



OCCUPATIONAL EXPOSURE OF HAIRDRESSERS TO FORMALDEHYDE: A CROSS-SECTIONAL STUDY

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ABSTRACT

Objective: The use of formo in brazilian beauty salons is a public health problem. The Brazilian population currently uses the most aesthetic resources to improve their appearance. One of the most used areas are the so-called "beauty salons". These spaces have as main aesthetic treatment the hair care, where mainly women but also men use chemicals to make them more beautiful and desired. Among the chemical products used is the formol that has been causing eczema in hairdressers as well as in customers. The objective of this study was to investigate the occupational exposure of hairdressers to formaldehyde. The research was conducted in salons through visits and completion of specific forms, duly prepared to respond to research. It has actually been found that hairdressers are constantly exposed to chemicals, mainly to the formalin which has triggered the appearance of the following symptoms cough, rhinitis, skin eczemas among other symptoms. There was a need for educational campaigns to reduce occupational exposure to formaldehyde, as well as investment to increase inspection by the formal use of formaldehyde in salons.

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INTRODUCTION

In Brazil, the occupational exposure of workers is a public health problem with a large number of underreporting (BARBOSA et al., 2014). Among the various chemicals that exposes the worker is the formaldehyde used in the laboratory

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of anatomy, funeral, museums, synthetic fibers industry and beauty salons. Acute exposure to formaldehyde can cause eye, nose, throat and skin irritation while long-term exposure has been associated with certain types of cancer (eg sinonasal) as well as asthma (Daisey et al., 2003). Exposure to formaldehyde occurs in certain occupational settings (eg, embalmers, anatomists, morphological science teachers), but exposure through formaldehyde-emitting products such as particulate panels, urea formaldehyde insulation, carpeting and

furniture is more common (Garrett *et al.*, 1999). In the United States, the legal occupancy limit for short-term formaldehyde exposure (ie <15 min) is 2 ppm, and the long-term limit (ie > 15 min) is 0.75 ppm (Occupational Safety and Health Administration (OSHA) 2005). The risk of formaldehyde in its improper application is all the greater as the concentration and frequency of use is increased, being caused by the inhalation of the gases and the contact with the skin and is both dangerous for the professionals who apply the product, as for the users (JESUS *et al.*, 2012). Studies in laboratory animals confirm the carcinogenic effects of formaldehyde and most epidemiological studies in humans indicate effects of sensory irritation, toxicity, sensitization and cancer risk. Thus, some of the symptoms, when this pollutant is present, are ocular irritation; nasal discharge; nasal congestion; phlegm production; cough; lack of air; chest pain; Headache; fatigue; unusual thirst; difficulty sleeping; dizziness; diarrhea; skin rashes; and menstrual irregularities (GODISH 2004).

Formaldehyde is known as methanal or formic aldehyde. At room temperature it is in a gaseous state with a characteristic odor. Formaldehyde is a 35% aqueous formaldehyde solution containing in its formula methanol as a preservative against polymerization. It is a gas, also found in solutions, formalin - 37% to 50% 1. For some time I began to observe the hair professionals better and it was through some doubts and complaints that I decided to question these professionals about their real knowledge about the use of formaldehyde and which PPE's are used when handling this product (ANDRADE-FILHO *et al.*, 2001; MCGWIN *et al.*, 2011). Hairdressers are directly exposed to numerous chemicals in the workplace, including potential carcinogens, such as formaldehyde, a substance found in most of the products used in the hair straightening process. This exposure is cause for concern for the health of workers in view of the great exposure experienced by this class of workers, since it is directly linked to the performance of their profession the handling of these products containing formaldehyde present in most of these progressive brushes offered in the market. The risks of formaldehyde in its improper application are all the greater the greater the concentration and the frequency of use, and it is due to the inhalation of the gases and the contact with the skin, being dangerous for professionals who apply the product without protection and without the approval of the Brazilian health surveillance agency.

