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General Interest

Latex Glove Use by Food Handlers: The Case for Nonlatex Gloves

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ABSTRACT

There is increasing concern that continued exposure to latex products can predispose individuals, particularly those who are atopic (allergy prone), to latex allergy. Latex allergy as a serious hazard has been well documented in the health care industry. There are also well-documented cases of food handlers who have had allergic reactions after the use of latex gloves. The contamination of food with latex proteins by food handlers using latex gloves can also result in potentially severe allergic reactions in latex-allergic consumers. We review latex allergy and present the case for avoiding latex glove use by food handlers in the food and hospitality industries. Adopting the use of nonlatex gloves has benefits for workers, consumers, and the food industry.

Latex allergy is recognized as a serious problem among health care workers and patients. Some studies have reported that up to 25% of atopic (allergy prone) health care workers became sensitized to latex during the course of their work *(32, 35).* Similarly, children with spina bifida are reported to become allergic to latex because of early exposure to latex and multiple surgical procedures *(2).* In one such study, 32 (40%) of 80 children with spina bifida had levels of immunoglobulin E to latex of more than 0.7 kU/liter *(2).*

Other occupational groups experiencing an increased risk of sensitization with exposure to latex include janitors, construction workers, those in the sex industry, and food workers *(11, 48).* However, in contrast to the health care industry, latex allergy in other occupational groups has not been systematically studied. Here we review latex allergy and present the rationale for advocating synthetic gloves in the food industry.

LATEX PRODUCTION: HISTORICAL BACKGROUND

The rubber tree, *Hevea brasiliensis,* may have been discovered by early Mayan Indians. It was found again in Brazil in the 19th century. From there it was exported to the Kew Gardens in London in the 1880s, and then to Sri Lanka, Singapore, and Malaysia. Although the tree was not native to Asia, it thrived, and large tracts of rain forest were cleared for rubber plantations in the first half of the twentieth century.

Charles Goodyear, Nathaniel Hayward, and Thomas Hancock are credited with the discovery of vulcanization *(34)*: when the sap from the tree is heated, it becomes less sticky and develops the elastic properties that we associate with rubber.

Rubber manufacture is a complex process. The sap from the tree is first collected by cutting the bark, a task undertaken by workers known as rubber tappers. Ammonia is placed at the bottom of the collecting vessels to prevent coagulation. The resulting liquid latex is subsequently processed with the addition of multiple chemicals and heating. This allows cross-linking of the *cis*-1,4-polyisoprene rubber polymer, which is what gives the latex the characteristic elastic and tensile properties. Because of this complex process, latex products contain a large number of added chemicals as well as proteins from the rubber tree sap. Several of these proteins are the triggers for allergic reactions to latex *(43).*

THE ADVANTAGES OF LATEX

The use of gloves in surgery is a long-established practice to prevent infection of both the surgeon and patient with each other's pathogens. For surgeons, latex gloves have several advantages. The tensile properties allow freedom of movement. Latex gloves also have excellent tactile properties and are less prone to developing microtears compared with vinyl gloves with prolonged usage *(26).* Therefore, surgeons are less likely to be exposed to pathogens, particularly during longer operations.

THE DEVELOPMENT OF SYNTHETIC ALTERNATIVES

The major impetus for the development of synthetic rubber was the Japanese invasion of Southeast Asia in

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World War II. Rubber from these areas was no longer available to the rest of the world. As a result, many latex alternatives were developed to assist the war effort.

Synthetic alternatives to rubber gloves include neoprene and polymers such as polyvinylchloride. Nitrile gloves, which are increasingly used in some industries, appear to have tensile properties superior to those of vinyl gloves *(42).* One recent study assessing examination gloves found that nitrile gloves had fewer preexisting pinhole defects compared with latex gloves *(36).* In another comparison of puncture resistance and flexibility, nitrile gloves were found to be comparable to latex, although the latex gloves resealed more effectively after puncturing. These gloves were available at a reasonable cost and were considered a suitable alternative for those health workers who have sensitivities to latex proteins *(37).*

However, some alternatives to latex gloves have disadvantages. They are mostly petroleum based, and some brands are more expensive than latex gloves. Secondly, they may be less biodegradable, and incineration can produce toxic fumes *(7).* It is also important to note that some synthetic gloves may have latex, which is added to enhance the tensile properties of these products *(17)*; the risk for latex sensitization by hybrid gloves needs further investigation.

