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Conditions of Work and Dermatitis in Workers Exposed to Chemical Risks by Cement

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Abstract

This research was carried out in order to identify the working conditions in workers exposed to cement in a cement factory in the city of Cartagena. Through different tools it was possible to carry out the diagnosis of the working conditions and to identify the hazards to which the workers of the company are exposed when being in direct contact with the cement; in this way it was possible to know that the dermatitis that were manifesting the workers has its direct relation with this chemical and therefore to be able to establish those measures tending to ensure the complete state of health of the workers. The type of research carried out is descriptive-qualitative, the applied methodology used as a closed questions survey tool, it was obtained as a result that 70% of the respondents did not use personal protection elements when handling cement, so can say that there is a considerable number of people exposed, which increases the likelihood that they may suffer contact dermatitis, through this the different preventive measures for working and health conditions among the employees of the cement company were raised.

Keywords: Cement, Working conditions, Construction, Dermatitis, Prevention, Health.

INTRODUCTION

Construction workers perform a variety of tasks related to the repair and destruction of buildings, bridges, dams, roads, railways and others [1]. These jobs can include mixing, pouring and spreading concrete, asphalt, gravel and other materials. Despite the increasing mechanization of construction and the more frequent use of prefabricated concrete sections, contact with wet cement still occurs, particularly in small jobs [2]. The above activities give rise to occupational diseases of the skin around the world, including occupational contact dermatitis, being the most prevalent and comprising irritant contact dermatitis [3].

While in Germany the consequences of not implementing adequate measures to prevent occupational dermatitis not only generate factors that affect the health of the worker, they also cause absenteeism and interfere in the normal development of work activities, negatively affecting productivity and As a consequence, the effectiveness and efficiency of the company will be affected, although contact sensitivity to chromate decreased from 43.1% to 29.0%, sensitization to epoxy resin increased from 8.4% to 12.4% among those worked under construction before 1994 and after 1999 with a significantly lower risk of chromate sensitization [4].

These chemicals are frequently found in the activities of the construction sector, because of their exposure is evidence of the harmfulness to human health through the effects it generates on the person, these damages can be reversible and irreversible, this risk can occur by a continuous and uncontrolled exposure to chemical agents, which gives rise to the appearance of diseases [5].

In this sense, it has been found the greatest number of affected in the Services, Agriculture, Manufacturing and Construction companies where the additional work with wet cement; epoxy resin; Hardeners; Acrylic sealants; Bitumen or asphalt; Solvents used in paints, glues or other surface coatings; gasoline; diesel; oils; fats; degreasers; scalers and detergents can also increase the risk of occupational dermatitis [6].

The economic consequence of occupational contact dermatitis is considerable and has an impact on the quality of life of an individual. There are a number of prevention strategies, including elimination or substitution of harmful exposures, technical control measures, personal protection, identification of susceptible individuals, education, training and health surveillance. Each has been shown to have varying degrees of success in reducing OCD, but more work is needed to evaluate the effectiveness of preventive measures in the workplace [7].

Cement is increasingly being used in the construction industry. It has been found that cement management is responsible for many cases of occupational dermatitis, early surgical diagnosis and coverage of these burns allows limiting the socioeconomic echo and reducing the risk of side effects for this population of mainly young and active patients. The need to reinforce precautionary measures with these users

sufficiently informed about the risks, the daily use of cement at work is a constant in the construction sector [8].

Cement burns have rarely been reported. The alkalinity of wet cement, abrasion by sand particles and prolonged contact due to wet clothing are relevant factors for cement burns. Although cement burns can produce full thickness burns and severe sequel, prevalence and severity are underestimated due to lack of knowledge of patients and physicians. It is concluded that occupational cement produces hand dermatitis among workers of the cement where the most common allergens among cement workers are potassium dichromate, thiuram blend, fragrance blend and cobalt chloride. The high positive rate of chromium hypersensitivity among cement workers reflects the urgency of regulating the addition of ferrous sulfate to cement [9].

High-risk occupations for the onset of dermatitis include health workers, hairdressers and construction workers. Often the latter are exposed to both irritants and allergens [10]. The average costs of health care for professional contact dermatitis amount to 724 euros for each worker served [11].

