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Epidemiological Profile of Cases of Hair Cosmetic Poisoning and Investigation of Risk Factors in Morocco (1981-2011)

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Abstract

Intoxications from cosmetic products are common incidents resulting from inappropriate or excessive use, whether accidental or intentional, through ingestion, inhalation, or skin absorption of substances present in cosmetic products. The aim of this retrospective study is to establish the epidemiological profile of hair cosmetic poisoning cases reported to the Moroccan Poison Control and Pharmacovigilance Center (CAPM) between 1981 and 2011. The results indicate a predominance of females (74.12%). However, 54.11% are adults, 20% are infants + toddlers, and 24.70% are adolescent children. Furthermore, 66.67% of them suffered from hair dye and coloring intoxication. On the other hand, a majority of 41% showed a slight risk or no risk at all. Another notable observation is that 39% of the victims have shown a moderate risk. Furthermore, it is worth mentioning that the fatality rate is 1.1%. Furthermore, there is a need to raise awareness among the public and the media about the dangers of using certain cosmetic products.

Keywords: Hair cosmetic products, Intoxication, Determinants factors, Lethality, CAPM, Morocco.

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1. Introduction

Intoxication from hair cosmetics can occur due to the presence of certain ingredients. These ingredients can have harmful effects on the body when absorbed by the scalp or inhaled. It is crucial to be aware of the ingredients in hair care products in order to avoid any potential intoxication [1]. The hair care products, such as shampoos, hair masks, and hair oils, are widely used to cleanse, enhance attractiveness, and protect the hair. These products contain various ingredients that provide different activities, such as gentle cleansing, hydration, softness, and shine. Nanotechnology has, also been applied in the development of hair care products, enabling targeted treatment of the hair shaft, hair follicle, and scalp. Nanocarriers, such as nanoparticles, cyclodextrins, liposomes, and nano-emulsions, have employed to address hair disorders and enhance hair health. Furthermore, there are cosmetic products for hair dyeing and bleaching that contain specific agents to achieve the desired results [2-4]. In a study conducted by Cara et al., (2022), a synthesis analysis revealed that, depending on the task at hand, hairdressers were exposed 4 to 78 times more than consumers to a wide range of hair cosmetic products used in their daily professional lives [5]. Ingesting hair dyes as a form of suicide is not common knowledge in the Western world, but it is prevalent in certain countries in Asia, the Middle East, and Africa, such as Morocco. There have been numerous reported cases of self-poisoning through the ingestion of hair dyes in these regions [6]. The objective of our study is to establish the epidemiological profile of cases of intoxication by hair cosmetic products and to investigate determining factors recorded at the Moroccan Poison Control and Pharmacovigilance Center (CAPM) between 1981 and 2011.

2. Materials and methods

2.1. Study Type

Retrospective study of cases of intoxication by hair cosmetic products reported to the Moroccan Poison Control and Pharmacovigilance Center (CAPM), over a 30-year period from January 1, 1981, to the end of December 2011

2.2. Moroccan Poison Control and Pharmacovigilance Center (CAPM)

The Moroccan Poison Control and Pharmacovigilance Center (CAPM) was designated as a World Health Organization Collaborating Center (WHO CC) for pharmacovigilance in 2011. This designation followed that of the WHO Collaborating Centre for International Drug Monitoring in Uppsala, Sweden (1978), and the University of Accra in Ghana (2010).

The official announcement of this designation was made during the Annual Meeting of National Pharmacovigilance Centers in Dubrovnik, Croatia.

2.3. Data Collection

Based on reports to the CAPM by healthcare professionals, the public, the media, and the scientific community, cases of intoxication are then documented on standard reporting forms after verification.

2.4. Data Processing

The data collected from the declaration forms were entered and coded in an Excel spreadsheet, enabling the creation of a General Database (GBD). This database was exported to a sheet in the SPSS software (trial version). Qualitative variables were expressed as frequencies in percentages, and quantitative variables were presented as mean ± standard error. The statistical test employed was the chi-square independence test with a 5% error rate.