THE RECENT HISTORY OF LATEX ALLERGY

After the HIV/AIDS epidemic in the early 1980s, the Centers for Disease Control and Prevention issued guidelines for universal precautions to reduce the risk of transmission of the virus. As a result, there was a dramatic increase in latex glove usage *(44).*

By the mid 1980s, latex allergy was recognized as a major occupational hazard for health care workers and patients *(20).* As indicated above, up to 25% of atopic health care workers developed latex sensitization *(35).* Earlier studies identified increasing risk of latex allergy among susceptible children with spina bifida because of multiple operations and exposure to other latex products such as catheters *(2).* Recent data suggest that up to 10% of children with eczema are at risk of latex sensitization *(23).*

The explanation for the rapid increase in latex allergy is uncertain *(34),* but several possible explanations have been offered *(6).* Due to increased demand for latex gloves in the 1980s and 1990s, manufacture occurred in many poorly regulated latex factories *(6).* There is a suspicion that some of these manufacturers released large quantities of poor-quality latex gloves into the market because of the sudden commercial opportunity.

Second, there was a change in manufacturing location from areas where latex was used, to countries where latex was produced. Prior to relocation of these factories, liquid latex was transported in vats containing ammonia. This process took several months, and it may have enhanced hydrolysis of latex proteins *(34).* When there was a shift of manufacture to countries where latex was produced, the exposure time to ammonia was reduced.

Last, changes in latex processing and use of trees with high-latex yields may have contributed to the allergenicity of latex products. These possibilities are not mutually exclusive, as there are no systematic studies of the allergens in different latex glove brands before 1987. Increased usage *(34),* in addition to increased awareness and diagnosis, is likely to have contributed to the apparent increased burden of latex allergy.

Adverse reactions to latex can take several forms *(15, 46).* Type I hypersensitivity reactions occur when patients generate immunoglobulin E antibodies to latex proteins. Some of those patients sensitized can develop life-threatening anaphylaxis on re-exposure to latex. These individuals can be identified by skin or radioallergosorbent testing and in some cases, by latex challenge in specialized settings.

People with latex allergy are also at increased risk of reacting to certain foods such as avocados and bananas *(31).* This is thought to be due to cross-reactivity between chitinase, a defense-related protein in fruits, and the Hev b6 protein in latex *(44).* The allergenic proteins are structurally very similar, even though they are not botanically related *(8).* Other common foods that have been implicated in cross-reactions with latex proteins resulting in allergic reactions are kiwifruit, chestnut, potato, tomato, and papaya *(49).* There are reports of many other foods, which also have the potential to cross-react with latex.

Other people can develop type IV contact sensitivity reactions to latex *(19).* It is thought that these individuals react to some of the chemicals such as thiurams and carbamates, which are added during the latex production process. These patients can be identified by patch testing.

People who wear latex gloves are also at risk of irritant dermatitis caused by poor or excessive hand washing or not drying their hands before and after glove usage. It is very important to distinguish these different reactions, as both the prognosis and implications for prevention vary *(22).*

POWDERED LATEX GLOVES

The addition of cornstarch is a major risk factor for latex sensitization and allergic reactions *(30).* Cornstarch is added to make the donning of gloves easier in some contexts, e.g., the health care industry. It is thought that cornstarch particles become airborne and carry latex proteins, which allows sensitization via the respiratory tract *(3, 47).*

Studies have shown that the use of powdered latex gloves is associated with much higher levels of airborne latex protein *(4).* The most convincing evidence for the allergenicity of powdered latex gloves comes from a large study in Germany, in which reduction in use of powdered latex gloves was associated with a concomitant reduction in the reported systemic reactions to latex *(1).*

LATEX IMMUNOTHERAPY

Continued sensitization to latex can be prevented through the avoidance of latex exposure. There has been interest in latex-specific immunotherapy (generally involving periodic exposure to latex allergen by subcutaneous injection), although results for efficacy and safety from clinical trials have been inconsistent *(41).* There is a risk of significant allergic reactions during these procedures. Re-

TABLE 1. *Advantages and disadvantages of latex gloves and alternative synthetic gloves*

NRL[a] gloves		Synthetic gloves	
Advantages	Disadvantages	Advantages	Disadvantages
Reduced risk of transmission of viruses (HIV) High degree of puncture resistance Seal after puncturing Reasonable cost Good tensile properties	Irritant dermatitis caused by poor hand washing practices Susceptible individuals risk sensitization to latex proteins: after wearing latex gloves, after treatment by a health professional wearing latex gloves, by consuming food handled by a wearer of latex gloves	Reduced risk of transmission of viruses (HIV) Susceptible individuals are not exposed to latex proteins Similar cost to NRL gloves (nitrile gloves) Tensile properties similar to NRL	Irritant dermatitis caused by poor hand washing practices Less biodegradable than NRL gloves

[a] NRL, natural rubber latex.

cently an alternative to conventional immunotherapy has been investigated in Europe *(13).* The administration of latex allergen sublingually may offer reduced risk of adverse reactions; however, extensive clinical trials are still required to prove efficacy and safety *(33).* This form of immunotherapy is not approved in the United States *(13).*

HYPOALLERGENIC LATEX GLOVES

Latex proteins that trigger type I hypersensitivity reactions are not required for the tensile properties of latex gloves. Attempts are being made to degrade these proteins during the manufacture of latex products *(38).* The addition of alcalase may reduce latex proteins in gloves *(16).*

A 2-year study of the use of powder-free, low–natural rubber latex (NRL) allergen gloves identified improved satisfaction in healthcare workers, a large reduction (approximately 50%) in reportage of symptoms to NRL, and significant cost savings *(25).* This observation is supported by a systematic review suggesting the use of nonlatex gloves prevents sensitization in health care workers *(28).*

There is still considerable variation in latex glove quality *(21, 24).* In a survey of gloves used by health care workers for either examination or surgery in Singapore *(24),* examination gloves had higher NRL allergen content than surgical gloves had *(24).* These data highlight the problem with variable glove quality. A summary of the advantages of nonlatex gloves over latex gloves is presented in Table 1.