Dermatitis in workers exposed to cement is generated by exposure to cement in the execution of tasks and work activities within which requires the use of chemicals that can cause skin diseases in workers, demonstrating that dermatitis Occupational contact (OCD) is a common occupational disease affecting a variety of groups of workers [12].

The construction and public works sectors encompass many activities with multiple risks to the skin: exposure to cement, acids, solvents and paints, various adhesives and glues, including epoxy resins and other allergens, to wood (for carpenters, cabinetmakers and cabinetmakers); in addition, carcinogenic hydrocarbons affecting those working with asphalt in road construction and crystalline silica dust are responsible for contact dermatitis and scleroderma in masons, miners and potters [13].

Occupational dermatitis is caused by deficiencies in safety, such as non-use of Personal Protective Equipment (PPE), lack of supervision, information, instruction and training related to the nature of the health risk and precautions as well as cases of dermatological reactions due to exposure to chromium attributed to cement sensitization in Australia, which has considerable morbidity annually [14,15].

A cement company is a company that is dedicated to the construction of buildings, in which the main raw material is cement, this is a product that contains chemicals harmful to health, where continuous exposure can generate occupational contact dermatitis in workers, the affected organ is the skin6, which begins with a period of dryness and irritation accompanied by itching and pain, being even more severe if it is ingested [16].

At present there is a great diversity of problems due to exposure to cement which causes the appearance of contact dermatitis in the execution of the tasks and labor activities within which the use of chemical substances that can generate skin diseases in where the use of cement is widespread in the United Kingdom and warnings about burns caused by contact with the material are often printed on bags and delivery documents. However, about 2% of people admitted to burn units have injuries, many of them severe, caused by prolonged contact with moist cement [17].

The consequence depends on the route, the time of exposure and the toxicity of the chemical being used, the health of the worker becomes more vulnerable because of the chemical products because its use is increasing, nevertheless each time the controls to be established are more demanding [18].

Occupational dermatitis is defined as an inflammation of the skin caused by the work environment or by the contact of a harmful substance with the skin. It is one of the occupational diseases that constitutes a problem for the construction sector because some of the professions such as workers, masons, painters, plumbers have a higher incidence of dermatological contact problems caused by exposure to cement. Exposure to cement can produce two types of dermatitis: chronic contact dermatitis consisting of local irritation of the skin exposed to wet cement and allergic contact dermatitis which is a generalized allergic skin reaction caused by exposure to addition of water-soluble chromium found in most cements [19].

Workers most likely to develop such a disease are those who perform wet jobs (such as food handlers), toileting, handling solvents or those exposed to cement (masonry) and rubber [20].

According to the European Risk Observation Report, hand was the region of the body most affected by occupational dermatitis, with 80% of cases. Different studies have also found that hands are in the first place, with 28.4% among affected sites, suggesting that this may occur due to the lack of use of Personal Protective Equipment (PPE) [21]. In Greece, the prevalence of Occupational dermatitis is high contrary to all official reports of the Greek National Health Institute where skin disorders reached 33% of restoration workers, 35% of cleaners and construction workers [22].

Occupational skin diseases often have considerable medical and occupational consequences, whereas the cure of allergic dermatitis occurs in 27% and irritant dermatitis in 23% are reported as risk factors for dermatitis persistent professional contact, without changes in work, older than 45 years and male workers [23].

Mago in 2009 study the incidence rate of occupational dermatosis in cement factory was 3.7%, in addition, it was identified that of 100% affected by the disease, 70% did not react to allergens and 13% reacted to chromium, 5% to cobalt and another 7% to chromium and cobalt. Where the male

gender represented 100% of the evaluated ones, of which 86% of these presented skin pathologies and 14% of these showed occupational dermatosis [24].

Ahn & Kim (2010) [25] Until 1981, reported 2,222 cases of professional skin diseases in Korea, which were reported by the personal physician in the medical examination, accounting for 4.9% of all occupational diseases and since 1999 Korea Occupational health and safety (KOSHA) published the number of professional skin diseases through the statistics of Causes Investigation Industrial Events. In the interval of 1999 and 2007, 301 cases were reported.

