Fundamentals of the knowledge about chemical additives present in rubber gloves

Fundamentos sobre o conhecimento dos aditivos químicos presentes nas luvas de borracha

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Abstract: BACKGROUNDS: One of the most frequent causes of allergic contact dermatitis of occupational origin are rubber additives, which are present in Personal Protective Equipment (PPE). The most allergenic additives of natural and synthetic gloves are thiurams, carbamates and mercapto group.
OBJECTIVE: To investigate the state of knowledge about the chemical additives used in the manufacture of synthetic rubber gloves.
METHODS: This was a qualitative research study in which professionals working in the manufacture, research, prescription and commercialization of gloves answered an open questionnaire.
RESULTS: 30 individuals were interviewed: 4 researchers in occupational medicine, 5 occupational physicians, 2 occupational safety technicians, a rubber workers' union physician, an occupational safety engineer, a production engineer of rubber gloves, 4 importers of gloves, a manufacturer of gloves, 3 businessmen who sell PPE, 3 salesclerks working in stores that sell PPE, 2 businessmen who own stores that sell products for allergic individuals, and 3 dermatologists.
CONCLUSION: Knowledge of the chemical composition of rubber gloves is scant. The labeling of gloves, with the description of their chemical composition, would facilitate choosing the best type of glove for each person. This low-cost action to businesses would be a gain from the standpoint of public health, with huge repercussions for users of rubber gloves.
Keywords: Allergy and immunology; Dermatitis, allergic contact; Dermatitis, contact; Dermatitis, occupational; Gloves, protective; Rubber

Resumo: FUNDAMENTOS: Uma das causas mais frequentes de dermatite de contato alérgica, de origem ocupacional, são os aditivos da borracha, presentes nos Equipamentos de Proteção Individual. Os aditivos das luvas natural e sintética mais alergênicos são tiurams, mercaptos e carbamatos.
OBJETIVO: levantar o nível de conhecimento em relação aos aditivos químicos utilizados na fabricação das luvas de borracha sintética.
MÉTODOS: Foi aplicado um questionário aberto a profissionais que trabalham com fabricação, pesquisa, prescrição e comercialização das luvas. Foi adotado o método de pesquisa qualitativa.
RESULTADOS: Foram entrevistadas 30 pessoas: 4 pesquisadores na área de Medicina do Trabalho, 5 médicos do Trabalho, 2 técnicos de segurança do Trabalho, 1 médico do sindicato de trabalhadores da borracha, 1 engenheiro de Segurança do Trabalho, 1 engenheira de Produção do setor de fabricação de luvas de borracha, 4 empresários importadores de luvas, 1 empresário fabricante de luvas, 3 empresários que comercializavam Equipamentos de Proteção Individual, 3 vendedores de lojas de Equipamentos de Proteção Individual, 2 empresários de lojas que comercializavam produtos para alérgicos e 3 dermatologistas.
CONCLUSÃO: O conhecimento da composição química das luvas é pequeno. A rotulagem das luvas, com a descrição da composição química, facilitaria a escolha do melhor tipo de luva para cada pessoa. Esta ação, de baixo custo para as empresas, seria um ganho, do ponto de vista da saúde pública, e teria grande repercussão nos usuários de luvas de borracha.
Palavras-chave: Alergia e imunologia; Borracha; Dermatite alérgica de contato; Dermatite de contato; Dermatite ocupacional; Luvas protetoras

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INTRODUCTION

Occupational dermatoses represent a significant portion of occupational diseases worldwide. We have observed that its social importance has increased due to improvement in detection. Etiologic diagnosis, in association with the activity performed by the individual, partly depends on the knowledge that the patients have about the products they use and their awareness about their own health condition and risks. It also depends on the knowledge that the physician who is providing assistance has.[1]

Occupational dermatoses represent from 13% to 34% of occupational diseases worldwide. Contact dermatitis represents from 4% to 7% of all dermatologic visits and of these, 50% are occupational contact dermatitis. The family and individual socioeconomic status of workers with allergic contact dermatitis is usually lowered. Individuals begin to experience financial difficulties that affect their health and psychological state. Countries such as the United States spend around 3 billion dollars per year on occupational skin diseases. Studies show that in the United States, Canada, Australia and other countries in Europe 5% to 10% of the population are allergic to rubber additives, and it has been observed that the increased use of personal protective equipment (PPE) is directly related to a higher incidence of allergic contact dermatitis. [2,3]

In Brazil there are no reliable statistical data on occupational diseases. Some of the reasons for this are lack of access to health services, self-medication and high levels of informal work. To further complicate things, there is the difficulty in establishing occupational etiological diagnosis and lack of notification. However, it is usually possible to identify which chemical substances cause occupational dermatosis. The ones that most often cause allergies are the additives used in the manufacture of rubber. [4,5,6]

