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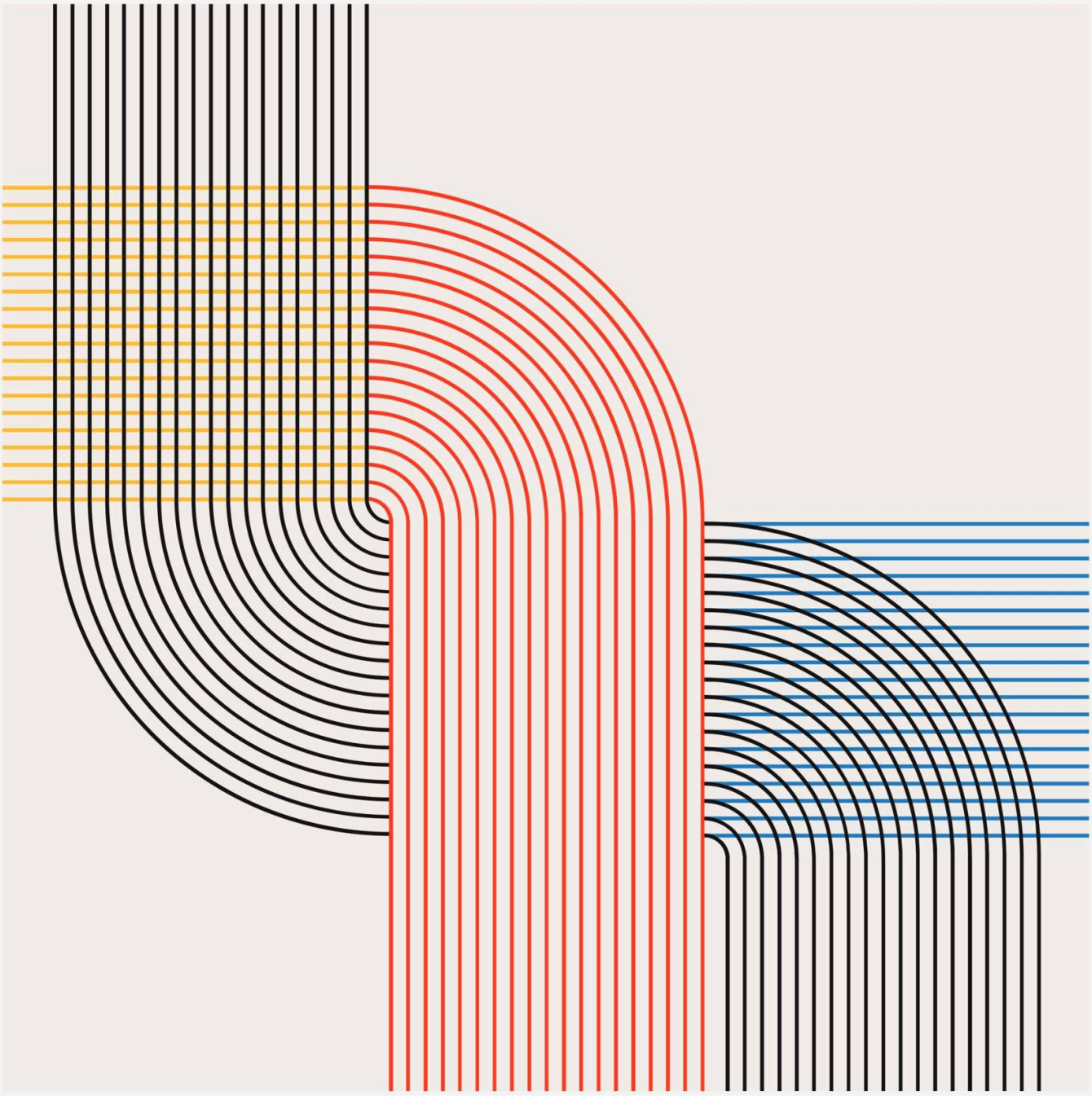

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LÍNEA SUEROS ANTIOFÍDICOS
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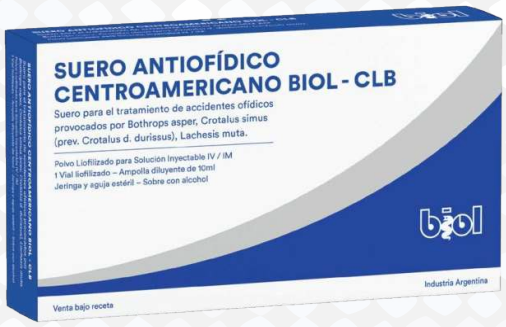
LIOFILIZADO INYECTABLE **NO REQUIERE CADENA DE FRÍO**

Inmunización pasiva para neutralizar los venenos de las siguientes víboras



EN SUDAMÉRICA

- **Cascabel**
  (Crotalus durissus terrificus)
- **Yarará de la Cruz**
  (Bothrops alternatus)
- **Yarará Ñata**
  (Bothrops ammodytoides)
- **Yarará Chica**
  (Bothrops diporus neuwiedii)

EN CENTROAMÉRICA

- **Cascabel**
  (Crótalus simus)
- **Terciopelo - Barba amarilla**
  (Bothrops asper)
- **Verrugosa - Cascabel muda - Mapanare**
  (Lachesis muta)

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EDITORIAL

Three decades since the Tokyo subway sarin attack: Lessons learned and ongoing challenges

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The sarin gas attack on the Tokyo subway left an indelible mark on the history of Japan and the world. Thirty years later, the reverberations of this tragedy continue to be felt, both in the physical and psychological consequences that still affect the victims and society at large.

