

## From leisure to blindness: effects and consequences of methanol ingestion

*Del ocio a la ceguera: efectos y consecuencias de la ingestión de metanol*

*Do lazer à cegueira: efeitos e consequências da ingestão de metanol*

**Daniela de Stefani Marquez<sup>1\*</sup>**

ORCID: 0000-0002-1463-2012

**Claudia Rosana Trevisani Corrêa<sup>2</sup>**

ORCID: 0000-0002-3158-8666

**Paula Gomes da Silva<sup>3</sup>**

ORCID: 0000-0001-6705-0182

**Genilson Geraldo dos Santos<sup>4</sup>**

ORCID: 0009-0006-8990-6774

**Wagner Rafael da Silva<sup>5</sup>**

ORCID: 0000-0002-0952-4877

**Annelisa Gregório Andreazzi<sup>6</sup>**

ORCID: 0009-0002-2915-9528

**João Márcio Andreu<sup>7</sup>**

ORCID: 0009-0006-8357-3972

**Juliana Cesar de Vete Caldas<sup>8</sup>**

ORCID: 0009-0008-2378-2371

**Ben Hessed dos Santos<sup>9</sup>**

ORCID: 0000-0002-3901-8297

**Andréa Pereira Diniz Soares<sup>10</sup>**

ORCID: 0009-0006-9088-8841

<sup>1</sup>Universidade do Rio Verde. Goiás, Brazil.

<sup>2</sup>Universidade São Caetano do Sul. São Paulo, Brazil.

<sup>3</sup>Centro Universitário Sagrado Coração. São Paulo, Brazil.

<sup>4</sup>Instituto de Educação em Saúde. São Paulo, Brazil.

<sup>5</sup>Universidade Brasil. São Paulo, Brazil.

<sup>6</sup>Centro Paula Souza. São Paulo, Brazil.

<sup>7</sup>Núcleo de Especializações Ana Carolina Puga. São Paulo, Brazil.

<sup>8</sup>Faculdade Venda Nova do Imigrante. São Paulo, Brazil.

<sup>9</sup>Faculdade Embu das Artes. São Paulo, Brazil.

<sup>10</sup>Universidade Guarulhos. São Paulo, Brazil.

### How to cite this article:

Marquez DS, Corrêa CRT, Silva PG, Santos GG, Silva WR, Andreazzi AG, Andreu JM, Caldas JCV, Santos BH, Soares APD. From leisure to blindness: effects and consequences of methanol ingestion. Glob Acad Nurs. 2025;6(Sup.3):e509. <https://dx.doi.org/10.5935/2675-5602.20200509>

### \*Corresponding author:

[daniela.marquez@unirv.edu.br](mailto:daniela.marquez@unirv.edu.br)

Submission: 09-05-2025

Approval: 10-15-2025

### Abstract

Methanol ingestion constitutes a significant public health problem due to its high ocular toxicity, capable of causing irreversible blindness. This reflective article analyzes the effects and consequences of methanol poisoning, with an emphasis on acquired blindness, and contextualizes recent outbreaks in Brazil resulting from the adulteration of alcoholic beverages. The analysis was guided by a critical-reflective methodology, allowing for a critical and interpretative approach to the available evidence. The results point to significant toxicological impacts, challenges to consumer safety, and social repercussions for people with visual impairments, whether pre-existing or resulting from poisoning. The discussion highlights the importance of the role of the multidisciplinary health team, preventive measures, and public policies focused on sanitary surveillance, social inclusion, and the promotion of collective health.

**Descriptors:** Methanol; Multidisciplinary Health Team; Collective Health; People with Visual Impairment; Consumer Safety.