According to Loaiza in 2014 [26], indicated that workers in the construction sector are at risk of contact dermatitis, among the exposure substances, cement was the main one, being 80.56%, followed by glue 11.11%, paint 5, 56% and diluent 2.78%. Being a mason was a risk factor mainly due to contact with cement. It was also related to the time of work in the construction sector with an average of 16.83 years and the history of dermatological pathology.

Nassiri et al. in 2016 [27] mentions the relation of the average age of the workers of 24.8 years (range, 19-34 years) with the dermatitis that affected exposed parts in 93.75% and the areas covered in 62 (RA: 20% 20%), epoxy resin (RA: 30%), cobalt (RA: 20% 20%), 5% and most common allergens such as chromate (relevant allergy / RA: 60% of workers evaluated patch) tiuram (RA: 10%) and black rubber blend (RA: 10%). Two cases (20%) had irritant contact dermatitis.

Construction workers who handle cement and suffer from irritant contact dermatitis as corrosive effects in a proportion of 7.8% with morbid skin conditions, frictional callosities on the palms of the hands and 4.3% with contact dermatitis. Other conditions included dry, fissured and scaly skin, infectious skin lesion, tinea cruris, lesion and ulcers on the hands and / or soles of the feet; skin conditions were common in the 20-25 age group, men with exposure for 1 year and those who work for longer hours. Half of the workers who did not use personal protective equipment had reported skin-related symptoms [24]. Exposure to cement is strongly correlated with increased prevalence of skin lesions and reduction of lung function [28].

Occupational dermatitis occurs when the structure of the skin is damaged or when the protective mechanisms are unbalanced due to external agents, which makes the disease visible through symptoms such as pruritus (itching) that can lead to signs of scratching , burning sensation in eczema, pain in the affected area and malaise [29].

Clinically, skin lesions have been observed in 51% of those exposed, with allergic reactions in 47% and an increase in antiretroviral immunoglobulin E (IgE) in 73%. In the respiratory aspect the result of spirometry was normal in 81%, obstruction in 8%, restriction in 10% and mixed pattern in 1% [30].

A recent study in Brazil found 3027 cases of occupational dermatitis in Brazil. In 61.4% of the cases, the patients were men aged 35-49 (39.6%). The etiological agent was chromium (13.9%). The most affected body was located in the hands, with 28.4% of the cases. The construction sector is involved in 28.7% of cases and domestic services by 18%. Allergic contact dermatitis is the most prevalent occupational dermatitis (20.6%) and the region with the highest number of notifications was the Center-West region, with 376.4 cases per million inhabitants [31,32].

Occupational dermatosis has a high incidence, with important medical and occupational consequences, in the construction sector 60% of these conditions were caused by cement being the hands the main area of the affected body in all the labor groups [32]. The cutaneous responses irritants and allergies represent the great majority of cases of occupational contact dermatitis [33, 34, 35].

METHODS

A descriptive-qualitative investigation was applied in collecting and analyzing data describing the situation on the exposure to cement and the condition of dermatitis among the workers of a cement company in the city of Cartagena de indias, Colombia.

Descriptions were made from observations that take the form of interviews, narrations, written records of all kinds, photographs, among others. The causes that caused the mentioned disease were known, which is important for the fulfillment of the general objective of this research, applied on a population of 30 employees, distributed in the operational area with direct exposure to the cement, which meet the criteria study.

The collection of information was done through a first approach with the workers exposed to the cement in order to motivate them to participate in the investigation, giving them know the objectives of the same. Then an interview and a questionnaire closed question was applied in the form of questionnaire on dermatitis due to exposure to cement in the company, we used primary collection techniques that allowed to collect directly through an immediate contact with the population exposed to cement.

The management of the information of the survey was carried out with closed questions to the studied population, allowing its quantification and statistical treatment. This process started when all the information obtained from the surveys was collected, where the data referring to each target variable was classified and the activities of validation and editing, coding, data entry, tabulation and statistical analysis were performed.