3. Results

3.1. Distribution of intoxicated cases by age, gender, and origin

During the investigation period, a total of 90 poisoning cases caused by hair products were identified. The chi-squared test revealed a significant relationship between gender and age category (chi2 = 14.32; $p < 0.014$) (Table 1). This implies that there is a remarkable link between the two aforementioned factors. By examining the distribution of cases by age category, it was found that adults were the most frequently involved group, accounting for 55.2% of the total cases, followed by toddlers (17.2%), then adolescents (14.9%), and children (9.2%). It should be noted that a few exceptional cases of poisoning have involved an infant and an elderly person. It is worth noting that a clear predominance was observed in women, with a rate of intoxication cases reaching 74.12% (n = 63). Out of these intoxicated women, 78.26% (n = 36) were adults and 100% (n = 13) were adolescents. Furthermore, 98.7% (n = 74) of the reports came from urban areas, with the majority of them being women (77.78%) (Table 1). It is important to note that only one adult patient was from rural areas, which highlights the urban nature of the phenomenon.

3.2. Distribution according to the incriminated product

The Table 2 displays the distribution of the accused products based on age, gender, and place of residence. It is important to note that a significant portion of poisonings, particularly 55.6%, were attributed to hair dyes followed by lightening bleaches, which represented 21.1% of cases, while relaxers and shampoos accounted for 14.4% and 8.9% of cases respectively. The chi-square test reveals a remarkable correlation between the gender of the individuals involved and the specific product causing the intoxication (chi2 = 13.14; $p < 0.041$). It is interesting to note that 76% of the individuals who were poisoned as a result of using hair dye and colorants were female patients. Similarly, a large majority of 68.42% of individuals who suffered from poisoning due to whitening agents were also women. Moreover, out of a total of 13 individuals poisoned by a hair relaxer, 11 were women, which is noteworthy. Interestingly, it is worth mentioning that the 6 cases of poisoning resulting from the use of shampoo involved men. On the contrary, when examining the population of intoxicated individuals from urban areas, it appears that over half of them, or more than 50%, have been victims of poisoning caused by the use of dye or colorants. Furthermore, 21.62% of urban victims were poisoned by skin bleaching agents, while 16.22% were poisoned by a hair relaxer. Interestingly, a smaller subset of the urban population, consisting of 8 people, was poisoned as a result of using shampoo. Returning to the statistical analysis, the chi-squared test highlights a strong correlation between the age category of individuals and the specific nature of the product responsible for their intoxication (chi2 = 33.64; $p < 0.004$). Furthermore, among adults, 66.67% of them were suffering from intoxication caused by hair dyes and colorants. Compared to that, 16.67% of adults have been poisoned by the use of bleaching and/or whitening agents (Table 2). Regarding the route leading to intoxication, it is noteworthy that a significant majority of cases, particularly 78.05%, occur as a result of oral ingestion. This indicates that the most common route of intoxication is through the consumption of this substance. In contrast, a lower percentage of cases, around 17.07%, is attributed to the dermal route, where the substance is absorbed through the skin. It is interesting to note that only 4.88% of cases are related to inhalation, meaning individuals inhale the intoxicating substance. However, when examining specific cases of poisoning caused by dyes and colorants, a slightly different trend emerges. It is observed that 75.55% of these intoxications occur through oral ingestion, emphasizing the significance of this exposure route. Furthermore, 17.78% of cases involve absorption through the skin, while a small number of victims, specifically three individuals, are intoxicated through inhalation. Digging deeper into the analysis, it is worth noting that in cases of intoxications caused by lightening agents, 94.74% of cases occur through oral ingestion. This underscores the predominant role of this exposure route in such scenarios. In contrast, only one case of dermal intoxication has been reported. Focusing on other products, such as relaxers and shampoos, it becomes evident that oral ingestion is the primary mode of intoxication. The prevalence of this trend further emphasizes the importance of understanding the various pathways through which individuals can become intoxicated, as it allows for the implementation of targeted prevention strategies and interventions. The distribution of intoxications according to circumstances shows that 50% of cases were accidental, and 50% were intentional. Additionally, the chi-square test showed a significant association between gender and circumstance (chi-square=8.82; $p<0.003$). Indeed, in cases where intoxication is accidental, 60.97% are females compared to 29.03% males. However, in the group where intoxication is intentional, 89.74% are females.