### Resumén

La ingestión de metanol constituye un importante problema de salud pública debido a su elevada toxicidad ocular, capaz de causar ceguera irreversible. Este artículo de reflexión analiza los efectos y consecuencias de la intoxicación por metanol, con especial énfasis en la ceguera adquirida, y contextualiza los recientes brotes en Brasil derivados de la adulteración de bebidas alcohólicas. El análisis se basó en una metodología crítico-reflexiva, que permitió un enfoque crítico e interpretativo de la evidencia disponible. Los resultados señalan importantes impactos toxicológicos, desafíos para la seguridad del consumidor y repercusiones sociales para las personas con discapacidad visual, ya sea preexistente o resultante de la intoxicación. La discusión destaca la importancia del rol del equipo de salud multidisciplinario, las medidas preventivas y las políticas públicas centradas en la vigilancia sanitaria, la inclusión social y la promoción de la salud colectiva.

**Descriptoros:** Metanol; Equipo de Salud Multidisciplinario; Salud Colectiva; Personas con Discapacidad Visual; Seguridad del Consumidor.

### Resumo

A ingestão de metanol constitui um relevante problema de saúde pública em virtude de sua elevada toxicidade ocular, capaz de causar cegueira irreversível. Este artigo de reflexão analisa os efeitos e consequências da intoxicação por metanol, com ênfase na cegueira adquirida, e contextualiza os surtos recentes ocorridos no Brasil em decorrência da adulteração de bebidas alcoólicas. A análise foi orientada pela metodologia crítico-reflexiva, possibilitando uma abordagem crítica e interpretativa das evidências disponíveis. Os resultados apontam impactos toxicológicos significativos, desafios na segurança do consumidor e repercussões sociais para pessoas com deficiência visual, sejam preexistentes ou decorrentes da intoxicação. A discussão destaca a importância da atuação da equipe de saúde multidisciplinar, das medidas preventivas e das políticas públicas voltadas à vigilância sanitária, à inclusão social e à promoção da saúde coletiva.

**Descritores:** Metanol; Equipe de Saúde Multidisciplinar; Saúde Coletiva; Pessoas com Deficiência Visual; Segurança do Consumidor.



## Introduction

Vision is not a process solely of the eyeball; it is a process of interaction between the eye and the brain. The structure that bridges the eye and the brain is called the optic nerve. Methanol is a simple alcohol used in various industrial sectors. Despite its legitimate uses, it represents significant risks to human health, especially when ingested. Methanol poisoning constitutes a serious threat to public health, given that its toxicity exerts deleterious effects on the central nervous system and the visual system, potentially resulting in blindness and, in more severe cases, death. The presence of methanol in alcoholic beverages, even in small concentrations, represents a substantial risk to public health due to its high systemic and ocular toxicity. When ingested, methanol is metabolized in the liver into formaldehyde and formic acid, substances that exert a direct cytotoxic effect on the mitochondria of the optic nerve and retinal cells. The accumulation of formic acid inhibits the mitochondrial respiratory chain, reducing cellular energy production (ATP) and promoting tissue hypoxia. This process leads to the degeneration of optic nerve fibers and irreversible destruction of retinal ganglion cells, culminating in permanent blindness. Thus, the ingestion of beverages adulterated with methanol reveals not only a serious clinical problem, but also a failure in sanitary control policies and in the monitoring of safe alcohol consumption<sup>1,2</sup>.

Methanol poisoning is a serious public health problem, posing a direct risk to life and visual function. Exposure occurs through ingestion, inhalation, or dermal contact. Methanol is rapidly absorbed and preferentially distributed in tissues with high mitochondrial activity, such as the optic nerve and brain. In the liver, it is metabolized by alcohol dehydrogenase and aldehyde dehydrogenase into formic acid, a metabolite responsible for toxicity by inhibiting the mitochondrial enzyme cytochrome c oxidase, compromising cellular respiration, and causing metabolic acidosis. The clinical picture is biphasic: initially, there is mild depression of the Central Nervous System, followed by a period of asymptomatic latency, evolving into severe metabolic acidosis, progressive visual disturbances, coma, and risk of death. Chronic intoxication, which is less common, can cause headaches, persistent digestive and ocular changes. Treatment involves removing the source of exposure, using antidotes (ethanol or fomepizole) under medical supervision, maintaining serum ethanol levels between 100-125 mg/dL, administering sodium bicarbonate, folic acid, and, in severe cases, hemodialysis. The prognosis depends on the speed of diagnosis and therapeutic intervention<sup>2,3</sup>.