The attack was orchestrated by the apocalyptic cult *Aum Shinrikyo* ('Aum Supreme Truth'), which targeted the vicinity of the Metropolitan Police Department in Chiyoda. The sect was led by Shoko Asahara, born Chizuo Matsumoto in 1955 into a poor family. He suffered from congenital glaucoma, which led to his enrollment in a school for the blind, where he endured bullying. Initially, Asahara pursued studies in acupuncture and massage therapy, but over time, he became increasingly involved in Buddhism, New Age practices, yoga, and divination. After a brief period within the *Agonshu* sect and following two trips to India and Japan, he founded *Aum Shinsen No Kai* ('Society of Hermits of Aum Mountain') with the objective of restoring original Buddhism by renouncing materialism and establishing a monastic-type society.[1]

In 1987, the movement rebranded as *Aum Shinrikyo*, and by 1989, it had grown to approximately 4,000 followers and 390 clergy.[2] Many of the sect's members were highly educated, with backgrounds in fields such as medicine, engineering, and physics. They contributed significant financial resources to the group in exchange for perceived spiritual privileges and gifts.[3] To promote its ideology and attract followers, the movement employed various media, such as television, radio, and newspapers.

Aum Shinrikyo established its own program for the production of biological and chemical weapons, led by Hideo Murai and Masami Tsuchiya, who began manufacturing sarin in small quantities in 1993. Anticipating a raid on their facilities and aiming to trigger the apocalypse prophesied by their leader, five members of the group punctured eight packages containing sarin using the tips of umbrellas.[1,4] The attack was carried out during Tokyo's rush hour (at 7:55 AM on a Monday), near the Kasumigaseki station (Fig. 1),[5] which is in close proximity to both government and police headquarters. At ground level, several vehicles were stationed to await the perpetrators, who had atropine on hand as an antidote to the nerve agent.

St. Luke's International Hospital, located approximately 3 km from the incident site, became the primary referral center for affected patients. The overwhelming number of victims, combined with the lack of established protocols for responding to chemical emergencies, severely strained the hospital's resources. This hindered the effective execution of decontamination procedures and the timely adminis-tration of atropine and 2-PAM, an oxime. Furthermore, medical personnel were subjected to secondary con-tamination. As a result, 13 individuals died, and over 6,000 people were affected, with some suffering long-term health consequences.[6-8]

When Asahara was captured, he was found with electrodes attached to his head, a method of suggestion used to 'transfer energy' between the leader and his followers. In 2000, *Aum Shinrikyo* formally acknowledged its responsibility for the attack and provided monetary compensation to the victims' families. The group later rebranded as *Aleph*, from which its leader, Joyu Fumihiro, eventually separated to form *Hikari no Wa* ('Ring of Light').[3] Finally, in 2018, Asahara and 13 other members of the sect were sentenced to death by hanging.[9]

The sarin gas attack on the Tokyo subway is regarded as one of the most significant terrorist attacks of the 20th century. This event serves as a stark reminder of the dangers posed by unconventional arms

Figure 1. Kasumigaseki Station - Hibiya Line (Credits: Maruu).

and the vulnerabilities of modern societies. Thirty years later, chemical weapons remain a persistent threat, not only in the context of violent radicalization but also in ongoing armed conflicts, as demonstrated by the war in Syria.[10] In this context, the Organisation for the Prohibition of Chemical Weapons (OPCW), which was awarded the Nobel Peace Prize in 2013, has played a pivotal role in advancing the goal of a world free from chemical weapons through the Chemical Weapons Convention (CWC). This international treaty not only prohibits the development, production, stockpiling, transfer, and use of chemical weapons but also mandates the destruction of existing reserves within a defined timeframe. In an increasingly unstable geopolitical landscape, it is imperative for all nations to prioritize efforts to control weapons of mass destruction, regardless of political, economic, or religious differences.

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REVIEW

Poisoning by *Brugmansia arborea* (L.) Steud.: Plant characterization and toxicological profile

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ABSTRACT. Poisoning by *Brugmansia arborea* constitutes an underestimated public health issue, especially in regions where the plant is widely accessible. This species contains high concentrations of tropane alkaloids, primarily responsible for inducing an anticholinergic toxidrome with potentially severe clinical manifestations. A narrative review was conducted using a targeted search of the scientific literature on the toxicological, pharmacological, clinical, and ethnobotanical aspects of *Brugmansia arborea*. Sources included peer-reviewed articles, academic books, and case reports published in English and Spanish between 1976 and 2024. Enhanced understanding of *B. arborea* toxicity and its toxic effects is essential to improve diagnosis, clinical management, and prevention strategies.

Key words: *Brugmansia arborea; Tropane alkaloids; Solanaceae; Plant poisoning; Anticholinergic syndrome.*

Brugmansia arborea (L.) Steud., commonly known as *floripondio*, is a plant belonging to the *Solanaceae* family, widely distributed throughout the Andean regions of South America. Its flowers contain tropane alkaloids such as scopolamine, atropine, and hyoscyamine, which exert anticholinergic effects. Although traditionally used for ornamental and ethnobotanical purposes, accidental or intentional ingestion can lead to severe clinical manifestations. This review aims to characterize *B. arborea* and describe the clinical features associated with its toxicity.