In addition, it was necessary to make a matrix of hazard identification and risk assessment, which allowed us to know the working conditions in the cement plant, where the

information process was given once the hazards found in the company were inspected and identified, then the risk was evaluated associated to each identified hazard, deciding whether the categories were acceptable or not and finally determining the controls of the risks or prevention measures prioritizing and intervening. After obtaining the information, an analysis was made and the results obtained were deepened. After this stage, results are delivered to management to find possible solutions.

RESULTS AND DISCUSSION

The companies are organized in processes according to the service or product they offer, which are made up of Activities and they are broken down into tasks, which are carried out, by the workers and where they find the different risks that can affect their health. A cement company its activity is the construction of a building, the processes that are part of this are: the process of structure, is in charge of building the foundation of the building, which has the activities of building pavement columns and plates; the masonry process is the one that is in charge of the placement of the materials, such as brick, installation of cement blocks, to make the towel and to install the pipes and this the process of finishes that is in charge of the facade of the place and to finalize Internal construction details The activities that accompany it are: veneer, installation of glass, paint and stucco and bathroom installation. Based on the implementation of the GTC 45 Matrix, it was possible to identify the processes, activities and tasks where the worker is most at risk from exposure to cement, effects and improvement options, which are shown in Table 1.

Table 1: Working conditions

Working conditions					
Process	**Activities**	**Task**	**Task causes of dermatitis**	**Effects**	**Improvement options**
Structure	* Building pavement * Columns * Beams * Plates	* Casting plates * Casting of columns * Casting of walls	* Misuse of cement mixer * Manipulation of cement mixture	* Dermatitis by contact with cement *Mucous membranes	* Procedure for the safe handling of chemical substances * Inspection of the use of Personal Protection Elements
Masonry	Masonry	*Towel	* Manipulation of the cement mixture powder	* Dermatitis by contact with the cement * Redness *Desquamation and aggregation of the skin	* Implementation of surveillance for the prevention of dermatitis * Know preventive measures on exposure to cement

It was evidenced that the manipulation of the cement in the construction of the building does not have sufficient controls in the accomplishment of the activities of constructing pavement, columns, plates and walls, which are part of the Structure process and in the activities of masonry such as realization of the task of braces; GTC 45 shows that these activities and tasks at their risk level are not acceptable or acceptable with specific control, which can trigger possible health effects of workers such as: redness and inflammation, dryness, peeling and skin irritation and the mucous membranes, with occupational disease as the worst dermatitis of contact.

On the other hand, it was elaborated from the closed questions survey, with the objective of obtaining more information on the actual conditions to which the workers are exposed to cement in the company Cement, the results can be observed in the following figure:

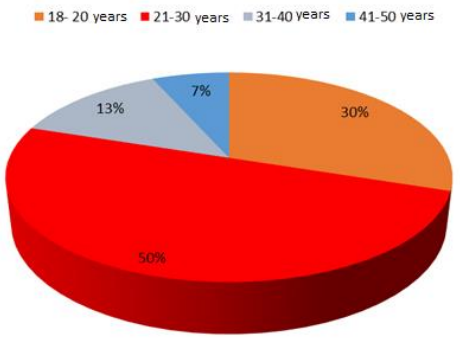

Figure 1: Age of population exposed to cement

Fifty percent of the population studied is between 21 and 30 years old, and 30% in a range of 18 to 20 years, which shows that this population is the most exposed to cement.

Mago (2009) [24] in his work titled "Occupational Dermatology in Workers of a Cement Company in January 2006 / May 2008", mentioned that the age groups most affected by dermatitis were aged between 34 and 41, 26 to 33 and 42 to 49 years, that is to say that the ages have the workers of each company, in this case, years. In addition it is pointed out that the main ones affected by dermatitis are men with 86%, whereas in women 14%, but this depends on the personnel hired, in the specific case of the company, there

were only men so all means of communication question says that it is man and therefore any risk that is affected are of that sex.