Methanol ingestion, especially in leisure contexts and through the consumption of adulterated beverages, represents a serious public health risk, particularly due to neurotoxic effects that can lead to irreversible blindness. When correlating this scenario with interdisciplinary strategies, the importance of integrated healthcare teams in addressing conditions affecting the central nervous system becomes evident, highlighting the need for collaborative practices among professionals from different health areas to ensure effective, humane, and person-centered

interventions. Technical Note No. 04/2025, issued by the Epidemiological Surveillance Management of Florianópolis, warns about the increase in cases of exogenous methanol poisoning resulting from the consumption of adulterated alcoholic beverages. Methanol, used in the composition of solvents and fuels, has high toxicity and its use in beverages is prohibited, potentially causing blindness, multiple organ failure, and death. The document establishes the immediate notification of suspected cases and defines clinical criteria. In relation to a suspected case, these are: ingestion of alcoholic beverages associated with gastrointestinal or visual symptoms after 12 hours; in a confirmed case, the presence of severe manifestations, metabolic acidosis, positive serum dosage, or increased osmolar gap<sup>2-4</sup>.

Clinical progression ranges from mild symptoms such as headache, nausea, and blurred vision to severe cases, including coma, seizures, and permanent blindness. Recommendations include notification to Epidemiological Surveillance and the Poison Control Center (CIATox), laboratory tests (blood gas analysis, electrolytes, osmolarity), administration of ethanol as an antidote, correction of metabolic acidosis with bicarbonate, clinical support, and hemodialysis according to severity. Patients with mild symptoms should be hospitalized in a ward, while severe cases require admission to an Intensive Care Unit (ICU). The note also emphasizes the mandatory registration in the Notifiable Diseases Information System (SINAN), an official instrument of the Brazilian Ministry of Health, created to register, process, analyze, and disseminate data on diseases and conditions subject to mandatory notification throughout the national territory, including SINAN (ICD T51.1), and the integrated action of Sanitary Surveillance in the inspection of establishments that sell potentially adulterated beverages<sup>3-5</sup>.

The vulnerability of populations and individuals affected by methanol poisoning requires robust public policies, active health surveillance, and educational actions focused on prevention, inclusion, and the promotion of comprehensive health. Methanol poisoning represents a significant clinical problem that can result in permanent sequelae, such as blindness, constituting a physical disability that demands specific attention from health services. In this context, the care provided to people with disabilities must be guided by principles of accessibility, respect for functional diversity, and inclusion, with professionals properly trained to meet the different needs of patients, adapted environments, and effective communication strategies. Additionally, it is fundamental that public policies aimed at prevention and the promotion of comprehensive health consider the specificities of vulnerable groups, such as individuals with cognitive disabilities, who may be more susceptible to exposure to adulterated products due to barriers in understanding the risks involved<sup>4,5</sup>.

Inclusion must also be present in educational actions, ensuring that information is transmitted in an accessible and understandable way for all audiences. Therefore, the approach to methanol poisoning must transcend immediate clinical treatment, incorporating guidelines that ensure equity, accessibility, and social



inclusion, both in healthcare and in surveillance and prevention strategies<sup>6,7</sup>.

Given this complex context, this study aims to critically understand the impacts of methanol poisoning, emphasizing its effects on vision, as well as the repercussions for public health, consumer safety, and the inclusion of visually impaired people.

## Methodology

This study adopted a reflective article approach, based on a literature review, a method that allows for the critical and interpretative analysis of scientific evidence dispersed across different sources. The review was chosen for its ability to integrate studies with different methodological designs, including qualitative, quantitative, and theoretical research, enabling a multidimensional analysis of the topic. The methodological process was structured in interdependent stages: definition of the guiding question, systematic search in databases, selection of studies, categorization of data, critical content analysis, and interpretative synthesis of results<sup>8</sup>.

