



ASOCIACIÓN NACIONAL
DE
MÉDICOS FORENSES

Spanish Journal of Legal Medicine

Revista Española de Medicina Legal

www.elsevier.es/mlegal



FORENSIC MEDICAL CASE

Suicidal poisoning by sodium nitrite: A dangerous mode from Internet. In regard of a case



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Received 2 September 2022; accepted 23 October 2022

Available online 11 April 2023

KEYWORDS

Nitrites;
Methemoglobinemia;
Suicide;
Internet

Abstract A case of suicide by nitrites ingestion is reported: a young woman was found death into a car with various objects around her, such as a white powder bag labelled as “Sodium nitrite” and pills of lorazepam, acetaminophen and metoclopramide. The autopsy revealed signs compatible with methemoglobinemia and samples of blood, vitreous and gastric content were submitted to the Drugs Service of the National Institute of Toxicology and Forensic Sciences in Madrid, as well as the powder bag, the pills and other objects. The white powder was identified as sodium nitrite, and nitrites concentrations similar to other fatalities were detected in biological samples. The methemoglobin level was 80%. The existence of websites where suicide with nitrites and metoclopramide is described step-by-step, joined to the increasement of reports about these fatalities, alert us to a possible trend.

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PALABRAS CLAVE

Nitritos;
Metahemoglobina;
Suicidio;
Internet

Intoxicación suicida por nitrito sódico: una peligrosa modalidad en Internet. A propósito de un caso

Resumen Se reporta un caso de suicidio por ingesta de nitritos. Se trata de una joven que fue hallada muerta en un vehículo junto a una serie de objetos como una bolsa de polvo blanco etiquetada como “Nitrito sódico” y comprimidos de lorazepam, paracetamol y metoclopramida. La autopsia reveló signos compatibles con metahemoglobinemia. Se remitieron muestras de sangre, humor vítreo y contenido gástrico, así como la bolsa con polvo, los comprimidos y otros objetos al Servicio de Drogas del Departamento de Madrid del Instituto Nacional de Toxicología y Ciencias Forenses. El polvo fue identificado como nitrito sódico, y se detectaron

☆ Please cite this article as: García Caballero C, González del Campo Rollán V, Martínez González MA. Intoxicación suicida por nitrito sódico: una peligrosa modalidad en Internet. A propósito de un caso. Revista Española de Medicina Legal. 2022. <https://doi.org/10.1016/j.reml.2022.10.002>

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concentraciones de nitritos en las muestras biológicas similares a las de otras intoxicaciones letales. El porcentaje de metahemoglobina en sangre fue del 80%. La existencia de páginas en Internet donde el suicidio con nitritos y metoclopramida es detalladamente descrito, así como el aumento del reporte de este tipo de suicidios, alertan acerca de una posible tendencia.

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Introduction

Sodium nitrite (NaNO_2) is an inorganic compound in the form of a white or yellow crystalline water-soluble powder. It is basically used in the food-processing industry as a preservative, and in pharmacology it is used to treat cyanide poisoning.¹

In toxicological terms, nitrites together with other ions such as chlorates (ClO_3), aromatic amino and nitro compounds such as aniline or nitrobenzene; or local anaesthetics like benzocaine, belong to the group of agents that cause methemoglobinemia.² These agents oxidise the ferrous cation (Fe^{2+}) of haemoglobin to the ferrous form (Fe^{3+}), preventing oxygen from binding so that it cannot be transported to the tissues, causing hypoxia.

As well as high levels of methaemoglobin, which is considered to be lethal at levels above 70%,³ due to the resulting oxidative stress in the erythrocytes, these compounds are able to produce a subsequent haemolysis caused by the denaturalization of the structure of the haemoglobin.²

Accidental intoxications due to sodium nitrite within the context of food (water and food) have been widely

documented in the scientific bibliography.^{4,5} However, in recent publications several authors have warned of appearance of intoxications caused by suicide using this compound, and cases have been recorded in Canada,³ South Korea,⁴ the United States⁵ or Portugal.^{6,7}

We hereby present a case of suicide using sodium nitrite that occurred in Spain (in the Community of Madrid) in 2022.

Medical-forensic description

The Drugs Department of the National Institute of Toxicology and Forensic Science (Madrid), received biological samples from Madrid Legal Medicine and Forensic Science Institute of a 20 year-old woman found deceased in a vehicle. They were accompanied by implements found in a box next to the cadaver (a bag of white powder labelled "*sodium nitrite 100 g*", a bottle of water, a glass with white powder, fragments of the vehicle windows, 2 spoons and opened blister packs with 3 different types of tablets, labelled *stada 1 g*, *metoclopramida HC-10 mg* and *lorazepam 1 mg*) (Fig. 1).