This study aims to explore the social relevance of allergic contact dermatitis triggered by additives present in synthetic rubber gloves. Our objective was to investigate the state of knowledge about these additives by professionals who work directly with synthetic rubber gloves, either in research, manufacture, sales or recommendation of its use as PPE. This topic is important because skin diseases are a cause of workplace absenteeism. Moreover, if workers become ill, they can be permanently professionally disabled. [7,8,9]

MATERIAL AND METHODS

The objective of this study, which was "the understanding of the actual state of knowledge of each interviewee about the chemical additives used in the manufacture of synthetic rubber gloves," was achieved by means of qualitative research using questionnaires applied through interviews. Data was collected via personal contact with each interviewee through the application of a questionnaire. We interviewed 30 individuals with potential knowledge about synthetic rubber gloves and their chemical composition: 4 researchers in occupational medicine, 5 occupational physicians, 2 occupational safety technicians, a rubber workers' union physician, an occupational safety engineer, a production engineer of rubber gloves, 4 importers of gloves, a manufacturer of gloves, 3 merchants who sell PPE, 3 salesclerks working in stores that sell PPE, 2 owners of stores that sell products for allergic individuals, and 3 dermatologists.

In addition to the interviews, we contacted six synthetic rubber gloves manufacturing factories to request access to their production sector.

RESULTS

The types of synthetic rubber gloves described and known by respondents were nitrile, neoprene, butyl, Viton ® and Silver Shield. ® [10]

Protective glove testing for the issuance of the CA (Certificate of Approval) in Brazil include mechanical resistance tests and, in the case of sterile surgical gloves, microbiological assays, based on information from a researcher who works in the area of technological development.

Knowledge of most respondents is limited, as they do not know which chemical additives are present in synthetic rubber gloves. Physicians, occupational safety technicians, occupational safety engineers, production engineers working for a glove manufacturing industry and merchants, in general, had little practical and theoretical knowledge on the subject. This reinforces the findings of the literature.[11] Only the first two respondents who carry out research in the field of occupational medicine had extensive experience on the topic and could enrich the research. They reported that in recent years there has been a huge increase in the use of PPE; however, despite the fact that Brazilian legislation regulates the use of protective gloves, often what weighs more when a company chooses the type of glove they will buy is the presence of CA (Certificate of Approval), which is required by law for PPE and to determine costs.

Based on an informal conversation with a researcher, the authors of the present study were told that there had been no major changes in the chemical additives used in the manufacture of gloves in recent years. We were also informed that thiourea is an old allergen, but the increase in publications classifying thiourea as a major allergen, which is present in neo-

prene rubber, indicates that this rubber is being more widely used today.

The protective gloves that dermatologists are more familiar with are surgical latex gloves and gloves for household use.

Occupational physicians are trained to target prevention. They have a little more knowledge about the universe of protective gloves, but it is more theoretical. The gloves they recommend in case of allergy to natural rubber are PVC gloves (polyvinyl chloride). These physicians can have more access to workers. They state that many workers have reported difficulty making use of gloves continuously for many hours, complaining that the glove heats up and their hands sweat. If the skin is injured, it is difficult to wear gloves and manual dexterity is impaired; sometimes, the use of gloves reduces production.

The occupational physician who works in the area of labor issues concerning workers in the rubber industry states that these workers have other diseases, in addition to contact dermatitis caused by allergy to rubber additives.

Occupational physicians stated that the use of gloves for hand protection not always complies with pre-established scientific criteria. They agree that good quality, carefully chosen gloves will sell faster. The correct choice of gloves and the chemical substances used to manufacture them, the perfect finish of the final product, as well as knowledge and education of the worker who will use PPE are important factors for adhesion to the use of protective gloves and PPE. [12,13]

Salesclerks who work in stores that sell PPE and were interviewed by us did not receive training and information from their employer. The knowledge they had was passed on orally by more experienced coworkers. Their knowledge is informal and they only provide general information to the buyer.

The storeowner who sells products for allergy sufferers stated that she sold cotton gloves to be worn under rubber gloves when buyers reported that they were allergic to rubber. The researcher of this project explained that cotton does not offer protection, since the allergen could easily break the barrier and reach the skin. She advised it is best to use delicate vinyl gloves.

All the respondents, in a conversation that went beyond the scope of the survey, agreed that if PPE had a label indicating the chemical composition of the product, similar to what happens with food and drugs, it would be easier to recommend the best type of protective gloves to those sensitized to any chemical additives of rubber. The labeling of gloves is an act of citizenship that would not increase manufacturing costs. It would add value to the product, characterizing socially responsible marketing.

The author interviewed a production engineer working in the glove manufacturing industry who is also a member of an international organization that studies rubber gloves. She informed us that even abroad the identification of the chemical composition of rubber gloves is an issue that generates a lot of debate and is full of controversies due to fear of competition.