The central question that guided the investigation was: "What are the effects and consequences of methanol ingestion on eye health, and how can the actions of a multidisciplinary healthcare team and consumer safety policies mitigate these impacts?" To answer this, a search was conducted in the PubMed and Google Scholar databases, covering the period from 2020 to 2025. Keywords related to the topic were used, such as: "Methanol", "Multidisciplinary Healthcare Team", "Public Health", "Blindness", and "Consumer Safety".

Original articles, systematic reviews, and theoretical studies published in Portuguese, English, or Spanish were included, addressing the effects of methanol poisoning and its clinical and social repercussions. Publications not directly related to the topic were also excluded. Data analysis was conducted based on content analysis, in a critical-reflective manner, to foster questions and reflections on this new concern in public health.

## Results and Discussion

Leisure activities, when associated with the consumption of alcoholic beverages, constitute a moment of socialization and recreation; however, the ingestion of products adulterated with methanol poses a serious health risk. Even in small concentrations, methanol has high toxicity, potentially causing acute intoxication, multisystem failure, and irreversible blindness. It is not possible to distinguish methanol in the beverage at the time of ingestion. This situation highlights the need for surveillance policies, health education strategies, and awareness campaigns aimed at the population, especially the most vulnerable groups, to prevent severe consequences resulting from inappropriate recreational consumption. Leisure activities are associated with lower depression scores and higher scores in some dimensions of quality of life, such as physical and emotional functioning. The significant associations between leisure activities and anxiety scores, negative affects, and life satisfaction are findings that

Methanol ingestion can cause irreversible vision damage, with doses as low as 4 ml potentially resulting in permanent blindness. The estimated lethal dose ranges from 30 ml to 240 ml, depending on body weight and the speed of treatment. The toxicological effects of methanol include metabolic acidosis, central nervous system depression, and optic nerve damage, potentially leading to irreversible blindness. Studies show that ocular toxicity is one of the most serious manifestations of intoxication. Epidemiology reveals an increase in cases in regions with weak enforcement, with high mortality and incidence rates. Consumer safety is compromised by beverage counterfeiting, regulatory failures, and inadequate labeling. Healthcare teams have developed protocols for early detection, treatment with ethanol or fomepizole, and clinical and psychological follow-up of patients<sup>9,10</sup>.

People with blindness face significant challenges in interacting with their social environment. It is important to address the rights guaranteed to these individuals, seeking to identify strategies and solutions that promote their full inclusion, ensuring quality of life and equitable social participation, on an equal footing with other citizens. Emphasis is placed on the need for strategies that promote genuine interprofessional collaboration, aiming to improve the quality of care for alcoholics<sup>8-10</sup>.

In numerous reports of methanol poisoning, especially in the context of consuming adulterated alcoholic beverages, a high rate of neurological and ophthalmological complications is observed. In outbreaks recorded in Latin America and Asia, the mortality rate reached 30%, with more than 50% of survivors presenting permanent visual sequelae. Currently, the Brazilian Ministry of Health, in 2025, registered confirmed cases of methanol poisoning resulting from the consumption of alcoholic beverages. Methanol poisoning is considered a Public Health Event (PHE) and is reported to the Strategic Information Center for Health Surveillance (CIEVS). A Situation Room has been established to monitor cases, and guidelines are followed for states and municipalities to immediately report suspected cases<sup>11,12</sup>.

The Brazilian Law for the Inclusion of Persons with Disabilities (Law No. 13.146/2015) establishes rights and measures to promote the social inclusion of people with disabilities on an equal footing with other citizens. The legislation ensures access to fundamental rights and freedoms, guaranteeing full citizenship, and defines a person with a disability as someone who has long-term physical, mental, intellectual, or sensory impairments that limit their participation in society. The term "persons with visual impairments," as recommended by the World Health Organization (WHO) and the Brazilian Law for the Inclusion of Persons with Disabilities (Law No. 13.146/2015), also considers that leisure environments, such as bars and parties, can present significant risks when adulterated beverages are consumed. Individuals with visual impairments face significant social and psychological impacts from these events, which directly affect their quality



### Final Considerations

of life. This situation requires the coordinated action of multidisciplinary teams, offering comprehensive support to patients<sup>13</sup>.