The biological samples taken in the autopsy (peripheral blood, vitreous humour and stomach contents) were subjected to the following systematic toxicological analysis:

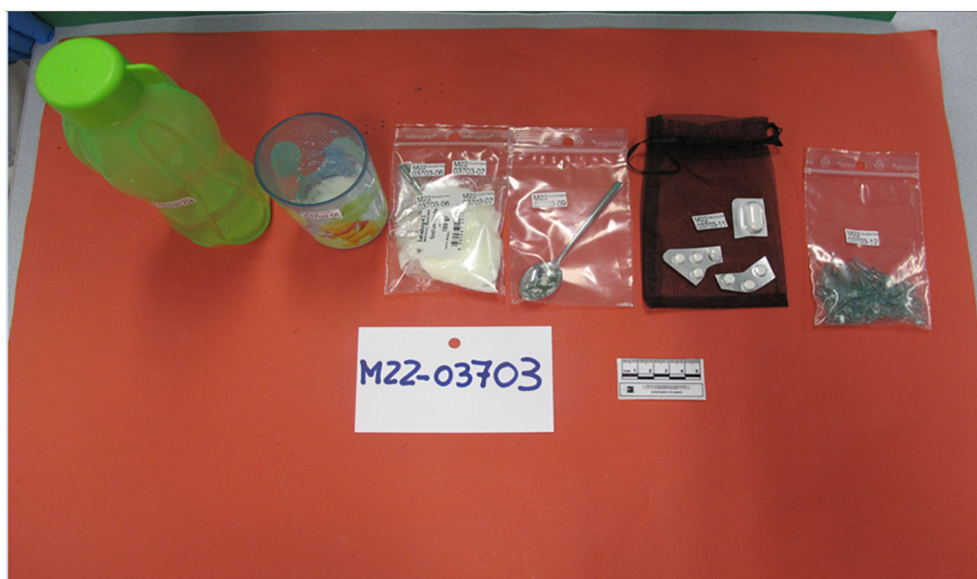


Fig. 1 Implements sent for analysis.

Table 1 Results obtained by the several techniques in blood, vitreous humour and stomach contents.

	Peripheral blood	Vitreous humour	Stomach contents
Nitrites (NO ₂ ⁻) (mg/l)	0.22	35	14,200
% Methaemoglobinemia	80	NP	NP
Lorazepam (mg/l)	0.02	ND	NP
Paracetamol (mg/l)	5.08	2.96	NP
Metoclopramide (mg/l)	0.24	0.05	NP

ND: not detected; NP: analysis not performed.

Analysis of volatile substances in the blood to determine ethyl alcohol by gas chromatography with a flame ionization detector (GC-FID-HS).

Analysis of organic toxins in blood samples and vitreous humour using high efficacy liquid chromatography coupled in tandem to a mass spectrometer (UPLC-MS/MS) in MRM (Multiple Reaction Monitoring) mode.

Analysis of nitrites in the blood, vitreous humour and stomach contents by ultraviolet-visible spectrophotometry (UV-VIS) after derivatization with Griess reagent (naphthylethylenediamine dihydrochloride and sulphanilamide).

Analysis of the percentage of methaemoglobin in the blood by ultraviolet-visible spectrophotometry (UV-VIS).

The results are shown in Table 1.

On the other hand, chemical analysis of the implements had the aim of identifying the nitrites in the white powder using Fourier transform infrared spectrophotometry (FTIR), which was positive.

The active ingredients in the tablets were confirmed by gas chromatography-mass spectrometry (GC-MS) as paracetamol, metoclopramide and lorazepam.

Lastly, the water in the bottle was analysed for nitrites using UV-VIS, showing a concentration of 0.47 mg/l. This falls within the legally established range for nitrites in drinking water (up to 0.5 mg/LL).⁸

Discussion

The preliminary report of the autopsy describes, among other aspects, a series of signs such as a chocolate blood colour, purple patches on inclined planes or oedematous lungs when cut. These signs agree with other cases of methaemoglobinemia.⁹

The concentration of nitrites found in the blood (0.22 mg/l) was identical to the concentration reported by Tomsia et al. in a similar case.⁹ The range of concentrations of nitrites in the blood in cases of lethal ingestion was set at 0.5–13 mg/l.⁷ Nevertheless, given that in the blood nitrites oxidize to nitrates, concentrations outside this range may be found in lethal cases.^{1,10}

The concentration of nitrites in the stomach contents is a revealing parameter. The level found in this case (14,200 mg/l) agrees with those reported by Durao et al. (16,000 mg/l and 8,800 mg/l, respectively).^{6,7}

The concentration in the vitreous humour does not seem to be a normal parameter in the study of nitrite

intoxications, even though this sample has a high water content (99%) in which nitrites are highly soluble. The concentration found (35 mg/l) may be compared to the level reported by Tomsia et al. (57.7 mg/l),⁹ concluding that these are similar values.

Respecting the percentage of methaemoglobin (80%), cases of lethal intoxication by nitrites have been described in which the said percentages varied from 33% to 90.3%.^{4,5} These percentages form a broad range of values, although they are high in all cases, given that normal levels of methaemoglobin are below 1%.³

However, the percentage of methaemoglobin in the blood may rise *post-mortem* due to a range of factors (sample storage time, temperature or the use of fluorides as preservatives), so that it is recommended that this indicator should be accompanied by the levels of nitrites in the blood and/or stomach contents, whenever this is possible.⁵

The drugs detected were found in concentrations that are considered to be therapeutic in isolation.¹⁰ Metoclopramide appeared in a similar case described by Durao et al., where the victim had acquired a kit through Internet which together with sodium nitrite included metoclopramide and ranitidine, used for their antiemetic and prokinetic effects.⁷ This form of suicide, combining nitrites and prokinetic agents, is described in detail in Internet forums as a method which is “easy, quick and painless”.⁶

The existence of this information in Internet, together with how easy it is to acquire sodium nitrite,⁴ are reasons why we understand that we should remain vigilant in the forensic world in case of an eventual proliferation of poisoning of this type.

Conflict of interests

The authors have no conflict of interests to declare.

Acknowledgements

We would especially like to thank the professionals of the Chemistry Department of the National Institute of Toxicology and Forensic Science (Madrid), for their decisive contribution to this case.

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