In recent years, in Brazil, hair salons have extensively used formaldehyde as a hair straightener in the so-called "progressive brushes" smoothing method that to achieve the desired effect must be done multiple times being used exhaustively and uncontrolled by the population (INCA, 2018). Although the National Health Surveillance Agency issued a ban on its use with this function, the technique continued to be used for a long time by beauty professionals, since there are no formaldehyde products authorized with the function of smoothing the hair, it is assumed that the same has been added to the hair at the discretion of each specialist (INCA, 2018). Considering the great exposure experienced by hair professionals to formaldehyde, where it is known that this product may cause damage to the human body and thus impair their quality of life, the importance of this research is emphasized in order to obtain a more complete knowledge about the the present study aims to identify the exposure to formaldehyde by hairdressers in the city of São Gonçalo do Amarante, Ceará and to identify if the professionals who

perform hair straightening procedures present necessary knowledge about the risks that these products can lead to when used improperly.

MATERIAL AND METHODS

An exploratory descriptive study with a quantitative approach was carried out. The exploratory research aims to familiarize itself with a subject that is still little known, little explored, providing a greater familiarity with the problem, with a view to making it more explicit (GIL, 2008). The research was carried out in salons located in the municipality of São Gonçalo do Amarante - Ceará, Brazil. The population consisted of 20 hairdressers and 15 salon assistants totaling 35 participants, with the following inclusion criteria: To be a professional hairdresser making use of formaldehyde, to be over 18 years old and exclusion criteria: Professionals who do not work with formaldehyde and under 18 years. The instrument used for data collection was a semi structured questionnaire, containing easy-to-understand questions and previously tested in a pilot study. This instrument was elaborated by the author based on the works of Freitas *et al.* (2007), modified by Cerqueira *et al.*, (2010) and a questionnaire was applied based on the work of ISAAC, FREITAS and ECRHS-BR (European Community Respiratory Health Surveillance) through self-reporting and stealth. The data collection was performed by a researcher previously trained to apply the questionnaire. This work follows the precepts of resolution 466/2012 and all participants signed the free and informed consent form, the work was approved by the ethics committee of the Federal University of Ceará - UFC (protocol No. CAAE 17931113.0.0000.5054).

RESULTS

Of the 24 professionals we observed that within the data of the research we have an age group between 40 and 49 years old where there are around 33.33% of the professionals hairdressers, therefore, with a more accentuated frequency of these professionals in this age group of age, thus demonstrating experienced professionals. Still observing the socio-economic data of the researched population, we found that 58.33% are married, 25% singles, 8.3% widows, 4.17% separated, and concubinage. Thus, we have in the population that was within the standards of inclusion of the research a greater constancy of married people, as we have a great majority of female people, we can conclude that the wives are contributing to the income of the family. These people in a proportion of 45.83% have income between 01 and 02 minimum wages and 54, 16% between 03 and 05 wages (Table 1). Therefore, we have a prevalence of the same proportion for the two wage bands. Thus, within these characteristics, we can affirm that earnings can vary from 788.00 to R \$ 3,940 reais, values that may vary depending on the clientele, the time available for activity, among other factors. It is good to point out that all this information is references to the population that was researched and included in the study criteria and this data can be verified in the following table: Looking at the last trait researched, we have a considerable number of professionals in the illiteracy situation, ranging from 4.17% to 8.3% of the population included in the survey. But where there is a greater presence of a level of schooling is present in the people who have average level, corresponding to 41.6%.

Table 1. Socio-demographic data

DATA	n	%
Age group		
16-19	02	8,33
20-29	07	29,17
30-39	06	25
40-49	08	33,33
50-59	1	4,17
Marital Status		
Married	14	58,33
Single	6	25
Unmarried	2	8,33
Divorced	1	4,17
Concubine	1	4,17
Rend		
1-2 Salary	11	45,83
3-5 Salary	13	54,16
Schooling		
Illiterate	1	4,17
Elementary School	3	13,41
High School complet	10	41,67
High School incomplet	1	4,17
Graduate complet	2	8,33
Incomplet Graduate	7	29,17