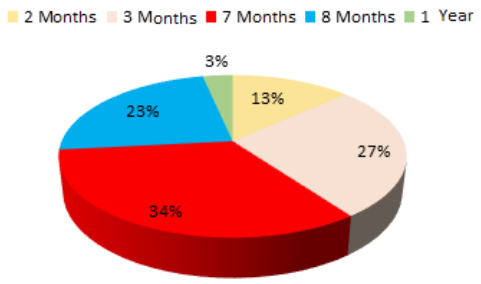

Figure 2: Monthly exposure of workers to cement

A 33.33% of the study population has been working in the company for 7 months, which means they are the most likely to develop occupational dermatitis.

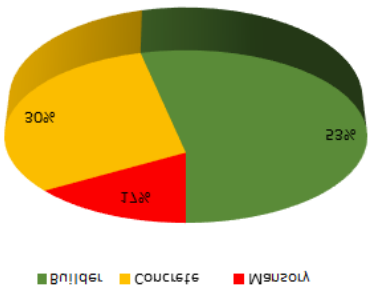

Figure 3L: Jobs exposed to cement

A 53.33% represents the bricklayer job, followed by 30% the concrete and finally with a 16.67% masonry. Thus, the positions that involve more contact with cement and may suffer from contact dermatitis are masonry.

A 53.33% represents the work of mason, followed by 30% of concrete and finally a 16, 67% of masonry. Therefore, positions involving more contact with cement and may suffer contact dermatitis son of masonry. Such as Ahn and Kim (2010) [25] It highlighted 2,222 cases of occupational skin diseases in Korea, accounting for 4.9% of total occupational diseases.

Loaiza (2014) [26], in his degree work titled "Risk Factors associated with contact dermatitis city of Loja conducted a case study divided into groups, one of which was composed of workers who had presented contact dermatitis: 24 masons, 3 welders, 4 electricians, 3 painters and 2 plumbers. Information was obtained from sociodemographic and clinical variables of interest by means of a questionnaire, all were given anamnesis and physical examination. The results of this investigation showed that workers in the construction sector are at risk of contact dermatitis, among the exposure substances, cement is the main one, being found in 80.56% of the population studied, where the cases which presented 27.78% acute phase contact dermatitis, 58.33% subacute phase, being the main characteristic of desquamation and 13.89% chronic phase with thickening of the skin as the main sign. It can be concluded that in this study there is a relation that with the question of the survey that shows that the job is directly related to the appearance of occupational dermatitis and both this research and Loaiza (2014) [26] show that the most risky position of suffering this disease is the one of the masons their contact with the Cement is permanent. 100% of the population studied work with cement, meaning that all workers are affected by exposure to cement.

Nassiri et al. (2016) [27] indicated that nickel sulfate was the most common allergen in patients. The disease activity was constant in 29.8% of the patients; increased by 27.8%, and declined just before performing the patch test at 42.4%. Of the patients, 52.3% worsened during weekdays. Occupational groups were significantly different in age and sex. The duration of the disease was also different in the occupational groups ($p = 0.001$). The shorter duration of illness was observed in health workers, and the majority of workers in service. Foot injuries were related to the period of employment.

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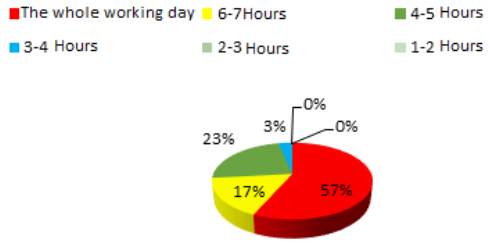

Figure 4: Workers exposed by cement handling in (hours / day)

The 56% of the population under study is exposed throughout the working day and 23% handles cement for 4 to 5 hours a day.

Question 3 tells of how long a worker has been exposed to cement for months, and in this case the hours he does, but the rationale for these two questions is the same as the worker's exposure to cement is proportional with the probability of occurrence of occupational dermatitis disease, but it can also be said that if no relevant measures are taken and continue to be exposed the disease will be more severe and less reversible as discussed in question number 4 Loaiza (2014) [26] mentions that the disease can be acute, sub acute and chronic.100% of the population surveyed stated that they had presented any symptoms of dermatitis on contact with cement.

