug use, including experiences with LSD. However, he characterized his tea experience as the strongest and most frightening hallucinogenic experience of his life. Samples of both the plant and the tea leaves were obtained for assay.

The plant and leaves were identified as *Datura stramonium* and assayed to contain large amounts of atropine and scopolamine. It was calculated that the patient ingested approximately 10 to 15 mg of total alkaloids. The resultant symptoms were characteristic of stramonium poisoning frequently seen following ingestion of a mixture of stramonium and belladonna extract (Asthmador) and other asthma preparations.¹³⁻¹⁵

CAPSULES

Many herbal handbooks as well as supplier advertisements instruct potential users to combine herbal tea use with ingestion of herb capsules, and both prepackaged capsules of herbal mixtures as well as empty gelatin capsules are readily available. The following is an intoxication resulting from the use of these capsules:

CASE 7.—A 30-year-old man came to the hospital complaining of nervousness, insomnia, and minor trembling. He claimed to be a strict vegetarian and avoided the use of alcohol, cigarettes, and coffee, as well as other psychoactive drugs. He explained that for three weeks he had been using "Gotu Kola" capsules, because he had read an advertisement that had described the product as "brain food" helpful in the treatment of mental and nervous

disorders, memory problems, ulcers, and general health of the body. He started ingesting approximately 5 gm of powder daily and immediately experienced an increase in energy, diminished appetite, and elevation of mood. He claimed it increased the enjoyment of sex and was an aphrodisiac. However, he did not experience the alleged enhancement of intellectual performance claimed by the advertisement. After three weeks of daily use, he became chronically nervous and had difficulty in sleeping. He was advised to discontinue using the capsules, but refused on religious grounds.

Gotu Kola was identified as ground kola nut (*Cola* spp) powder. Kola nut intoxication is extremely rare, and its use is mainly confined to parts of Africa. Nonetheless, the symptoms here

are similar to those reported in the ethnopharmacological literature.⁴ Kola nut contains approximately 2% caffeine (a similar concentration is found in coffee), and the patient here was ingesting approximately 100 mg/day, which could account for the observed symptoms.

COMMENT

While the use of herbal medicines dates back to ancient Chinese and early Greek practices, nonmedical experimentation with herbal intoxicants is enjoying a recent revival as users search for legal alternatives to the ever-increasing list of restricted drugs, particularly the hallucinogens. Indeed, most of the herbs listed in the

Table are promoted and used for their apparent hallucinogenic, euphoric, or marihuana-like effects. The ready availability of these substances and their marketing in a context of "health foods" represents a potential abuse problem. Physicians should be aware of the psychoactive effects of these compounds,¹⁶ particularly those effects resulting from long-term use, even when acute effects are minimal or nonexistent. Drug histories should include information on the use of herbal preparations, and their possible role in the etiology of medical complaints should be considered by all.