These indicators are important to understand the universe of action that is inserted professionals dealing with formaldehyde, since we have individuals with diversity of schooling, profitability, marital status and age, factors preponderant in the sense of understanding the risk situation. For example, a professional with an invoice of five minimum wages will most likely not use products that are more aggressive to health, since their clientele may be more demanding and more enlightened, and thus will be able to understand a risk situation more clearly. Among the main problems caused by exposure to formaldehyde by hairdressers we observed cough, asthma, sneezing, pharynx irritation and skin eczemas. Regarding the occupational exposure in relation to sex, the data obtained together with the beauty professionals of the studied area reveals the predominance of the female sex in the activities of hairdressers. There was no statistically significant difference between occupational exposure and sex (p 0, 699). In this way we can see that men and women are exposed in the same way (Table 2).

Table 2. Occupational exposure to formaldehyde in relation to sex

Sex	Exposure		X ²	P
	Yes	No		
Women	20	3	0,14	0, 699
Men	1	0		

It was observed that there is no statistically significant difference between the appearance of eczema on the skin and occupational exposure to formaldehyde, that is, exposure to formaldehyde is not a determining factor for the appearance of eczema in the skin, although formaldehyde induces this type of lesion (Table 3) (p0, 576).

Table 3. Relationship between the appearance of skin eczema and occupational exposure to formaldehyde

Exposure	Skin Eczema		X ²	P
	Yes	No		
Yes	2	0	0,31	0,576
No	19	3		

But contends, another factor must be clarified. Failure to detect eczema at the time of the survey does not guarantee that cases in the past have occurred and so few cases in the future may occur, since situations of this nature can occur in different time frames depending on the person and the degree of exposure in the skin. These injuries are not observed and hairdressers because formaldehyde is thinning in hair cream and by the use of procedure gloves that protects the skin. We have in table 03 one of the main factors that were explored in the research, where they refer to the level of knowledge about the exposure to formaldehyde and its consequences for the health of both professionals and clients. It was observed that there is no statistically significant difference between knowledge of risks and occupational exposure, that is, in this study knowledge of risks does not influence occupational exposure among hair stylists who use formaldehyde (p 0.576). Our studies corroborate with studies carried out in endemic agents that observed that there was no statistically significant difference between the factor knowing or not knowing the risk of occupational exposure (COSTA *et al.*, 2017).

Table 4. Relationship between occupational exposure to formaldehyde and knowledge of risks

Knowledge of risk	Exposure		X ²	P
	Yes	No		
Yes	16	1	2,33	0,126
No	5	2		

Understanding the risks involved in being constantly exposed to such a product is important, since we can have professionals who can perform functions almost daily depending on their clientele, thus having a considerable exposure to formaldehyde and its derivatives. Continuing the analysis of the factors obtained in the research we have the wheezing index or chest tightness due to exposure to the use of formaldehyde.

Exposure	Wheezing		X ²	Valor de P
	Yes	No		
Yes	4	17	0,685	0,407
No	0	3		

It was observed that there is no statistically significant difference between occupational exposure and the appearance of chest discomfort or wheezing among hairdressers who used formaldehyde (p 0.865) (Table 5).

Table 6. Hairdressers exposed to formaldehyde with respiratory symptoms

Exposure	Rhinitis		X ²	Valor de P
	Yes	No		
Yes	6	15	0,02	0,865
No	1	2		

In Table 6, we try to investigate a factor that can be observable regarding the exposure to formaldehyde. Rhinitis is one of the most common symptoms for anyone who is constantly dealing with chemicals such as formaldehyde. Being a nuisance that reaches the sandy ways, it is soon noticed when it begins to manifest itself through symptoms that are quite remarkable. When analyzing the situation of the researched population it

was observed that there is no statistically significant difference between the occupational exposure to formaldehyde and the appearance of rhinitis of $P = 0.865$.