One of the respondents said that access to information is a right guaranteed by the consumer code, but this aspect of democracy and respect for citizens has not yet been considered in the manufacturing of protective gloves. Access to information, especially by manufacturers of synthetic rubber gloves, was disappointing. No company contacted provided us with manufacturing details.

DISCUSSION

The rubber present in gloves can cause different types of skin reactions. The use of gloves by susceptible individuals can trigger irritative contact dermatitis, late allergic contact dermatitis caused by vulcanizing agents or an immediate reaction. Of the five types of synthetic rubber gloves, nitrile and neoprene gloves are more easily found, whereas butyl, Viton® and Silver Shield® are harder to find because they are less sold and more expensive. Nitrile gloves are the most marketable. Silver Shield ® and Viton ® gloves are special gloves which have high resistance to various chemical substances, are used to protect against "hazardous" chemical agents or recommended when the professional is dealing with an accident with chemical substances and does not know the specific type of risk involved. Silver Shield® is a thinner, disposable glove that can be worn over another glove. [14]

The country that has conducted more studies on allergens is Japan, where they use chromatography to identify the chemicals in gloves. Sometimes they combine the chromatography and patch tests to investigate the possible causes of allergic contact dermatitis. [15]

Some researchers advise that when an individual is suspected of having contact dermatitis caused by rubber additives, but the patch test with a standard battery of patches is negative, thiourea may be the suspected allergen. [16, 17] A study of this population showed that this group presents a higher incidence of stomach and upper aerodigestive tract cancers when compared with the unexposed population.[18]

The choice of gloves is a complex act, assuming that there are several brands of rubber gloves available in the market, each with different chemical and physical characteristics. No glove is resistant to all types of substances. [19]

It is true that prolonged use of gloves has advantages and disadvantages, but in 1990 the author stated that this must be taken into consideration when choosing the type of glove that the worker will wear. [20] Studies show that dermatologists have little knowledge about the different types of gloves and about their selection criteria. [21]

It is important to consider that the best information on the chemical composition of protective gloves will always be given or should be provided by the manufacturer. A list of chemical substances may be provided by the toxicological records of the product. [22]

Today it is clear that the use of PPE has increased due to safety and health policies in the workplace, which are slowly advancing both with regard to entrepreneurs and workers.

All the respondents, in a conversation that went beyond the scope of the survey, agreed that if PPE had a label indicating the chemical composition of the product, similar to what happens with food and drugs, it would be easier to recommend the best type of gloves to those sensitized to any chemical additives of rubber. The labeling of gloves is an act of citizenship that would not increase manufacturing costs. It would add value to the product, characterizing socially responsible marketing. The benefits are enormous, ensuring that manufacturers sell only good quality products with labels specifying the chemical components used in the manufacturing process of the product and its indicated use for each activity, similar to a drug that comes with specifications about its chemical composition, adverse reactions, and indications of use so that the marketing is socially responsible and sales can increase. This will also guarantee that the product is approved by quality control agencies.

Employers can be glad to know that their employees are being offered a quality product which is comfortable, thus minimizing skin lesions and promoting the use of PPE for the hands, with an increase in workers' adherence to this equipment. In the end, this may result in lower absenteeism, increased productivity and healthier and more satisfied workers. [23] It is encouraging to see that some companies are beginning to listen to their employees. This is a positive thing that interferes with the entire chain. This change of attitude will benefit everybody – from the supplier who sold the product to those who will wear it and have better working conditions, to the employer who did not spend money on PPE only to meet his legal obligations. This might lower absenteeism. A study describing the experience of a company that had a high rate of hand dermatitis due to lack of adherence to the use of PPE proves this. The company invested in education and encouraged workers to choose the type of PPE that they considered most appropriate to perform their activities. The author explains that before the workers chose the best type of PPE, the work safety team had conducted previous research and selected the most appropriate PPE for the activity to be performed. Inviting the worker to take part in the selection of PPE caused an increase in adherence to the use of this equipment. Subsequently, the number of hand dermatoses decreased and the workers felt they were heard and co-responsible for the gains.

The Brazilian labor law regulates that companies should increase their investments to implement collective protection measures, that is, substitution of allergenic substances, change of machinery, etc. In the short term, while these collective measures are not implemented, the use of PPE is necessary. The rule refers to changes in the workplace, but what we see on a daily basis is the prolonged use of protective equipment, unlike what the law dictates.

The domestic manufacturer or importer should market PPE with technical instructions in the national language, guiding its use, maintenance, restrictions and other references of use. The Ministry of Labor is responsible for supervising and orienting the appropriate use and quality of PPE, among other things.