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References

1. Anon: *Legal Highs*. San Francisco, Level Press, 1973.
2. Superweed MJ: *Herbal Highs*. San Francisco, Flash Transactions, 1970.
3. Superweed MJ: *Herbal Aphrodisiacs*. San Francisco, Flash Transactions, 1971.
4. Lewin L: *Phantastica: Narcotic and Stimulating Drugs*. London, Kegan Paul Trench Trubner & Co, 1931.
5. Jacobs KW: Asthmador: A legal hallucinogen. *Int J Addictions* 9:503-512, 1974.
6. Gowdy JM: Stramonium intoxication: Review of symptomatology in 212 cases. *JAMA* 221:585-587, 1972.
7. Weintraub S: Stramonium poisoning. *Postgrad Med* 28:364-367, 1960.
8. Cummins BM, Obetz SW, Wilson MR Jr: Belladonna poisoning as a facet of psychodelia. *JAMA* 204:1011, 1968.
9. Dean ES: Self-induced stramonium intoxication. *JAMA* 185:882-884, 1963.
10. Siegel RK, Collings PR, Diaz JL, et al: On the use of *Tagetes lucida* and *Nicotiana rustica* as a Huichol smoking mixture: The Aztec "yahutli" with suggestive hallucinogenic effects. *Econom Bot*, to be published.
11. Cronheim GE, Holmes LD, Gajdusek C, et al: Piper methysticum (Kava), in Efron D, Holmstedt B, Kline NS (eds): *Ethnopharmacologic Search for Psychoactive Drugs*, publication 1645. Washington, DC, Public Health Service, 1967, pp 103-181.
12. Weil AT: Nutmeg as a psychoactive drug, in Efron D, Holmstedt B, Kline NS (eds): *Ethnopharmacologic Search for Psychoactive Drugs*, publication 1647. Washington, DC, Public Health Service, 1967, pp 188-201.
13. Keeler MH, Kane FJ: The use of hyoscyamine as a hallucinogen and intoxicant. *Am J Psychiatry* 124:852-854, 1968.
14. Muller DJ: Unpublicized hallucinogens: The dangerous belladonna alkaloids. *JAMA* 202:650-651, 1967.
15. Bristol ML: Tree *Datura* drugs of the Colombian Sibundoy. *Botanical Museum Leaflet, Harvard University*. 22:165-227, 1969.
16. Siegel RK, Jarvik ME: Drug-induced hallucinations in animals and man, in Siegel RK, West LJ (eds): *Hallucinations: Behavior, Experience, and Theory*. New York, John Wiley & Sons Inc, 1975, pp 81-161.



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The So-called Cardiac Neuroses

[EDITORIAL, pp 330-331]

"Cardiac neuroses," so-called, have been attributed as a general rule to disturbances in the normal workings of the nervous apparatus of the heart. In this, as in many other instances, the effort at classification has probably gone beyond our actual knowledge of the nature of the processes in question, because it is not yet clear how much of cardiac function depends on the nervous mechanisms, and how much on the muscle cells of the heart. Just at present physiologists are inclined to lay especial stress on the automatism of the muscle cells and to refuse to attach much if any importance to nervous influences.

In a recent paper by L. F. Barker this subject is reviewed from the anatomic, physiologic, and pathologic points of view. It is pointed out that the heart has no nerves at all when it begins to beat in the embryo, and that the vague fibers grow out to the heart, while the sympathetic neurons, at first entirely distinct from the heart, gradually enter its walls and locate there permanently. Furthermore, that modern physiologists by experimental work have shown that the normal rhythm of the heart is inherent in the muscle cells of the adult heart and not due to the rhythmical discharge of nervous impulses along nerve fibers. The automatic rhythmic activity of the heart is favored by the Na-ions in the blood, associated in a certain proportion of Ca-ions. The muscle cells of the heart have three distinct properties, namely, contractility, conductivity, and the power to initiate primary automatic stimuli at regular intervals. These properties are influenced in various ways, especially by nervous influences. It has been proposed by Engelmann to call the nerve fibers that affect the force and extent of the contractions, inotropic; those that affect conductivity, dromotropic; and those that modify the frequency of primary auto-

matic stimuli, chronotropic. These designations need not be restricted to nervous influences alone, but may be well applied to any and all influences operating in the manner indicated.

Barker then discusses the abnormalities of cardiac rhythm—the tachycardias, bradycardias, embryocardias, pulsus intermittens, etc., and it is shown that the analysis of irregular heart action promises valuable results when based on modern anatomic, physiologic, and pharmacologic research. The most prominent feature of the present analysis is the importance assumed by the cardiac muscle itself, and Barker suggests that until the dynamics of the processes concerned are better understood the term "cardiac neuroses" should be left in the background, and the arrhythmic states grouped rather under a more general term, such as "disturbances of cardiac motility."

Just at present we know little concerning the functions of the nervous mechanisms of the heart, be it under normal or under pathologic conditions. Indeed, it is not at all unlikely that many morbid conditions, now called "nervous," will be found later to depend on factors better and more correctly described by other terms.