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TOXICOLOGICAL EXPOSURE IN MECHANICAL OFFICES: A CROSS SECTIONAL STUDY

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ABSTRACT

Occupational exposures to toxic substances constitute a relevant public health problem today. The objective of this study was to investigate the occupational exposure of mechanic workshop workers in Northeastern Brazil, particularly those related to chemical substances. An exploratory cross-sectional study with a quantitative approach was carried out. A semi-structured instrument was applied to 40 mechanic workshop workers. It was observed that the main chemical agents that the workers were exposed were: diesel oil and greases (42.5%), gasoline (20%), plastic mass (14%) and thinner (13%). The main symptoms of occupational exposure were: headache (42.5%) and burning eyes / nose (27.5%). It has been shown that headache and nausea due to exposure to gasoline vapors are the main symptoms of intoxication. As for personal protective equipment (PPE), only 25% used it. Thus, it is necessary to carry out health education campaigns with the purpose of stimulating the use of personal protective equipment in order to reduce exposure to solvents and chemical agents, thus avoiding occupational diseases.

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INTRODUCTION

In Brazil, occupational exposure to chemical substances is a public health problem with a large number of under-notifications and with public policies of initiation (COSTA et al., 2017; MARTINS et al., 2012).

The indiscriminate use of an increasing number of chemicals is growing and associated with environmental contamination has led to serious consequences for the public health system due to rising damage to human health (BARATA-SILVA et al., 2014). Under certain conditions, this occupational exposure may be hazardous to living beings considering the chemical characteristics of the toxic agent and organ affected. Even very low levels of exposure can lead to adverse effects in exposed

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populations, especially those that are more susceptible as low-income people and schooling (KIM *et al.*, 2017; MACHADO; MARTINS, 2018). In mechanical workshop several workers are exposed to various physical and chemical agents like gasoline, plastic mass among others. In addition to the physical hazards in which the mechanics are exposed, it is necessary to mention the chemical risks. The chemical risk is when the individual is exposed during the handling of chemicals that can cause physical damage or harm his or her health (MATHEUS & DAHER, 2009). Emphasis is given to chronic intoxication because of exposures to chemical substances from emissions of incomplete combustion of gasoline and diesel oil. In Brazil occupational exposure to organic solvents is a public health problem and lacking public policies as a prophylactic measure (DINIZ *et al.*, 2013). This lack of policies harms extensively as the exposure time increases. According to the Ministry of Health, the existing risks related to exposure to chemical substances are complex and require deepening for their contextualization because of the difficulties of correlating the dimensions with regard to, for example, the interaction between chemical agents and the body individual susceptibility (BRASIL, 2006). It is important to remember that the company is responsible as contractor for the implementation of preventive measures for accidents and work diseases for all employees of the establishment (LACERDA *et al.*, 2005a; LACERDA *et al.*, 2005b). However, monitoring should always be in place to ensure that employers are complying with the proposals established to promote quality in service.

The worker must be aware of the risks in which he is being exposed in such a way that he can allow his active participation in issues that provide his freedom to intervene and contribute to actions aimed at promoting the prevention of occupational accidents and diseases. Mechanical workshop workers, therefore chosen as the population for the study, are inserted in the environment of activities where there are chemical risks, providing important information so that we can know the reality of the exposure in which they are submitted. Considering their participation in the study, it is sought to contribute to actions that involve their health. Because activities that involve chemical risk are priority, it is necessary to recognize and analyze them to qualify the intervention in the defense of the health of the worker. In addition, there are a large number of informal mechanic workshops without registration throughout Brazil where there are no safety measures and use of personal protective equipment and even in legalized workshops there is no correct use of personal protective equipment due to lack of training or by ignorance on the part of the exposed professional. Therefore, the study seeks to describe occupational exposure and promote discussion, also due to the scarcity of work, demonstrating the occupational exposure to chemical risks in the northeast region. Thus, the purpose of this study was to demonstrate occupational exposure in mechanic workshop workers in the municipality of Icó-Ceará, Brazil.