3.3. Distribution According to the Circumstances of Intoxication

The distribution of poisonings based on the surrounding circumstances reveals an intriguing trend: 50% of cases were deemed accidental, while the remaining 50% were considered intentional (Table 3). Delving into the analysis, we employed the chi-square test, finding a significant association (chi-square = 8.82; $p < 0.003$) between gender and circumstances.

Specifically, in examining cases of accidental poisoning, 60.97% of victims were identified as females, while 29.03% were males, a relatively lower percentage. In contrast, for cases of intentional poisoning, 89.74% of the individuals involved were females. Expanding our inquiry, we directed our attention to another crucial variable: age. Once again, the chi-square test proved to be a valuable tool, revealing an exceptionally strong association (chi-square = 25.71; $p < 0.000$) between age and circumstances (Table 3). Examination of accidental poisonings showed that toddlers and adults faced these situations at relatively high rates of 38.46% and 41.02%, respectively. Conversely, in the analysis of intentional poisonings, the prevalence shifted towards adults, accounting for 68.29% of these incidents, with adolescents representing 24.39% of the cases. Our examination then expanded to explore the potential link between the specific product involved in the poisoning and the corresponding circumstances (Table 3). Once again, the chi-square test has proven its effectiveness, revealing a convincing association (chi-square = 16.45; $p < 0.001$) between these two variables. Interestingly, within the context of intentional poisoning, a significant majority of 73.17% was attributed to the use of dyes or tinting products. In comparison, accidental poisonings were mainly associated with lightening dyes or bleaching agents, each accounting for 34% of the cases. Moving on to another aspect of our analysis, we sought to examine the correlation between circumstances and the route of intoxication (Table 3). By using the chi-squared test again, we found a strong association (chi2=12.37; $p<0.002$) between these two factors. Impressively, over 59% of oral poisoning cases were considered deliberate, highlighting the intentional nature of these cases. On the other hand, the vast majority of skin intoxications, accounting for 90% of cases, have been deemed accidental. In the same way, the majority of inhalation poisonings, which accounted for 80% of incidents, were also classified as accidental. In summary, our comprehensive analysis of the distribution of poisonings based on various circumstances and variables has revealed several interesting findings. The connection between gender and circumstances, as well as age and circumstances, underscores the importance of considering these factors to understand the nature of poisonings. Furthermore, the association between the specific product involved and circumstances further emphasizes the need for targeted preventive measures. Finally, the correlation between circumstances and the route of intoxication highlights distinct trends observed in different poisoning modes. These results contribute to our understanding of the complex interaction between various factors related to the occurrence and nature of poisonings.

3.4. Distribution According to the Degree of Intoxication

The distribution of victims according to the degree of intoxication is illustrated in Figure 1. After analysis, it becomes evident that only 3% of individuals were exposed to a life-threatening risk, while 17% were exposed to a severe risk. In contrast, a majority of 41% had a minor risk or no risk at all. Another noteworthy observation is that 39% of victims exhibited a moderate risk. Additionally, it is worth mentioning that the fatality rate is 1.1%. Interestingly, among these statistics, 2 individuals were females, while only one was male. Furthermore, 80% of cases with severe risk were females. The three unfortunate deaths that occurred in cases of poisoning can be attributed to the use of lightening dyes, as well as dyes or bleaching agents. On the other hand, for individuals at severe risk, the products involved were primarily hair dyes and/or colorants. The individuals who tragically lost their lives were a toddler, a child, and a teenager. In contrast, among those exposed to severe risk, 80% were adults.