MATERIALS AND METHODS

This narrative review was based on a comprehensive, targeted search of the scientific literature, focusing on the toxicological, pharmacological, clinical, and ethnobotanical aspects of *B. arborea*. Sources included peer-reviewed journal articles, academic books, and case reports. Keywords used in various combinations included *Brugmansia arborea*, *tropane alkaloids*, *scopolamine*, *atropine*, *anticholinergic syndrome*, and *plant poisoning*. Relevant publications in English and Spanish from 1976 to 2024 were considered. In addition, authoritative reference texts in toxicology and pharmacognosy were consulted to complement and contextualize the findings.

DISCUSSION

General aspects

According to Schulz AG, *B. arborea* is known by multiple common names across different regions, reflecting both its traditional uses and its cultural significance.[1] Common terms include *floripondio* (Argentina, Ecuador, Bolivia, Chile, and Mexico); *trompeta de ángel*, *toloache*, and *borrachero* (Colombia); *floripón*, *campana*, and *flor de campana* (Cuba, Puerto Rico, and the Dominican Republic); *campanita* (Venezuela); and *toá* (Western Amazon). The term *angel's trumpet* is the most widely used and internationally recognized. The expression *burundanga* is a frequently used colloquial word in Latin America, commonly referring to the administration of psychoactive substances—most often alcoholic beverages or benzodiazepines, and less frequently scopolamine-containing preparations—with the intent to facilitate criminal acts such as robbery or sexual assault, a phenomenon known as 'chemical submission.' Although its exact etymological origin remains uncertain, it is possibly derived from African, Indigenous, or onomatopoeic influences and is thought to mean 'brew' or 'potion.'

B. arborea grows as a perennial or semi-perennial shrub, native to Central America, the Caribbean, and South

Figure 1. Specimens of *B. arborea* in the flowering stage. A. Shrub photographed in its natural habitat; B. *B. arborea* flower in full bloom, showing its characteristic bell shape and pale coloration (Credits: author's own photographs).

America, extending as far south as the Patagonian Andes (Fig. 1, A and B). Parodi and Dimitri (1988) describe *B. arborea* as a species widely grown in Argentine gardens, valued both for its ornamental appearance and for the fragrance of its flowers.[2] Schultes and Hofmann (1982) report that species of the genus *Brugmansia* have traditionally been used in shamanic rituals due to their potent psychoactive and hallucinogenic effects.[3] Roig and Mesa (1988) document the presence of *B. arborea* in Cuba under various vernacular names, highlighting its integration into the region's popular botanical knowledge.[4] It is also worth noting that tree-like *Datura* species have been reclassified under the genus *Brugmansia*. All species produce large, trumpet-shaped, pendulous flowers and spineless fruits.

Botany and taxonomy

The generic name *Datura* derives from the poison called *dhât*, a toxic substance historically used in India by the Thugs—organized groups who specialised in stealing from and murdering wealthy travellers by blending in and gaining their trust. The genus name *Brugmansia* was assigned in honour of the botanist and physician Sebald J. Brugmans (1763–1819), a professor of natural history in Leiden, the Netherlands. The name *Brugmansia* was attributed by Ernst Gottlieb von Steudel in *Nomenclator Botanicus*. A homonymous and synonymous taxon was also proposed by Nils Gustav Lagertheim in *Deutsche Botanische Systematik*. In 1973, Tom E. Lockwood definitively separated the two genera in his doctoral thesis at Harvard University, a distinction later corroborated at a botanical congress in 1979.

B. arborea is a shrub reaching two to three metres in height. The leaves are ovate-lanceolate to oblong, entire or sinuately angled, pubescent, and can grow up to 20 cm long. The flowers are white, aromatic, pendulous, measuring 15 to 30 cm in length, with a laterally split spathaceous calyx. The fruit is an ovoid berry, approximately 6 cm by 4.5 cm, and spineless. The morphological features of this species are illustrated in Fig. 2.

Active compounds

According to Trease and Evans (1991), *B. arborea* contains tropane alkaloids with pronounced anticholinergic activity, which form the basis of its pharmacological effects and toxicological profile.[5] The main active constituents include hyoscyamine (a stereoisomer of atropine) and scopolamine (hyoscine), both of which are known to exert pronounced effects on the central (CNS) and peripheral (PNS) nervous systems. Similarly, Bruneton (2001) indicates that various *Brugmansia* species consistently contain these alkaloids, whose neurotoxic effects are well characterised in both clinical and experimental contexts.[6]

Although several species of *Brugmansia* are found in different regions, they all contain similar active alkaloids. For instance, *Brugmansia sanguinea* (Ruiz & Pav.), commonly found in Ecuador, is traditionally used for its dried leaves, which serve as a source of scopolamine for extraction and