MATERIALS AND METHODS

An exploratory cross-sectional study with a quantitative approach was carried out. The inclusion criteria were to live in the municipality of Icó, Ceará and to work in a mechanical workshop for more than 2 years. From the first informant, indicated in the first mechanic's workshop, the Known snowballs, generally indicated for a highly specialized population and of small number of members (Albuquerque and

Lucena, 2004). In this way, they indicated other people for the continuity of the interviews, and so on, adding up 40 interviewees. All participants signed the Consent form. The mean exposure time for each worker Mechanical workshop was 35 hours / week. There were no students with a history of smoking, respiratory or skin diseases in this study. The instrument used for the data collection was a semi-structured questionnaire, containing easy-to-understand questions, and previously tested and based on the studies of Freitas *et al.* (16) and modified by Cerqueira *et al.* (17). The basic team for data collection was composed of four researchers, previously trained for the application of the questionnaire. The analysis of the data was of the descriptive type, in order to determine the occupational exposure of the mechanic. The dataset was coded in Microsoft Excel and analyzed using Graph Pad Prism 6.0. This study was approved by the Research Ethics Committee of the Federal University of Ceará, UFC (17931113.0.0000.5054). Free and informed consent forms are signed by the interviewed, with an assurance of anonymity for students and university. Participants were instructed about the voluntary nature of this study and their freedom to stop participating or leave blank answers.

RESULTS AND DISCUSSION

The data are presented according to sociodemographic characterization, aspects related to occupation as well as chemical exposure.

Table 1. Distribution of sociodemographic variables of the professionals interviewed

Variables	N	%
Sex		
Men	40	100
Income		
minimum wage	16	40,0
1 Salary	19	47,5
2 a 3 Salary	5	12,5
Schooling		
First full degree	1	2,5
Complete high school	9	22,5
Incomplete high school	14	35,0
Incomplete graduation	08	20,0
Graduated	03	7,5
Illiterate	05	12,5
		12,5
Total	40	100

It can be seen from the data in Table 1 that 100% of the sample is composed of males, this highlights the predominance of this gender in what corresponds to these activities. Some studies have shown that men expose themselves to toxic substances more than they expose women (CERQUEIRA *et al.*, 2013) to toxic substances. Therefore, such male representation must be inserted in this type of activity. Women are involved in many activities in the labor market, but do not get the same proportion when related to men in this type of work. The minimum age of the participants was 20 years and the maximum of 42 years. The average age among the interviewees was 25 years. Demonstrating with this, a young population that inserts itself earlier in this labor market and with this spends more time exposed to the chemical risks existing in the environment of a machine shop. The income of the interviewees showed that 47.5% are of a one salary. However, there are still 5 (12.5%) who have income of 2 to 3

salaries. It is common agreement that there was a historical evolution of the minimum wage, initially the purchasing power was reasonably enough, in order to guarantee survival with a little dignity, with the impact of the economic reality, this situation has changed little, so it has been readjusting and allowing the acquisition of goods and products. As for the level of schooling, (35%) have a complete high school, and five have a university degree. It can be linked to the fact that these five have a higher income among those who only have high school. All interviewees work in mechanics and funneling and occupational exposure time varies from 4 to 12 hours per day. The extreme hours worked favors even more the presence of symptoms resulting from contact with chemical substances.

Table 2. Symptoms reported by workers through contact with gasoline

Sintomas	N	%
Headaches	17	42,5
Burning in the eyes / nose	11	27,5
Dizziness	07	17,5
Itchy skin	05	12,5
seasickness	05	12,5
Lack of appetite	04	10,0
Pain or ringing in the ear	03	7,5
Peeling off	03	7,5
Loss of smell.	02	5,0
	02	5,0
Total	59	100

When questioned about the symptoms that presented with the use of gasoline, 17 (42.5%) had headache and 11 (27.5%) had eyes / nose burning. According to HINRICHSEN *et al.* (2013), gasoline is the best known oil derivative, composed of different hydrocarbons, flammable and volatile liquids. Such organic substances in contact with the human body can cause various symptoms resulting from this exposure According to the International Agency for Researchon Cancer (IARC), incomplete combustion of both diesel and gasoline generates exposures to thousands of chemicals in the gaseous and particulate form. It is also worth noting that the emission of diesel engines is probably carcinogenic to humans, being classified in group 2A and, as possibly carcinogenic, that of gasoline engines, classified in group 2B (ANDREOTTI *et al.*, 2006). Of the respondents 03 (7.5%) reported pain or ringing in the ear, it is necessary to show that of all the physical agents that the worker of a mechanical workshop can be immersed, noise is the most frequent exposure, with both auditory and extra-hearing (AMORIM; CAVALCANTE; PEREIRA, 2012). It is evident that exposure is in this environment for a short time, so the workers of this activity who spend more time suffer the consequences of noise. In addition to the noise itself, in the scientific literature, is very clear concern about the effects of toxic agents in the system (ALVARENGA *et al.*, 2003).

