EVALUATION OF POISONING CASES BY HOUSEHOLD CLEANING PRODUCTS IN ESPÍRITO SANTO

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ABSTRACT

Household cleaning products are destined for cleaning and disinfecting homes. However, these products can cause harm if used incorrectly, leading to mild or moderate intoxications. The COVID-19 pandemic increased household disinfectants use in an effort to reduce or eliminate its transmission, resulting in cleaning products mixtures and excessive use of these products without any protection against intoxications. In this context, this study evaluated intoxications by household cleaning products in Espírito Santo. Data collection was performed through an online questionnaire. Most of the studied population is aware of household cleaning products risks and they have a high educational level. Although, they don't really know the signs and symptoms of intoxication and they do not take any safety measures to avoid poisoning. Thus, this study highlights the need to search more information about the correct use of household cleaning products.

Keywords: *Intoxication; Disinfecting Products; Household Cleaning Products; Espírito Santo.*

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1 INTRODUCTION

Disinfecting products are substances or preparations for the purpose of cleaning, disinfection, disinfestation, sanitization, deodorization and odorization (INSTITUTO NACIONAL DE CONTROLE DE QUALIDADE EM SAÚDE: NÚCLEO TÉCNICO DE SANEANTES, 2023; ANVISA, 2023). In times of COVID-19's pandemia, personal and surface's hygiene techniques were imposed by the World Health Organization (WHO) to avoid the disease spread (Vermeil *et al*., 2019). In this pandemic context, there were an increase in sanitizing products use and, thereby, greater risks of intoxication (Lima et al., 2020). Poisoning data from CIATox in Espírito Santo in 2020 shows clearly this scenario: 521 cases of household product's poisoning were reported, followed by 630 cases in 2021 and 720 cases in 2022 (TOXCEN, 2020; TOXCEN, 2021; TOXCEN, 2022).

Chemical products such as ammonia, bleach, mixtures of hypochlorite with ammonia, detergents, disinfectants, glass cleaners and cleaning sprays have been identified as possible causes of respiratory disorders (Carder *et al*., 2019). Studies indicated that the inhalation of potentially corrosive chemicals can trigger damage to airway tissues and even aggravate pre-existing injuries, and that daily exposure aggravates damage to the respiratory mucosa, causing inflammatory reactions and can trigger "irritant-induced" asthma depending on both the concentration and duration of exposure to these agents (Svanes *et al*., 2018).

A series of cases observed by Lin *et al.* 2022 verified poisoning clinical signs resulting from the inadequate mixture of cleaning solutions and disinfectants in China. These products contained diluted hydrochloric acid and sodium hypochlorite, which, when combined, release chlorine gas. Of the seven affected patients, one experienced severe symptoms, including significant bilateral pulmonary effusion and type 1 respiratory failure. The reaction of chlorine with airway fluid components can result in oxidative damage to the surrounding epithelium, as well as triggers an acute inflammatory response, contributing for additional lung damage. Reported symptoms included wheezing, dyspnea and pharyngeal discomfort associated with lung damage. Most patients had increased white blood cell counts and elevated levels of C-reactive protein, suggesting an acute inflammatory response. Six patients presented

hypoxemia, five showed bilateral pulmonary effusions and three patients demonstrated toxic lung injury (Lin *et al*., 2022).

Spray-based cleaning and disinfection products, which typically contain volatile solvents, fragrances, disinfectants, and surfactants, result in greater inhalation exposure than non-spray alternatives (e.g., liquids, waxes, or gels) (Clausen et al., 2020).

The main routes of exposure to household products include dermal, oral, ocular and inhalation, and exposure may occur through multiple routes. Symptoms may be related to the form of exposure, such as vomiting in case of ingestion, eye pain after contact with substances, skin burns due to dermal exposure and respiratory difficulty after inhalation. Most patients remain asymptomatic or have only mild symptoms (Elamin *et al*., 2020).

The interaction between some cleaning products and body tissues is mentioned in a study by Muhammad EMO Elamin (2019) where liquid and capsule soap in contact with the eyes and skin lead to skin irritation, burns, conjunctivitis, eye irritation/pain, vomiting, corneal burns, central nervous system depression, stridor, airway burns and gastric lesions. Although disinfectants, when ingested, can cause a burning sensation, inflammation of the oropharynx and vomiting, and in more critical cases can cause hematemesis, diarrhea and mental confusion, aspiration pneumonia, pulmonary edema, hypothermia, hypotension, convulsions, renal failure and coma (Le Roux, 2020). Thereby, the present study aimed to evaluate the knowledge of household cleaning products in the population of Espírito Santo.

2 MATERIALS AND METHODS

After approval by the Human Research Ethics Committee of the University Center of Espírito Santo (CEP UNESC) (opinion number 5,656,336 and Certificate of Presentation of Ethical Appreciation, CAAE, number 63058622.4.0000.5062), data collection was carried out between October 2022 and November 2022 involving people aged 18 years old or over living in Espírito Santo.