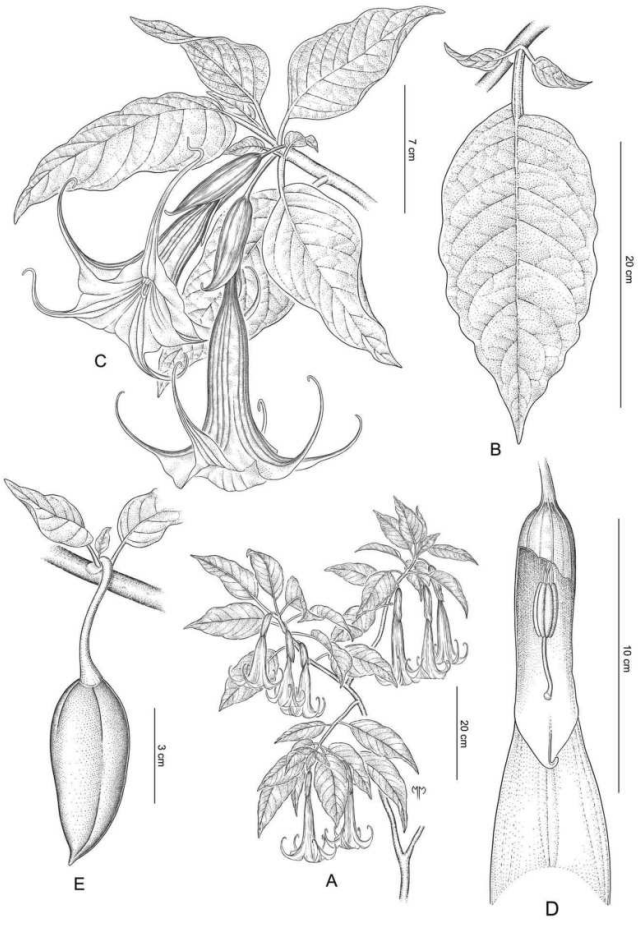

Figure 2. Botanical illustration of *B. arborea*. A. General aspect; B. Leaf, adaxial view; C. Portion of the inflorescence; D. Longitudinal section of the flower, stamens and style and E. Fruit (Credits: Marcelo A. Moreno – IBODA).

export. The productive lifespan of this plant is estimated to be approximately 10 years.

Pharmacodynamics and toxicodynamics

Atropine and scopolamine exert their pharmacological activity via competitive antagonism at muscarinic acetylcholine receptors (mAChRs), thereby inhibiting cholinergic neurotransmission within both CNS and PNS. This antagonism leads to a dose-dependent modulation of parasympathetic tone.

Atropine demonstrates a central excitatory profile at higher concentrations, attributable to its limited but sufficient CNS penetration, resulting in restlessness, agitation, and, in some cases, seizures. Scopolamine, by contrast, exhibits higher lipophilicity, facilitating more rapid and extensive CNS entry, where it acts predominantly as a central depressant, producing sedation, anterograde amnesia, and—at toxic levels—confusion, hallucinations, and psychomotor agitation.

Peripherally, both alkaloids block M1–M5 receptor subtypes in smooth muscle, cardiac tissue, and exocrine glands, producing the hallmark signs of antimuscarinic toxicity: mydriasis, cycloplegia, xerostomia, anhidrosis, tachycardia, urinary retention, and decreased gastrointestinal peristalsis. The clinical severity of intoxication correlates with receptor affinity, individual pharmacokinetics, and cumulative exposure, especially when co-administered with other anticholinergic agents.

Poisoning

Exposure. Poisoning may result from accidental ingestion, recreational purposes, or therapeutic use in adults—particularly due to the plant's antiasthmatic properties. The most common routes of administration include smoking dried leaves in the form of cigarettes or consuming infusions made from the flowers. *B. arborea* is among the main plants involved in pediatric poisonings associated with the popular use of medicinal herbs in Argentina.[7]

Clinical presentation. Symptoms depend on the dose ingested and potential co-exposure to other substances. Clinical manifestations may include dryness of mucous membranes, headache, facial flushing, occasional hyperthermia, tachycardia, mydriasis, blurred vision, hallucinations, delirium, agitation, motor incoordination, seizures, and, in severe cases, coma.

Identification. In suspected cases of plant-derived poisoning, it is essential to collect a sample of the material involved to allow for accurate botanical identification. This step is particularly important in countries like Argentina, where diverse phytogeographic regions result in significant variation in vernacular plant names. Identification should be performed by trained personnel as close as possible to the site of care. Establishing collaboration between medical and botanical experts is key, and the development of a small reference herbarium may greatly facilitate timely diagnosis and management in future incidents.

The plant material shown in Fig. 3 was brought in by an adult patient who had ingested an infusion prepared with three *Brugmansia* flowers to relieve an asthma attack. On admission, the patient presented with a fixed gaze, disorientation in time and space, and slow ambulation assisted by a family member. He exhibited mydriasis, was normotensive, and pulmonary auscultation revealed no wheezing. Management included observation in the emergency department and oral hydration. He evolved favorably.