4. Discussion

The study we conducted is a retrospective investigation of cases of intoxication by industrial cosmetic products reported to the Moroccan Poison Control and Pharmacovigilance Center (CAPM) over a 30-year period from January 1, 1981, to the end of December 2011.

Table 1: Distribution of cases intoxicated by ED products, by sex and the variables “age categories and origin”.

Variables	Gender		Total	Khi² (P- Value)
	Female	Male		
Age group				
Infant	1	1	2	khi2=14,32* (p<0,014)
Baby Walker	7	8	15	
Child	6	2	8	
Adolescent	13	0	13	
Adult	36	10	46	
Elderly people	0	1	1	
Total	63	22	85	
Origin				
Rural	0	1	1	khi2=3,34* (p<0,05)
Urban	56	16	72	
Total	56	17	73	

*: significant difference at 5%.

Table 2: Distribution of intoxicated cases by product and origin, sex and age.

Variable	Modality	Incriminated product				Total	khi2 (p-value)
		Dyes and pigments	Bleaching agents	Hair relaxer	Shampoos		
origin	Rural	0	1	0	0	1	
	Urban	38	16	12	8	74	
Total		38	17	12	8	75	
Gender	Female	38	13	11	2	64	13.14 (p<0.041) *
	Male	10	6	2	6	24	
Total		50	19	13	8	90	
Age	Infant	1	0	0	1	2	33.64 (p<0.004) **
	Baby Walker	6	2	1	6	15	
	Child	3	4	1	0	8	
	Adolescent	6	4	3	0	13	
	Adult	32	8	7	1	48	
	Elderly people	1	0	0	0	1	
Total		49	18	12	8	87	
Route of poisoning	oral	34	18	6	6	64	8.54 (p<0.20)
	cutaneous	8	1	4	1	14	
	Inhalation	3	0	0	1	4	
Total		45	19	10	8	82	

*: significant difference at 5%., **: significant difference at 1%.

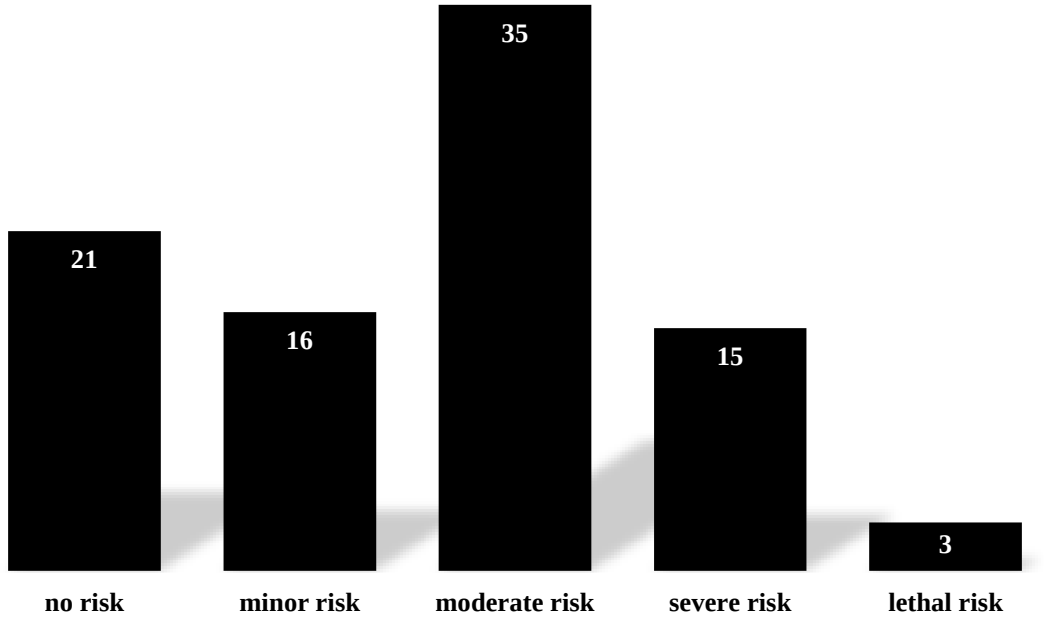

Figure 1: Distribution of victims by degree of intoxication.