Chemical substances, such as organic solvents, are present in various occupational areas and are inserted daily in the activities that are offered in mechanical workshops, posing a risk to the health of the worker, poisais substances have varied toxic characteristics, ranging from carcinogenic to ototoxic Only 0 5.0% interviewees reported loss of smell, and none presented a cough at night. In a study by Dellaméa *et al.* (2008) Among the professions that are exposed to chemical substances, mainly isocyanate and also to organic solvents, are the automotive painters, who are at risk of developing respiratory problems.

The results of the present study are consistent with the results obtained in the literature. The results of the present study are consistent with the results of the literature on the use of organic solvents in animal models. Therefore, corroborating with other studies, it is evident that headache and nausea due to exposure to gasoline vapors are one of the main symptoms of intoxication. VASCONCELOS *et al.* (2009) reports that the main signs and symptoms of intoxication are incoordination, hyperexcitability, visual disturbances, mental confusion, and as the present study headache and nausea, and although prolonged exposure causes central depression, respiratory disorders with exudative tracheobronchitis, edema pulmonary and pneumonitis, coma and death from respiratory failure. Thus, it is very important to evaluate the appearance of the first signs and symptoms resulting from exposure to the toxic pollutant, since they only occur several years after the workers are removed from the source of exposure (CERQUEIRA *et al.*, 2013).

Table 3. List of solvents and chemicals that workshop workers use in painting

Products	N	%
Diesel oil	21	28,37
Grease	19	25,67
plastic mass	08	10,81
Tinner Tin Ink	08	10,81
Alcohol	06	8,10
Varnish	06	8,10
Quick pasta	04	5,40
Catalyst	02	2,70
Total	74	100

In general, it was observed that 28,37% of the interviewees were exposed to diesel oil with 25,67% grease, 10,81% plastic mass and Tinner metallic paint, 8,10% alcohol and varnish, 5,4% quick past and 2,7% catalyst. Volatile organic solvents, such as benzene, toluene, xylenes, n-butanol and methyl isobutyl ketone are commonly found in the air during the painting process, from the release of organic solvents from fresh paint or used to dissolve or disperse paints, resins and polishes (DINIZ *et al.*, 2013). It is therefore shown that the increased exposure to this type of activity, in which they are incorporated into the services provided by such professionals.

Table 4. Occupational exposure to organic solvents and use of protective equipment

Use of protective equipment	Exposure to solvents		X ²	P Value
	Yes	No		
Yes	10	04	1,82	0,17
No	23	03		

In this study, personal protective equipment (PPE) is not used by all workers who are exposed to organic solvents, only 25.0% use it. There is no statistically significant difference in solvent exposure and use of PPE ($X^2 = 1,82, p = 0.17$). Emphasizing at that moment the level of schooling that may be correlated with this practice, since several studies show that the higher this level, the greater the understanding and disposition as the sensitization of problems that have intervention. The employer's obligation to make PPE approved by a competent body, at no cost to the employee, and to replace it whenever damaged or misplaced, is defined by Regulatory Standard 6 and 32, and EPI should not replace the search for the elimination or reduction of exposure to pathogenic biological agents and environmental and collective

measures (GALON, MARZIALE, SOUZA, 2011). However, it is important for workers to be aware of the risks arising from exposure to the chemicals they use in the service, because although it is the contractor's duty to provide the equipment for their employees, there is no diseases that may be caused by the non-use of such instruments. Therefore, studies that seek to establish the relationship of symptoms already mentioned in automotive workshops, also favor the search of public strategies in the prevention and orientation that effective the actions carried out in these occupational environments.

Conclusion

It has been found that there is a pattern of occupational exposure of workshop workers to organic solvents as well as the different chemical agents in which these workers are subjected in their activities and many clinical symptoms may be related to such exposures. The data show the relevance of the topic, since there is still much to be clarified mainly from an analytical and clinical point of view. Public policy-making to combat exposure to these chemicals is becoming evident. It is also noted the need to develop health education campaigns to encourage workers to use personal protective equipment and to make companies aware of their supply. Further research is needed to complement existing information gaps and contribute to a more in-depth understanding of the mechanism of exposure of workers to chemical agents present at work.

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