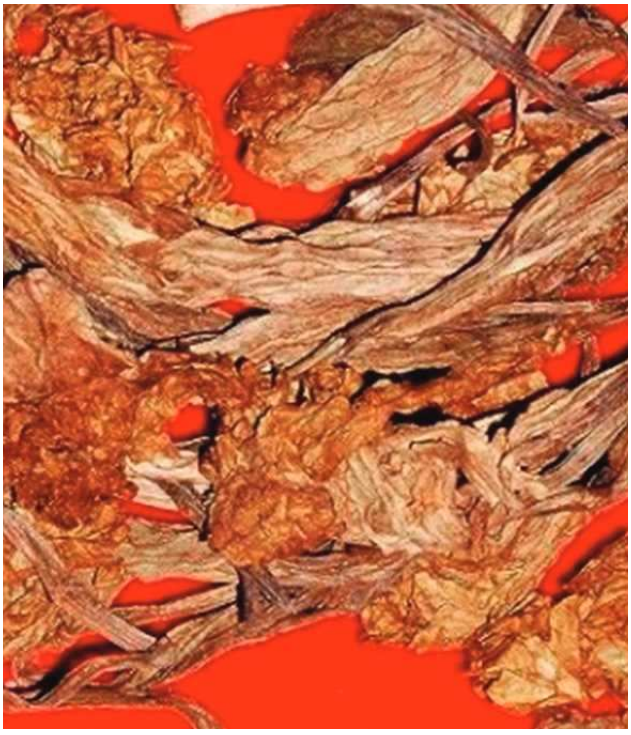

Figure 3. Dried flowers of *B. arborea*, preserved for morphological and phytochemical analysis. The tubular structure remains intact, and remnants of glandular trichomes are visible on the surface (Credits: author's own photographs).

Treatment. Management is primarily supportive. Intravenous fluid therapy may be necessary, and benzodiazepines are often indicated to control agitation. Continuous monitoring and symptomatic treatment should be provided as needed based on clinical severity. Most patients experiencing anticholinergic toxicity recover well with supportive care alone; however, some may require antidotal treatment with physostigmine.[8,9] It is recommended for cases presenting significant central anticholinergic symptoms, such as moderate to severe agitation or delirium. It should be avoided if there is suspicion of a diagnosis other than anticholinergic poisoning, a QRS interval exceeding 100 milliseconds, or in cases of tricyclic antidepressant overdose. Additional relative contraindications include reactive airway disease, intestinal obstruction, seizure disorders, and cardiac conduction abnormalities. Physostigmine seems more effective than benzodiazepines for treating agitation and delirium caused by anticholinergic toxicity.[10-12] While patients with mild symptoms may improve with low doses of benzodiazepines, those experiencing moderate to severe agitation are more likely to benefit from physostigmine.

The toxicologist requires collaboration with other disciplines such as anthropology, agronomy, ethnobotany, zoology, mycology, and chemistry, which are essential for identifying materials and providing information on their uses and active compounds. The diverse training backgrounds of professionals from different fields enrich the approach to solving complex problems. In today's highly specialized and fragmented scientific landscape, only an interdisciplinary team can maintain scientific efficiency.

CONCLUSIONS

B. arborea poisoning represents a significant public health concern due to its potent anticholinergic tropane alkaloids, which can cause severe and potentially fatal clinical presentations if not properly managed. Its widespread availability and traditional use increase the risk of accidental or intentional exposure, particularly among children and adolescents. Early recognition and supportive treatment are essential to improve patient outcomes. Strengthening community education and healthcare professional training is crucial for effective prevention and management. Furthermore, enhanced documentation and research are needed to better understand its toxicological profile and to develop more precise clinical guidelines.

Conflicts of interest

The author declares no conflicts of interest.

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ORIGINAL ARTICLE

Retrospective toxicological analysis of cocaine and cannabis use in postpartum women with social risk factors at a tertiary hospital (2020–2025)

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ABSTRACT. Substance abuse during pregnancy and breastfeeding is an increasing public health concern within our community. This study examines the prevalence of maternal substance use at a tertiary-level hospital, identifies the types of substances detected, and explores the correlation between their metabolites. Homogeneous enzyme immunoassay (HEIA) techniques were employed for toxicological analysis in the selected cases. The results reveal a 7.87% prevalence of substance use within the studied population.

Key words: *Substance abuse; Pregnancy; Breastfeeding; Toxicological analysis; Homogeneous enzyme immunoassay.*

The use of illicit drugs by pregnant women during the perinatal period has experienced a concerning increase, negatively impacting both maternal and fetal health. In this regard, the World Health Organization (WHO) states that 'the consumption of psychoactive substances during pregnancy represents a public health issue due to its adverse effects on the fetus, including low birth weight, premature birth, and neurodevelopmental disorders'.[1] In a study conducted at the Dr. J. A. Fernández Hospital in Buenos Aires, Cortese et al.[2] found that alcohol consumption had a prevalence of 46.3%, followed by tobacco at 12.1%, marijuana at 5.6%, and cocaine at 4.7% among hospitalized pregnant women. Neonates born to mothers with urine positive for any substance had lower birth weight and a shorter gestational age. Similarly, in the United States, the National Institute on Drug Abuse (NIDA) estimated that approximately 5.4% of pregnant women used substances in 2020.[3] In our region, we have identified analogous trends, coinciding with greater vul-nerability in areas with limited access to adequate healthcare.