Table 3: Distribution of intoxicated cases by circumstance and incriminated product, place of residence, sex and age.

Variable	Modality	Circumstance			Khi2 (p value)
		Accidental	Voluntary	Total	
origin	Rural	1	0	1	1.04 (p<0.31)
	Urban	34	36	70	
Total		38	17	12	
Gender	Female	25	35	60	8.82** (p<0.003)
	Male	16	4	20	
Total		41	39	80	
Age	Infant	2	0	2	25.71*** (p<0.000)
	Baby Walker	15	0	15	
	Child	4	3	7	
	Adolescent	2	10	12	
	Adult	16	28	44	
Total		39	41	80	
Route of poisoning	oral	25	36	61	12.37** (p<0.002)
	cutaneous	9	1	10	
	Inhalation	4	0	4	
Total		38	37	75	
incriminated product	dyes and pigments	14	30	44	16.45** (p<0.001)
	bleaching agents	13	5	18	
	hair relaxer	7	6	13	
	shampoos	7	0	7	
Total		41	41	82	

*: significant difference at 5%., **: significant difference at 1%. ***: significant difference at 1 %.

In this study, we selected hair products as the incriminated substance. Our objective is to describe the epidemiological profile and determine the risk factors influencing the life prognosis of intoxicated patients. Indeed, numerous studies have reported that hair dyes are causes of toxicity and multi-organ dysfunction [7-8]. The results obtained show a clear predominance among women, with an intoxication rate reaching 74.12% (n = 63). According to a study conducted by Ullah et al., (2023) and Dauda et al., (2023), women are more inclined to use various beauty products, such as hair dyes, which may contain toxic substances like lead, mercury, and arsenic [9-10]. The results show that 18.75% of the intoxicated cases were toddlers who were able to walk. This result was similar to that described by Gonzalez et al., (2019), confirming that cosmetic products are common causes of exposure, especially in children under five years old, and can lead to accidental poisonings [11]. According to Thessrimuang & Chaowalit (2016), the importance of cleaning products, including cosmetics, in pediatric poisonings has been emphasized [12]. On the other hand, Ryu et al., (2022) emphasized in his study the major risk of Intoxication caused by the prolonged use of kohl, especially in French-speaking countries [13]. These intoxications can lead to respiratory distress, laryngeal edema, trismus, carpopedal spasm, and toxicities associated with sodium EDTA [14]. In our study, the mortality rate is 1.1% and 17% were exposed to a serious risk. Furthermore, the route of intoxication of cosmetic products varies depending on the specific study. In our work, 81.33% of intoxications by cosmetics products applied to hair are through oral ingestion [15]. This is similar to the results mentioned by Bellaje et al., (2016) who reported that 95% of cases of poisoning from skin lightening creams were due to oral ingestion [15]. According to Nelms (2015), the use of cosmetics on the face and hair was through dermal absorption [16]. However, it is important to note that the specific route of intoxication can vary depending on the type of cosmetic product and its ingredients. Prompt management and supportive treatment can improve outcomes in cases of hair dye poisoning [17].

5. Conclusion

In light of these results, we were able to highlight the major role played by CAPM systems. This essentially focuses on the prevention and management of poisonings and the strengthening of notifications of cases of poisonings by cosmetic products. Furthermore, there is a need to raise awareness among the public and the media about the danger of using certain cosmetic products.

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