The estimated population of the state in 2022, according to the Brazilian Institute of Geography and Statistics (IBGE), was 3,833,712 people, which represents our studied population. Participants were those who volunteered to self-complete a virtual

questionnaire adapted from the literature (Schiffer, 2018). The questionnaire included questions about social characteristics (gender, age, level of education, relationship status, housing and occupation) and usage patterns and knowledge about cleaning products (substance used, frequency of use and knowledge about proper use and risks). The questionnaire was available through the “Google Forms” platform, sampling was done for convenience and the questionnaire was disseminated through social media.

It is a qualitative observational study. Quantitative data were organized and treated by descriptive statistics using the Excel® program (2016 version). Qualitative data were analyzed using Content Analysis in thematic mode (Gomes, 2007).

3 RESULTS

During the research, it was difficult to reach participants from all microregions of the state proportionally due to the limited scope of the dissemination and the short period of time for execution. Another obstacle was to avoid any bias, such as education and age. Given the used tool, it was necessary to have basic knowledge of computers, e-mail and cell phones. Most older people refused to participate due to their technological difficulties. It was also difficult to reach male participants proportionally to female participants, since women were more willing to interact with the research.

A total of 211 women and 89 men were interviewed, out of a total of 300 people with an average age of 29 years old (Table 1). These individuals are distributed across the four microregions of the state of Espírito Santo, the northwest region was the one that most of the participants where from and the south region the one that participated least (Table 1). Regarding relationship status, 43.3% claim to be in a stable union and 56.7% are single or do not have a stable union. Most of the population studied has incomplete or complete higher education (68.3%). The products most used by the participants were: detergent, chlorine-based products, disinfectant and washing powder, with chlorine-based products being the most used.

Table 1 - General characteristics of the study population (n=300).

Variable	Category	n (%)
Sex	Men	89 (29.67%)
	Women	211 (70.33%)
Age	Average	29 years
Microregions	Northwest	214 (71.33%)
	North Coast	30 (10.00%)
	Central	53 (17.67%)
	South	3 (1.00%)
Education	Elementary and High School	95 (31.7%)
	Incomplete Higher Education	93 (31.0%)
	Complete Higher Education	112 (37.3%)
Marital Status	Single / Widower / Separated	170 (56.7%)
	Married / Lives with Partner	130 (43.3%)

Source: The Authors (2024)

Among the individuals in the sample, 92.33% consider that exposure to cleaning products has risks to health and the environment (Table 2). Only 21.33% of women and 5.62% of men have jobs related to the use of household cleaning products (Table 2). Professions with direct contact with cleaning products were considered home cleaning assistants and chemical professionals such as: pharmacists, biomedical assistants, laboratory technicians, dental surgeons, nursing technicians, nurses, doctors and veterinarians.

Regarding the frequency of exposure to household cleaning products, 51.18% of women and 47.19% of men use household cleaning products every day (Table 2). Regarding the length of experience with these products, 56.40% of female participants and 51.69% of male participants reported having used them for more than 15 years

(Table 2). Despite the high frequency and long experience with the use of cleaning products, only 0.33% of all participants answered all questions about the correct use of household cleaning products correctly (Table 3). Most of the population did not know how to differentiate the symptoms related to poisoning by household cleaning products. This data may be related to the lack of specific information, as only 7.67% of individuals took a course or read an educational booklet on the subject (Table 3).

The lack of information may also be associated with other dangerous practices. Only 27.67% of the participants read the product labels (Table 3). Most of the participants said they did not use gloves to handle these products, with only 12.67% of participants stating that they did (Table 3). The practice of mixing products is carried out by 74.41% of women and 58.42% of men (Table 3). Among those interviewed, 37% said they buy illegally manufactured sanitizing products and 14.67% reuse beverage bottles to store them. In contrast, the majority of participants (91.67%) said they wash their hands after using household cleaning products, an important practice to avoid poisoning (Table 3).

Table 2 – Pattern of use of cleaning products according to sex (n=300).

Questions	Response	Women (n=211)	Men (n=89)
Frequency of cleaning product use	Every day	108 (51,18%)	42 (47,19%)
	Every two or three days	71 (33,65%)	27 (30,34%)
	Once a week	32 (15,17%)	18 (20,22%)
	Once every 15 days or more	0 (0,00%)	2 (2,25%)
Time of use and exposure to cleaning products	Between one and five years	23 (10,90%)	17 (19,10%)
	Between six and fifteen years	69 (32,70%)	26 (29,21%)
	For more than fifteen years	119 (56,40%)	46 (51,69%)
Do you work in areas associated with the use of cleaning products?	Yes. Cleaning/Home assistant	12 (5,7%)	2 (2,25%)
	Yes. Chemical professionals	45 (21,33%)	5 (5,62%)

Source: The Authors (2024)

Table 3 – Assessment of toxicological knowledge about household cleaning products according to sex (n=300).