The most commonly detected substances include cannabinoids, cocaine, and benzodiazepines. Their use is associated with multiple complications, such as preterm birth, intrauterine growth restriction, and neonatal abstinence syndrome. Cocaine crosses the placental barrier and can induce vasoconstriction in the placental circulation, thereby increasing the risk of spontaneous abortion, intrauterine growth restriction, and placental abruption.[4] Prenatal exposure to cannabis may affect fetal neurodevelopment, disrupt neonatal sleep patterns, and reduce attention capacity during childhood.[5]

This study aims to assess the presence of a statistically significant association between the use of cocaine and cannabinoids, as determined by the detection of their metabolites in urine specimens.

MATERIALS AND METHODS

General aspects

This was a retrospective, observational, and descriptive study conducted on patients admitted to the Obstetrics Department of a tertiary-level hospital in Buenos Aires, Argentina.

Population

A total of 252 urine samples were analyzed, collected between January 2020 and January 2025, with the aim of detecting urinary metabolites of cocaine and cannabis. The study included postpartum women aged 16 to 46 years, with documented social or behavioral risk factors (e.g. history of substance use, socioeconomic vulnerability, or lack of prenatal care), who underwent toxicological screening within the first 24 hours following delivery.

Analytical techniques

The detection of drugs of abuse in urine samples was performed using a homogeneous enzyme immunoassay (HEIA) on the Abbott® Architect c4000 platform. This method allows for the qualitative detection of specific metabolites of psychoactive substances. The cut-off values for a positive result were 300 ng/mL for benzoylecgonine and 50 ng/mL for THC, in accordance with standard screening thresholds. No confirmatory testing was performed. The immunoassay does not require physical separation of sample components prior to measurement, enabling rapid, automated detection with high specificity. In this regard, Moffat et al.[6] state that urine testing is one of the most widely used methodologies for identifying recent drug use, as metabolites of substances such as cocaine and cannabis remain detectable in urine for several days after consumption.

Statistical analysis

The data used in this study were extracted using the Infinity information system and Power BI software, both provided by Roche® Laboratories. Statistical analyses were conducted using R software (version 4.3.2) and the RStudio interface. The statistical tests were selected based on the type of variables and the study design. The Chi-square test was applied to assess the association between categorical variables, such as substance use. A p-value < 0.05 was considered statistically significant.

RESULTS

A total of 252 urine samples were analyzed for the presence of psychoactive substance metabolites. The analytes assessed included benzoylecgonine (a primary metabolite of cocaine) and Δ^9-tetrahydrocannabinol (Δ^9-THC), the main psychoactive compound in cannabis. Regarding cocaine, 52 samples tested positive, while 200 samples tested negative. In the case of cannabinoids, 96 samples were positive and 156 samples were negative. The distribution of results is presented in Table 1.

TABLE 1. Detection of cocaine and cannabinoid metabolites in urine samples (n = 252).

Substance	Positive (n, %)	Negative (n, %)
Cocaine	52 (20.63%)	200 (79.37%)
Cannabinoids	96 (38.10%)	156 (61.90%)

Assuming statistical independence between cocaine and cannabinoid use, the estimated probability of testing positive for both substances was approximately 7.87% ($P[\text{Cocaine} \cap \text{Cannabinoids}] = 0.2063 \times 0.3810 \approx 0.0786$), corresponding to an expected count of roughly 19.82 samples. Interestingly, 24 samples (9.52%) tested positive for both substances, exceeding the expected count under the assumption of independence. To evaluate the association between cocaine and cannabinoid use, a Chi-square test of independence was performed. The results indicated a statistically significant association between the presence of both metabolites: $\chi^2 = 4.23$, degrees of freedom (df) = 1, $p = 0.0397$. Table 2 shows the contingency table displaying the distribution of cocaine and cannabinoid test results in urine samples, illustrating the frequency of positive and negative cases for each substance and their co-occurrence. Additionally, the odds ratio was estimated at 1.52, suggesting that individuals who tested positive for one substance were approximately 1.5 times more likely to test positive for the other. These findings suggest that the concurrent use of cocaine and cannabinoids among the study population may occur more frequently than would be expected by chance alone.

TABLE 2. Contingency table of cocaine and cannabinoid test results in urine samples (n = 252).

	Cannabinoid +	Cannabinoid -	Total
Cocaine +	24	28	52
Cocaine -	72	128	200
Total	96	156	252

DISCUSSION

HEIA emerges as an effective tool for the early detection of maternal substance use in emergency settings, enabling timely preventive actions to protect the newborn. The findings of this study reflect an alarming clinical reality,

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consistent with international reports. The positivity rate was higher for cannabinoids (38.10%) than for cocaine (20.63%), suggesting that cannabis use or exposure is more prevalent than cocaine use in this sample of obstetric patients. Given that the p-value was < 0.05, the null hypothesis of independence between cocaine and cannabinoid use was rejected. This indicates a statistically significant association between the two substances: in this population, the use of one drug is associated with an increased likelihood of using the other.

Polydrug use is common among individuals who use illicit substances and is often associated with poorer clinical and social outcomes. Early identification of substance use during pregnancy allows for timely interventions that may significantly improve both maternal and neonatal outcomes.[7] From a preventive standpoint, there is an urgent need to develop early intervention programs, provide targeted education for women of reproductive age, and strengthen perinatal mental health services to address this growing public health concern.

CONCLUSIONS

Our findings highlight a high prevalence of cannabinoid and cocaine use among obstetric patients, with a significant association between both drugs. The increasing trend of illicit drug consumption during pregnancy underscores the need for early toxicological screening and the integration of comprehensive prevention and intervention strategies into maternal healthcare protocols.