In the field of public health, the need for the implementation of effective public policies becomes evident, encompassing the strengthening of sanitary surveillance, consumer education, and rigorous regulation of the alcoholic beverage market, with a view to preventing new episodes of methanol poisoning. Clinical recommendations point to the adoption of standardized protocols that favor early diagnosis and appropriate management of cases, contributing to the reduction of associated morbidity and mortality. Individuals with visual impairments, whether pre-existing or resulting from poisoning, require continuous monitoring, specific rehabilitation programs, and actions that guarantee their effective social inclusion.

Recent studies show that factors such as the type of leisure activity, socialization dynamics, and family context significantly influence patterns of psychoactive substance use, including alcohol, tobacco, and other drugs. Structured and supervised leisure environments demonstrate the potential to reduce the risk of exposure to toxic substances, while disorganized or unguided spaces favor experimentation and recurrent use. These findings reinforce the importance of preventive strategies aimed at promoting healthy habits, with an emphasis on education, supervision, and active family participation<sup>11-13</sup>.

Methanol poisoning, especially resulting from the ingestion of adulterated alcoholic beverages, constitutes a significant public health problem with repercussions encompassing clinical, social, and regulatory dimensions. The high ocular toxicity of methanol, with the potential to cause irreversible blindness, highlights shortcomings in sanitary control mechanisms and in the regulation of beverage sales, requiring the strengthening of public policies focused on epidemiological surveillance, product inspection, and consumer protection. In this context, the role of the multidisciplinary healthcare team stands out as essential for the comprehensive management of cases, from early diagnosis and clinical treatment to psychosocial support and functional rehabilitation of affected individuals. The interdisciplinary approach allows for a more effective and humane response, promoting the social inclusion of visually impaired individuals and ensuring respect for functional diversity. It is concluded that an interdisciplinary approach allows for a more effective and humane response, promoting the social inclusion of visually impaired people and ensuring respect for functional diversity. This reinforces the need for intersectoral strategies that articulate robust regulatory actions, qualified care practices, and public health promotion policies. Preventing methanol poisoning requires not only technical and regulatory measures but also a commitment to equity, accessibility, and the protection of vulnerable groups, consolidating an integrated and sustainable public response to this serious problem.