Question	Response	Women (n=211)	Men (n=89)
Do you recognize the risks to health and the environment of cleaning products use?	Yes	197 (93.33%)	80 (89.89%)
	No	14 (6.67%)	9 (10.11%)
The distractor term 'salivation' was marked as a correct symptom of intoxication	Yes	110 (52.13%)	70 (78.65%)
	No	101 (47.87%)	19 (21.35%)
Correctly identified all symptoms of poisoning	Yes	0 (0%)	1 (1.12%)
	No	211 (100%)	88 (98.88%)
Claimed to handle household cleaning products with gloves	Yes	26 (12.32%)	12 (13.48%)
	No	185 (87.68%)	77 (86.52%)
Mixed cleaning products	Yes	157 (74.41%)	52 (58.42%)
	No	54 (25.59%)	37 (41.58%)
Bought homemade cleaning products	Yes	78 (36.97%)	32 (35.95%)
	No	133 (63.03%)	57 (64.05%)
Washed their hands after using these products	Yes	196 (92.89%)	79 (88.76%)
	No	15 (7.11%)	10 11.24%)
Stored cleaning products in reused beverage bottles	Yes	31 (14.69%)	13 (14.61%)
	No	180 (85.31%)	76 (85.39%)
Read cleaning product labels	Yes	58 (27.49%)	25 (28.09%)
	No	153 (72.51%)	64 (71.91%)
Took a course or read an educational book or booklet about household cleaning products	Yes	15 (7.11%)	8 (8.99%)
	No	196 (92.89%)	81 (91.01%)

Source: The Authors (2024)

4 DISCUSSION

According to the IBGE (2022), the total population of Espírito Santo is 3,833,712 people, of which 51.2% are female and 48.8% are male, and 20.8% are between the ages of 25 and 29. This study had a higher percentage of female participants and the average age among those surveyed was 29 years, with a greater proportion in the northwest region for the convenience of the study.

According to data from CIATOx-ES, after the start of the SARS-CoV-2 pandemic, there was an increase in poisonings by household cleaning products, with hypochlorite being the main poisoning agent. In 2020, 3.76% of poisoning cases were by household cleaning products. Most poisonings occurred accidentally and at work. Among those affected, 8.06% were between 20 and 29 years old. Cases of poisoning occurred mainly in people between 1 and 4 years old. There were 521 people poisoned by household cleaning products in 2020, of which 282 (54.13%) were female, 238 (45.68%) were male, and one (0.19%) patient had an undisclosed sexual orientation.

Sampaio *et al*. (2022) reported, in their research on the profile of poisoning caused by household cleaning products in Brazil between 2010 and 2019, that Espírito Santo was the state with the highest incidence of poisoning between 2016 and 2019, with 56% of those poisoned being female and 48% being male, and 72.62% of poisonings occurring accidentally. National statistics, indicated by CIATOx, showed a predominance (58.5%) of accidental causes, followed by suicide, reporting that for every 3 accidental cases there is 1 attempted suicide. Also, toxicological accidents are more prevalent in urban areas than in rural areas.

It is important to notice that 93.36% of the female population and 89.99% of the male population surveyed in this study are at risk of poisoning, as they do not truly recognize the poisoning by cleaning products, they often used illegally manufactured household cleaning products, they reuse beverage bottles and they mixed these agents.

The education level and age of the participants in this study may be associated with the research instrument used, as in order to answer the virtual questionnaire, participants needed to have basic computer and email skills. Also regarding education, 68.3% of the population surveyed had completed or incomplete higher education,

which indicates a well-educated population. However, despite of being educated and recognizing that household cleaning products have risks to health and the environment, they do not truly identify the symptoms of poisoning by these agents. Even with a high level of education, most participants in our study do not read the information contained on product labels.

A study conducted by Nascimento *et al* in 2021, with 100 residents of a neighborhood in São Paulo, sought to evaluate the behaviors associated with the handling of household cleaning products through interviews and indicated in percentages the household cleaning products most used by the population interviewed - disinfectants (100%), fabric softener (95%), bleach (83%), aerosol mosquito killer (68%), scouring powder (30%), anti-rat product (15%) and caustic soda (14%).

Jurquer (2021) also observed data consistent with ours, in which bleach and disinfectant are also the products most used by the population studied and that 12% of those studied read the labels of cleaning products. As well as 98% of participants claimed to be aware of the health problems caused by the lack of use of personal protective equipment.

5 CONCLUSION

Thus, this study shows that Espirito Santo's population do not seem to show strong concern about adequate protection when using cleaning products. Also, they are unaware of the toxic potential of mixing cleaning products.

The lack of clarity on the packaging information of household cleaning products also contributes as a significant risk to consumer safety. Confusing information or information written in small prints makes it difficult to understand the instructions for use and necessary precautions, increasing the likelihood of household cleaning products accidents, especially among the population with low levels of education.

Therefore, it is essential to promote education through public policies on the safe use of such products, highlighting the importance of reading labels and following the instructions of manufacturers of products regulated by ANVISA, as well as avoiding inappropriate mixtures, in order to prevent poisoning, strengthening population safety strategies.

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