DISCUSSION

Our results demonstrate that the occupational exposure of hairdressers to formaldehyde did not show statistically significant differences between the factors studied, perhaps these differences did not appear in the reduced sample, but we observed that the symptoms due to occupational exposure to formaldehyde are present in workers such as asthma, rhinitis, skin eczema, cough, allergic rhinitis among others. Among the main problems caused by exposure to formaldehyde are asthma. Asthma is an inflammatory disease of the airways characterized by episodic symptoms and a physiology associated with airway hyperresponsiveness, bronchoconstriction, cough and excessive mucus production. Studies carried out in the South of Brazil investigators found that 35.3% of the hairdressers presented cough, 8.8% expectoration, 73.5% burning or irritability in the upper airways (SPOLTI *et al.*, 2013). In our work we were only observed respiratory discomfort. These symptoms occur mainly due to the presence of formaldehyde in the smoothing creams. During brushing the formalin is exposed to high temperature releasing formalin vapors that cause respiratory symptoms. PIERCE *et al.* (2011) analyzed four products used in progressive brushing by gas chromatography and mass spectrometry. The result of the analysis of the creams was much higher than expected, with a variation of 3.0% to 11.5% of formaldehyde. The authors also sampled the air collected during the use of these four products in a salon in downtown Chicago and quantified the samples using HPLC and UV. Results were much higher than allowed. During the process there was a change from 0.08 ppm to 3.47 ppm during the smoothing process. In the present study, the researchers found that 34.87% of the hairdressers presented skin eczema characterized as irritation on the scalp accompanied by alopecia after the use of progressive brush with formaldehyde (MIYAMURA *et al.*, 2014). A French study demonstrated that the ingestion of 250 ml of formalin at 35% by a patient who attempted suicide orally presented mental confusion, abdominal pain, polypnea, Glasgow 8, congestive erythematopathic pangastritis, severe purulent ulcer with an erythematous bulboduodenitis. This type of manifestation is only observed through oral ingestion, in hairdressers the manifestations are dermal and respiratory such as eczema, rhinitis, sinusitis and cough (SORO *et al.*, 1997). In the city of Uberlândia, Brazil, a 31-year-old woman came to the hospital after a progressive brush. She had an allergic reaction to formaldehyde and reported symptoms such as headaches, swelling in the body and itchy scars (MAIWORM *et al.*, 2017).

In the Northeast of Brazil, a 13-year-old girl died of cardiorespiratory arrest after a progressive brush. In addition, the Federal University of Rio de Janeiro analyzed 12 samples of hair straightening cream, seven of them higher than the Brazilian Sanitary Surveillance (MAIWORM *et al.*, 2017, R7, 2013). Regarding the use of individual equipment and the knowledge of the risks of exposure to formaldehyde, our studies corroborate with the studies by Martins and collaborators (2012) that verified the low use of personal protective equipment (PPE) during the handling of pesticides. In this way we verified that the formol exposes the work has

carcinogenic potential but many Brazilian women stimulated by the beauty industry associated with the dream of marrying and improve its aesthetic aspect exposes its health to become more beautiful. In addition, in the interior of Brazil there is an expression "Live the luxury and die the stomach" where many women stop eating to be more beautiful investing their money in beauty and past hunger and others need to show a social pattern that is not yours reality.

Conclusion

It was found that the use of formaldehyde among hairdressers in Brazil is an uncontrolled public health problem, since the lack of human resources by the Sanitary Surveillance Agencies associated with uncontrolled sales and illegal obtaining of formaldehyde by beauty salon exposes women to adverse reactions. Such long-term reactions may lead to the appearance of neoplasia in the larynx of the hairdressers and scalp of the clients adept at the use of formaldehyde in hairbrushes. In this way, it is extremely important that the workers' health organs that are closest to the situation can act within this perspective, stimulating prevention to avoid further damage to such exposure, and this should be done by developing joint actions and seeking partnerships that aimed at protecting the health of hairdressers by setting essentially educational actions, stating the importance of the use of personal protective equipment and adoption of other care, so that the exposure of formaldehyde in the activities of hairdressers.

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