Assessment of allergenic material in gloves may be possible, and cutoff levels have been investigated *(39).* Large-scale, long-term studies may be needed to quantify risk of sensitization, based on NRL allergen levels in gloves. Levels of NRL allergenic proteins are currently not routinely stated for gloves. As all latex gloves are potentially allergenic, the U.S. Food and Drug Administration, Center for Devices and Radiological Services does not allow the use of the label ''hypoallergenic gloves'' on any latex products sold in the United States *(14).*

Because of the significant increase in the occurrence of latex allergy, several U.S. hospitals are actively pursuing a latex-free policy *(9),* even though latex may have some advantages over some varieties of synthetic gloves for surgeons.

WHAT ARE THE RISKS FOR THE FOOD INDUSTRY?

Glove use is common among food handlers to prevent pathogen contamination of food. With increased exposure, there are greater risks for both handlers and consumers of developing latex allergy. Several case reports of severe reactions to latex in chefs and other food handlers have been documented *(27, 45).* These workers, particularly those who are atopic, may be at increased risk of latex sensitization and allergy. One Spanish study suggested that latex allergy might be as common among food workers as health care workers *(48).*

In addition to the occupational safety and health risks for food workers using latex gloves, there is mounting concern that food consumers with latex allergy are at increased risk of allergic reactions. Food contamination with latex proteins from gloves can occur during processing or food service practices. One study demonstrated that cheese handled by a worker wearing latex gloves had significant levels of latex proteins *(5).* In a case study of a child who had an anaphylactic reaction after consuming a doughnut, latex proteins were identified as the trigger *(8).*

While establishing cause and effect in such instances is challenging, the role of latex as an avoidable food allergen justifies precautions similar to those being taken in the health care industry.

The U.S. Food and Drug Administration convened in a meeting in 2003 *(12)* to examine the evidence that latex allergens from food handlers' gloves could trigger allergic reactions in susceptible consumers. It was accepted that there was a risk, albeit slight, of such reactions. The panel called for further studies including double-blind threshold studies to determine the level of risk to consumers. We have not been able to identify any studies that have examined the threshold of transferred latex allergens that might cause allergic reactions in susceptible consumers.

POLICY RELATING TO GLOVE USE

The marginal advantages of latex gloves in the health care industry are not applicable to the food industry. In contrast to surgeons, the barrier and tensile properties of latex are less critical for food workers. Policies on the use

of gloves in food handling have evolved more from a sense that ''glove use results in safer food.'' The development of safe food handling practices throughout food manufacturing and food service industries should incorporate the principle of hazard analysis and critical control point system. This approach identifies microbiological, physical, and chemical hazards across the spectrum of the food production and distribution pathway and implements control measures to reduce these risks.

The Codex Alimentarius (an international food standards code) does not include guidelines for the use of gloves by food handlers *(10).* A number of issues have been identified by the U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition for the appropriate use of gloves as a barrier to bare-hand contact with ready-to-eat food. These include adequate hand washing before and after wearing, the type of material used in the glove and its durability *(18).* In the absence of specific policies discouraging the use of latex gloves, food safety control plans need to consider the hazard of allergic reaction among latex-allergic consumers exposed to latex-glove-handled food.

Policies relating to glove use must also consider the availability, cost, and biodegradability of glove components, and ensure that recommendations do not put at risk the basic tenets of food hygiene. In particular, clear messages regarding the appropriate handling of foods and use of barrier protection where relevant should remain paramount. An intervention study from a food court in Victoria, Australia, has shown that food handling practices can be effectively managed to minimize the use of latex glove while still safeguarding good food hygiene procedures *(29).*

Because of increasing concern, the Centers for Disease Control, National Institute for Occupational Safety and Health has recommended that workers in the food industry use synthetic gloves *(40).* Several U.S. states such as Oregon have banned latex glove use in the food industry. The major impetus for this has been an increase in workers compensation claims related to latex allergy. Others such as New York require signage indicating that latex is being worn by food workers.

Given the availability of less allergenic alternatives that would place both workers and susceptible consumers at reduced risk of significant reactions, we believe there is a compelling case for using nonlatex gloves in the food industry when glove usage is considered necessary.

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