Conflicts of interest

The authors declare no conflicts of interest.

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CASE REPORT

Prolonged hallucinogenic effects following *Psilocybe cubensis* ingestion: Case report

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ABSTRACT. *Psilocybe cubensis* is a widely used psilocybin-containing mushroom with well-documented acute psychoactive effects. We report a case of prolonged perceptual disturbances and flashbacks occurring weeks after ingestion, requiring psychopharmacological intervention. This case illustrates the potential for persistent neuropsychiatric symptoms following psilocybin intoxication and highlights the need for individualized treatment approaches. Given the increasing recreational use of psilocybin, enhanced harm reduction strategies and expanded clinical research are essential for effective management.

Key words: *Psilocybe cubensis; Psilocybin; Hallucinogens; Mushrooms; Poisoning.*

In recent years, there has been a steady increase in the recreational use of psilocybin-containing mushrooms. According to the Global Drug Survey (2021), the proportion of respondents reporting the use of 'magic mushrooms' rose from 8.6% in 2015 to 16.1% in 2021, representing a significant rise within just six years.[1] This trend has been attributed both to the increased availability of these species and to growing interest in their perceived positive effects on mood and creativity. Within this context, we present a clinical case of acute intoxication with *Psilocybe cubensis*, notable for the persistence of psychedelic symptoms beyond the acute phase.

CLINICAL CASE

A 23-year-old male with a history of occasional cannabis use and Tourette syndrome, with no medical follow-up in the past eight years, attended a medical consultation after experiencing persistent symptoms following ingestion of a psychoactive mushroom. During a social event, he ingested, for recreational purposes, a whole dried specimen (approximately 4 grams) of a mushroom commonly known as *hongo albino* ('albino fungus' in English). One hour after ingestion, he developed dysesthesias, visual and auditory hallucinations, paranoid ideation, and a sense of impending doom.

In the following days, and up to the time of his first medical consultation—21 days after ingestion—he experienced spontaneous episodes of symptom recurrence consistent with flashbacks. During the consultation, the patient provided one of the consumed specimens for identification, which a specialist confirmed as *P. cubensis* through mycological analysis.

During outpatient follow-up, symptomatic treatment with olanzapine and clonazepam was initiated to manage episodes of perceptual re-experiencing and residual psychotic symptoms. Over the subsequent five months, the patient reported a progressive reduction in flashbacks, with no recurrence of hallucinations or emergence of paranoid ideation. However, antipsychotic treatment was associated with a worsening of motor tics—characteristic of his underlying diagnosis—posing an additional clinical challenge. The last contact occurred during a telephone evaluation at month five, after which the patient was lost to follow-up.

DISCUSSION

P. cubensis is a psychoactive mushroom with a broad geographical distribution, classified within the family Hymenogastraceae. It is one of the most commonly used species of psilocybin-containing fungi due to its widespread availability and relative ease of cultivation. This species

Figure 1. The macroscopic characteristics of *P. cubensis* specimens can be observed across different stages of their development, revealing distinct morphological changes (Credits: A. Rockefeller).

commonly inhabits tropical and subtropical environments, thriving in warm, humid conditions, and is often found growing on the dung of large herbivores—particularly cattle—across regions such as the Americas, Southeast Asia, and northern Australia. Macroscopically, *P. cubensis* is distinguished by a cap (pileus) that transitions from conical or bell-shaped in youth to broadly convex with maturity, exhibiting a yellow-brown to golden coloration and a characteristic blue staining when handled, which reflects psilocybin oxidation (Fig. 1).[2]

Microscopically, it yields purplish-brown spore prints and displays ellipsoid, thick-walled spores. Fig. 2 shows selected microscopic features of the *P. cubensis* specimen.[3]

Due to its significant psilocybin and psilocin content, *P. cubensis* is one of the most thoroughly researched species within both recreational and clinical psychedelic contexts. Psilocybin acts as a prodrug, quickly converting in the body to psilocin, which produces psychoactive effects mainly by partially activating serotonin 5-HT2A receptors.[4] These receptors are primarily located in cortical and thalamic areas that regulate sensory perception and cognitive functions, leading to the characteristic alterations in consciousness, perception, and thought processes associated with psychedelic experiences.[5]

The symptoms observed in this case correspond to the well-documented acute and subacute effects of psilocybin, including perceptual disturbances, depersonalization, and lingering psychotic features.[6] Although delayed flashbacks, also known as hallucinogen persisting perception disorder (HPPD), have been reported previously, they are usually brief and self-resolving.[7] In contrast, this patient experienced unusually severe and prolonged symptoms, necessitating the use of psychopharmacological treatments such as antipsychotics and anxiolytics.

These findings underscore the necessity for individualized therapeutic strategies in the management of such cases. Moreover, with the growing use of psilocybin outside clinical environments, it is imperative to enhance harm reduction initiatives, promote comprehensive mental health education, and expand the clinical research framework to provide evidence-based guidelines for the effective treatment of these complex presentations.

Figure 2. Microscopic view of *P. cubensis* spores, captured at 1000x magnification using differential interference contrast (DIC) microscopy (Credits: A. Rockefeller).