## References

1. Santa Catarina. Secretaria de Estado da Saúde. Diretoria de Vigilância Epidemiológica. Nota de Alerta nº 008/2025: intoxicação exógena por metanol associada ao consumo de bebidas alcoólicas adulteradas [Internet]. Florianópolis: SES/SC; 2025 [citado 2025 Out 14]. Disponível em: [https://www.dive.sc.gov.br/conteudos/notasalerta/2025/Nota\\_de\\_Alerta\\_008\\_2025\\_Intoxicacao\\_Metanol.pdf](https://www.dive.sc.gov.br/conteudos/notasalerta/2025/Nota_de_Alerta_008_2025_Intoxicacao_Metanol.pdf)
2. Agência Fiocruz de Notícias. Giro Saúde destaca intoxicações por metanol e uso de células da pele para gerar óvulos [Internet]. 2025 Out 3 [citado 2025 Out 14]. Disponível em: <https://agencia.fiocruz.br/giro-saude-destaca-intoxicacoes-por-metanol-e-uso-de-celulas-da-pele-para-gerar-ovulos>
3. Fundação Oswaldo Cruz. Metanol: intoxicação [Internet]. Rio de Janeiro: Campus Virtual Fiocruz; 2025 [citado 2025 Out 14]. Disponível em: <https://mooc.campusvirtual.fiocruz.br/rea/metanol-intoxicacao/>
4. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde e Ambiente. Departamento de Vigilância em Saúde Ambiental e do Trabalhador. Nota técnica conjunta nº 360/2025-DVSAT/SVSA/MS: orientações para atendimento e notificação de casos de intoxicação por metanol após consumo de bebida alcoólica [Internet]. Brasília, DF: Ministério da Saúde; 2025 [citado 2025 Out 14]. Disponível em: <https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/notas-tecnicas/2025/nota-tecnica-360-2025-intoxicacao-por-metanol.pdf>
5. Conselho de Secretários Municipais de Saúde de São Paulo (COSEMS-SP). Protocolo Metanol SP 10102025 [Internet]. São Paulo: COSEMS-SP; 2025 [citado 2025 Out 14]. Disponível em: [https://www.cosemssp.org.br/wp-content/uploads/2025/10/protocolo\\_metanol\\_SP\\_10102025.pdf](https://www.cosemssp.org.br/wp-content/uploads/2025/10/protocolo_metanol_SP_10102025.pdf)
6. Valle PRD, Ferreira JDL. Análise de conteúdo na perspectiva de Bardin: contribuições e limitações para a pesquisa qualitativa em educação. Educ Rev [Internet]. 2025 [citado 2025 Out 14];41:e49377. Disponível em: <https://doi.org/10.1590/0102-469849377>
7. Fonseca CSG, Voltarelli A, Silva WR, Andreazzi AG, Marquez DS, Silva JJS, et al. Estratégias interdisciplinares em saúde para crianças neurodivergentes. Glob Acad Nurs [Internet]. 2025 [citado 2025 Out 14];6(2):e474. Disponível em: <https://doi.org/10.5935/2675-5602.20200474>
8. Andrade NC, Subrinho LQ, Pinho LB, Santos MVF, Siqueira MM. Interprofissionalidade na atenção ao alcoolista: o olhar dos profissionais. Glob Acad Nurs [Internet]. 2024 [citado 2025 Out 14];5(2):e389. Disponível em: <https://doi.org/10.5935/2675-5602.20230389>
9. Dethlefs R, Naraqi S. Ocular manifestations and complications of acute methyl alcohol intoxication. Med J Aust. 1978 Nov 4;2(10):483-5. doi: 10.5694/j.1326-5377.1978.tb131655.x.
10. Brasil. Ministério da Saúde. Brasil registra 29 casos confirmados de intoxicação por metanol após consumo de bebidas alcoólicas [Internet]. 2025 Out 10 [citado 2025 Out 15]. Disponível em: <https://www.gov.br/saude/pt-br/assuntos/noticias/2025/outubro/brasil-registra-29-casos-confirmados-de-intoxicacao-por-metanol>



11. Brasil. Ministério da Saúde. Alerta sobre intoxicação por metanol em bebidas alcoólicas. Boletim Epidemiológico [Internet]. 2020 [citado 2025 Out 15];51(39). Disponível em: <https://www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/edicoes/2020/boletim-epidemiologico-vol-51-no39.pdf>
12. Voltarelli A, Sakman Gatto R, Estevão França C, Miranda C, de Arruda AL, Lima do Nascimento A, et al. Saturnismo: efeitos da intoxicação pelo chumbo em seres humanos. Glob Clin Res [Internet]. 2022 [citado 2025 Out 15];2(2):e33. Disponível em: <https://doi.org/10.5935/2695-4760.20220033>
13. Brasil. Lei nº 13.146, de 6 de julho de 2015. Institui a Lei Brasileira de Inclusão da Pessoa com Deficiência (Estatuto da Pessoa com Deficiência). Diário Oficial da União [Internet]. 2015 Jul 7 [citado 2025 Out 15]; Seção 1:1. Disponível em: [http://www.planalto.gov.br/ccivil\\_03/\\_ato2015-2018/2015/lei/l13146.htm](http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2015/lei/l13146.htm)