A study conducted by the Ministry of Labor involving manufacturers and buyers of PPE made a sad reality clear, which only confirms what physicians feel when they recommend the use of the most appropriate PPE for workers and/or their function. The result of this study shows that most manufacturers and companies that buy PPE are only concerned about complying with the legislation. The primary factor guiding the buying decision is the presence of CA, issued by the Ministry of Labor, and then cost. Comfort, lightness and better finish are often not taken into account. It is important to note that small details can interfere with comfort and they can either alleviate or intensify the daily torture of being forced to use PPE. [24]

Since many chemicals are used in the manufacture of rubber gloves, sometimes it is very difficult to identify which allergen is responsible for the allergy. In Brazil, physicians still rely on the patch test for guidance, but the patch test battery is limited because it contains only the most common allergens. With technological advances, every day new products are introduced in the manufacture of rubber. Therefore, even though batteries are constantly reviewed and updated, they will always be deficient. In addition to these factors, we must consider that this test depends on a rigorous training of the person who will administer it, the results take at least 96 hours and it can only be performed when the dermatosis is not in the acute phase. Research is being conducted and in the near future we can expect more technological

resources such as chromatography to identify the allergen in gloves and lymphocyte proliferation test, which can identify the antigen using patient serum. [25,26]

The production and consumption of natural and synthetic rubber have increased over the past years.[27] We can infer that contact dermatitis caused by synthetic rubber allergens has also followed this trend. Studies show that the prevalence of allergies to rubber additives and latex proteins has followed an upward curve, particularly after the 80s with the advent of AIDS, when, as preventive measures, rules to minimize the risk of contact with biological secretions were adopted. With this, there was increased use of gloves and allergic contact dermatitis caused by the use of PPE. Early and late allergic responses in health workers are becoming a public health issue. The use of gloves has also increased in the industrial and service sectors. [28] Workers in the civil construction and cleaning areas (including housewives) have more dermatitis caused by the use of protective gloves. Several studies have shown that the main rubber additives involved in triggering delayed hypersensitivity reaction are thiurams, carbamates and mercapto mixes. [29]

Brazilian law says that consumers have the right to know what they are buying or consuming. But this information is not provided by the industry. It is not available for physicians, researchers or the population that buys rubber products. Every chemical substance has a safety data sheet that provides information about the chemical agent, its properties, toxicity and conduct that should be taken in the event of an accident involving such substance. This information should be widely publicized. The entire commercial chain should have access to this information. Even companies should provide these data when requested by health services. Our level of democracy has not yet reached this stage. One way to grant universal access to information would be to label glove packages similarly to what is done with medicine and food.

Attempts to replace allergens with a higher potential for sensitization have been done; an example was the replacement of mercaptobenzothiazole with mercaptobenzimidazole. However, we have observed that the latter has also become an important sensitizer over time. Currently the reduction of the concentration of substances known to be allergens has been suggested. Another factor that hampers the substitution of a product that causes allergy for another that causes less sensitization is high cost. In Denmark, where recommendations of a number of committees have been accepted by European manufacturers, a carbamate (dibutyldithiocarbamate) with less potential to cause sensitization has been used to replace other allergens.[30]

Polysensitization to rubber components - thiuram, mercapto mix, carba mix – is commonly observed in the patch test. These groups of chemical substances are used to manufacture various products used in the workplace and in people's daily lives. This makes it difficult for a person who is allergic to rubber components to abstain completely from contact with these allergens. An individual allergic to any rubber component can be exposed to allergens via medicine, food, pesticides, etc. Today it is almost impossible for a person to spend a day without coming into contact with a product containing rubber substances in its composition. The study of chemical additives used in the manufacturing process of synthetic rubber gloves is important from a practical, economic and political standpoint. Practical because, as individuals become aware of the importance of using gloves to protect their hands, the use of synthetic rubber will increase and, as a consequence, more and more people can become sensitized to rubber additive allergens and to new allergens that may appear as technological changes are implemented in the manufacture of gloves. Economic because sales of gloves will increase; with the availability of good quality gloves the author assumes that the worker will adhere to the use of this PPE, the risks of accidents, hand diseases and absenteeism will decrease, etc., and political because guidance on the use of PPE is part of the Regulatory Norms that control the safety and health of workers in Brazil. In a democratic government citizens have the right to obtain detailed information about what they are consuming and using and which risks a particular product can pose. Therefore, the labeling of gloves with information about the chemical substances used in the manufacture of each type of protective glove is not only politically correct but, first and foremost, an act of citizenship.

CONCLUSION

The main additives with the greatest sensitizing potential used in both natural and synthetic rubber gloves are the Thiuram, Mercapto and Carbamate groups. This study points to the scant knowledge about the chemical substances used in the manufacture of rubber gloves. Therefore, better and wider dissemination of the chemical composition of gloves is need. A cheap way to do this would be to standardize a label with the description of the chemical substances present in each type of glove. ❑

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