CONCLUSIONS

This case highlights how *P. cubensis* ingestion can lead to persistent and severe perceptual disturbances, sometimes requiring pharmacological treatment. It underscores the need for personalized care and improved harm reduction and clinical guidelines in the context of rising psilocybin use.

Conflicts of interest

The authors declare no conflicts of interest.

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LETTER TO THE EDITOR

Reflections on genetic and epigenetic impacts of industrial chemical exposure in workers

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ABSTRACT. Genetic and epigenetic effects resulting from industrial chemical exposure significantly impact worker health. Exosomes play a critical role in mediating intercellular communication, while the exposome concept provides a comprehensive framework for understanding cumulative environmental and lifestyle influences. Cellular adaptations through allostasis illustrate the dynamic response to toxic stress, underscoring the necessity for integrated risk assessment that considers environmental and socioeconomic variables.

Key words: *Exosomes; Exposome; Epigenetics; Occupational exposure; Chemical toxicity.*

To the Editor: This communication aims to offer a reflection on the current situation of workers exposed to diverse industrial chemical agents. Continuous contact with contaminated environments can induce genetic alterations and disrupt cellular functions, including those of the plasma membrane, potentially leading to the development of various pathologies. For example, exposure may cause modifications in the configuration of cellular receptors and activate second messengers capable of reaching the cell nucleus. It is important to emphasize that cellular responses are not strictly preprogrammed but dynamically adapt to environmental signals. At this critical point, DNA and the complex genetic mechanisms of workers exposed to industrial chemicals play a central role.

Intercellular communication enables the transfer of information within a tissue through direct signaling or by transmitting signals to neighboring or distant tissues. A critical component of this communication network is exosomes—small extracellular vesicles, typically ranging from 30 to 200 nanometers in diameter, secreted by virtually all cell types in large quantities. Exosomes serve as essential messengers by mediating the transfer of biomolecules such as messenger RNA, proteins, cytokines, peptides, and coenzymes between cells. This exchange plays a vital role in cellular regeneration processes, including the renewal of senescent cells, skin cells, and immune system cells.

Epigenetics is an essential factor to consider when assessing chemical exposure and associated risks. It refers to stable changes in gene expression that occur without alterations to the underlying DNA sequence. These variations are regulated by mechanisms such as DNA methylation, histone modifications, and non-coding RNAs, which influence gene activation or silencing. It is critical to investigate whether chronic exposure to industrial chemicals induces alterations in gene expression profiles in exposed workers, or if epigenetic modifications contribute to transcriptional and translational errors in DNA, thereby generating mutations that have historically influenced human biology and the phenotypic characteristics of organisms. Advances in omics technologies—including genomics, trans-criptomics, proteomics, and metabolomics—are enabling systematic, multi-scale evaluations of whether chemical exposure leads to changes in metabolic pathways, functional and structural protein expression, DNA transcriptional regulation, or genomic replication fidelity.

Cellular turnover rates vary significantly across tissues, reflecting the dynamic nature of cell renewal in the human body. While some cell types undergo rapid regeneration, others may persist for years or even decades. These physiological renewal processes are highly susceptible to disruption by xenobiotic compounds, which can dysregulate cell proliferation by either accelerating or inhibiting mitotic cycles.

Such alterations may impair tissue homeostasis and contribute to the development of chronic diseases resulting from toxicant exposure.

Considering socioeconomic conditions in Latin America and other regions where food security is uncertain, diet represents a critical component of the exposome. The exposome encompasses the totality of environmental exposures an individual experiences throughout their lifetime, including lifestyle factors, chemical agents, and social determinants that influence health outcomes. Alongside diet, other important factors include tobacco and alcohol consumption, the use of household chemicals, exposure to environmental pollution, engagement in regular physical activity, duration of rest or sleep, and the level of occupational stress faced by workers in the chemical industry. Understanding the exposome is essential for assessing the cumulative impact of these diverse exposures on worker health.

From a toxicological perspective, the term homeostasis is inadequate to describe the organism's response to industrial chemical exposure, as it implies a constant maintenance of stability that rarely occurs under such conditions. Instead, the concept of allostasis better reflects the organism's ability to dynamically adapt to external demands, involving multiple tissues and systems to achieve a new functional equilibrium. In this context, metamolecular processes provide a framework for understanding interactions at the nanometric and intracellular levels, which can be either organized or disrupted. Chemical exposure frequently leads to disturbances in these processes, resulting in the formation of dysfunctional structures and ultimately manifesting as occupational diseases related to toxic chemical exposure.

We still do not fully comprehend the interaction of these concepts, including the role of emerging contaminants such as micro- and nanoplastics, and how they affect worker health in the short, medium, and long term. In particular, the impact of chronic exposure to these agents on the stability of genetic structures—such as the integrity of introns and exons (non-coding and coding regions of genes, respectively) during DNA replication—remains poorly understood. Additionally, it is essential to recognize that the activation or suppression of oncogenes and tumor suppressor genes does not occur spontaneously but is regulated by biochemical signals from the environment. Therefore, it is critical for specialists in occupational medicine and toxicology to accurately identify and characterize the industrial exposome affecting workers in order to assess whether such exposures induce genetic modifications that contribute to the development of occupational diseases.

Conflicts of interest

The author declares no conflicts of interest.

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