The penetration of sensitizing substances such as chromium and other metals contained in the cement can cause an allergic eczema excessively. When sensitization of the individual to the allergen occurs because of prolonged and repeated exposure, the symptoms are redness, pain or cracking of the skin.[28]

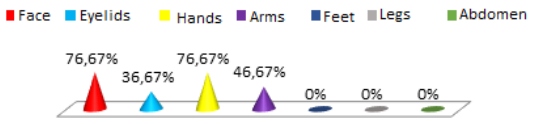

Figure 5: Parts of the body most affected by skin rashes due to exposure to cement

The studied population presented skin eruptions in 76.67% in the face and hands, other affections were in the eyelids with a percentage of 36.67% and arms with 46.67%.

The previous result depends on the PPE that the jobs use; in his grade work, entitled "Occupational dermatosis in workers of a cement company January 2006 / May 2008" obtained a questionnaire result, which showed that the pathologies of occupational dermatitis affected parts of the body of workers such as hands, forearms, respectively with a significant numerical reference.[24]In this research was also affected the part of the face for such reason should be taken into account this information in the formulation of different preventive measures.

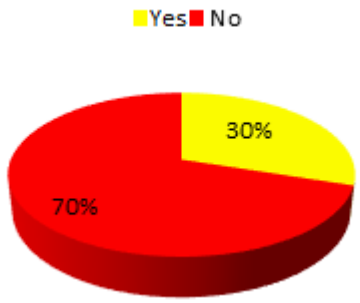

Figure 6: Workers who use personal protective equipment when handling cement

The 70% of respondents in this question answered that they do not wear personal protective elements when handling cement, which can be said that there are a considerable number of people exposed to cement, which increases the likelihood that they suffer from contact dermatitis cement. Nassiri et al. 2016 [27] mentions the relation of the average age of the workers of 24.8 years (range, 19-34 years) with the dermatitis that affected the exposed parts in the 93.75%. Indicating that the non-use of the personal protection elements is a trigger of contact dermatitis.

Figure 7: Workers who apply hygiene standards before and after being exposed to cement

The 66.67% of the population studied does not apply hygienic measures such as handwashing during and after the manipulation of cement, which increases the chances of causing occupational dermatitis. In the thesis developed by Heluane, Impact of preventive measures on the incidence of occupational contact dermatitis 2009, mentions the implementation of a prevention program with the aim of reducing the prevalence of contact dermatitis. The activities were supervised and supervised use of personal protection elements, modification of personal hygiene habits, education on prophylaxis and treatment of contact dermatitis.In the average obtained in this question shows that the majority of workers do not start hygiene either because of ignorance or lack of dedication is therefore the importance of the program of prevention of dermatitis due to exposure to Cement.

CONCLUSION

Based on the results obtained in this investigation, four major conclusions were drawn from this research. The appearance of dermatitis is directly proportional to the time of exposure to workers' cement, that cement components such as Calcium Oxide and Magnesium Oxide are the cause of skin lesions in workers causing the appearance of dermatitis, this occupational disease can be mitigated through a prevention program that includes training on the hazards to which workers are exposed, adequate use of cement, hygiene measures and adequate use of personal protective equipment, and since cement can not be substituted in the construction because it is the material with which the activities are carried out and there is no other product that has its same properties should also be taken into account decrease the worker exposure time.

In the same direction, the following recommendations are proposed: Incorporate a Cement Exposure Dermatitis Preventive Program to companies that have activities where they use this component since it cannot be eliminated. To carry out epidemiological surveillance in the labor activities

that are exposed to the cement in this way to control the number of cases that can present of the dermatitis. Implement training program to be carried out at the beginning of work for different knowledge and recommendations to workers on the effects of cement on health and how to prevent it, talks every 4 months as required and supervision of the use of personal protection elements. Medical labor entrance, periodic and discharge examinations. Revision by specialists (dermatologists) of workers with symptoms of dermatitis. Conduct audits on compliance with the implementation of the prevention program to know its level of effectiveness to mitigate dermatitis in workers exposed to cement.

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