

Natural Latex Sensitization and Respiratory Function Among Workers in Latex Glove Factories: A Pilot Study

James Couch, Mozhgan Moghtaderi, Shirin Farjadian, Zahra Momeni and Khadijehsadat Najib

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TABLE OF CONTENTS LISTING

The table of contents for the journal will list your paper exactly as it appears below:

Natural Latex Sensitization and Respiratory Function Among Workers in Latex Glove Factories: A Pilot Study
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Case Study

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5

INTRODUCTION

Natural rubber is a processed plant product derived from *Hevea brasiliensis* trees. Gloves are an example of dipped-rubber manufactured products.⁽¹⁾ Most reactions associated with natural rubber latex can be classified into three categories: (1) nonimmunologic irritant contact dermatitis, (2) cell-mediated allergic contact dermatitis, and (3) an immediate hypersensitivity reaction associated with generation of IgE antibodies to latex proteins. Signs and symptoms of the third type include asthma, rhinitis, conjunctivitis, urticaria, and anaphylaxis.⁽²⁾

The prevalence of latex sensitization in the general population is less than 1%, whereas among health care workers the prevalence rises to 6–17%.^(3–5) A positive skin prick test is the primary confirmatory test for a diagnosis of natural latex sensitization. Because workers in latex glove factories are exposed to airborne hydrolyzed latex peptides, latex sensitization may be a concern in this population. This study was designed to determine the incidence of latex sensitization in latex glove factory workers in Shiraz, Iran.

MATERIAL AND METHODS

Thirty-two men comprising the entire work force at two glove factories in the Fars province of southern Iran were enrolled in this study after providing informed consent in writing. These workers had to include at least one of the following duties: stripping gloves from the glove molds, inspecting the gloves, and packing of powdered gloves into branded boxes. Each of the factories produces 24,000 pairs of gloves per day. A physician developed a questionnaire that included questions to detect demographic characteristics, occupation, and allergic symptoms. Participants with upper respiratory tract infection or cardiovascular diseases and drug users were excluded. Cough and shortness of breath were considered pulmonary symptoms, itchy skin rash a skin symptom, and an itching and burning sensation in the eye as conjunctivitis. Symptoms were considered work-related if they started after the individual began work at the factory.

The skin prick test was performed for all workers with commercial latex, banana, and kiwi extracts (Stallergen, Antony, France). Wheal diameter ≥ 3 mm greater than negative control in response to the extract was considered as positive sensitization. Histamine (10 mg/mL) and saline were used as positive and negative controls, respectively. The results were analyzed 15 min after application.

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40 Pulmonary function tests were performed with a spirometer (Cosmed, Rome, Italy). All tests were done in the morning (8:00–11:00 a.m.) to minimize diurnal variation. Forced vital capacity (FVC), forced expiratory volume in 1 sec (FEV₁), ratio of forced expiratory volume in 1 sec to forced vital capacity (FEV₁/FVC), peak expiratory flow (PEF), and forced mid-expiratory flow between 25–75% of the exhaled vital capacity (FEF_{25–75%}) were measured. Each test was performed three times, and the best performance was recorded for analysis. The threshold of abnormality was identified as less than 80% of the predicted value for FVC, FEV₁, FEV₁/FVC, and PEF. Values of FEF_{25–75%} that were ≤ 60% of the predicted value were considered abnormal. Obstructive airway disease was defined as reduced FEV₁ and FEV₁/FVC ratio less than 80%, and restrictive airway disease was defined as a reduction in vital capacity to less than 80% and a FEV₁/FVC ratio ≥ 80%. Pulmonary deficits were classified as mild for FEV₁ values between 70% and 79%, moderate between 60% and 69%, and severe for < 60% of the predicted value.⁽⁶⁾

RESULTS

60 **T**hirty-two male workers in two latex glove factories were included in this study. They ranged in age from 18 to 50 years (mean 34.15 years) and worked 8 to 10 hr daily 6 days per week. The average duration of employment for these workers was 9.6 years (range 1–18 years).

65 Out of 32 workers, 16 had symptoms suggesting allergic diseases. Evaluation of their clinical symptoms revealed work-related respiratory symptoms in 9 of the workers (28.12%), skin manifestations in 6 (18.75%), and eye irritation in 14 (43.75%). However, four men had a history of atopic disease before starting their job, which was aggravated by employment.

70 Twenty-eight (87.50%) glove factory workers had normal pulmonary function tests. The findings for different functional tests are summarized in Table I. None of the workers had a FEV₁/FVC ratio less than 80% of the predicted value. Two workers showed mild restrictive airway disease with an FEV₁/FVC ratio more than 80% and a reduction in vital capacity of 70%–79%. Of the four workers with abnormal pulmonary functioning, only one had all respiratory, skin, and eye symptoms. He had a history of atopy.

The results of skin prick tests showed no sensitization to latex, banana, and kiwi extracts in any of the workers.

DISCUSSION

85 **T**he process of manufacturing gloves from natural raw latex requires human labor and involves long-term exposure to airborne latex dusts, which can result in acute or chronic respiratory disease. Irritation or immunologic sensitization to work-related inhalational allergens mediates pulmonary, skin, and eye symptoms.⁽⁷⁾ Results of this study showed abnormal pulmonary function test results in four (12.50%) workers. The effect of latex on lung parameters led to a decline in

TABLE I. Pulmonary Function Values in 32 Latex Glove Workers

Pulmonary Function Parameters	No. of Workers
FVC ≥ 80% (normal)	29
FVC 70–79% (mild)	3
FVC 60–69% (moderate)	0
FVC < 60% (severe)	0
FEV ₁ ≥ 80% (normal)	31
FEV ₁ 70–79% (mild)	1
FEV ₁ 60–69% (moderate)	0
FEV ₁ < 60% (severe)	0
PEF ≥ 80% (normal)	29
PEF 50–80% (moderate flow rate)	3
PEF < 50% (respiratory defect)	0
FEF 25–75% > 60% (normal)	31
FEF 25–75% ≤ 60% (subnormal)	1

FVC, PEF (both 9.37%), FEV₁, and FEF_{25–75%} (both 3.12%). An FEV₁/FVC ratio < 80% was not observed in any of the participants. Since it is reported that the particles with aerodynamic diameter between 0.5 and 5 μm can deposit in airways, poor penetration of allergen into the lower respiratory tract appeared to be related to relatively large particle size.⁽⁸⁾

None of the latex glove workers had a positive skin reaction to commercial latex extract. Chaiear et al.⁽⁹⁾ reported a rate of 1.5% positive skin tests to latex among 795 Thai workers exposed to high concentration of latex allergen in the factory air. Among 155 workers in Turkey, the incidence of latex allergy was 3.20%.⁽¹⁰⁾ The low rate of latex sensitization in the present study and other reports might be due to improvements in the latex materials manufactured in recent years and the use of suitable ventilation in factories.

The lower rate of sensitization in latex workers compared with health care workers reflects the different types of exposure to latex. Airborne allergen inhalation is the dominant type in factory workers, whereas high skin exposure is dominant in health care workers. Long-term exposure to high concentrations of airborne latex may induce tolerance in latex industry workers.

In this study, approximately 50% of the participants suffered from work-related eye irritation. Cornstarch used in the manufacturing process binds latex allergens and behaves as an airborne carrier for conjunctivitis.⁽¹¹⁾ A 1998 study showed a high prevalence of work-related eye irritation (76.50%) among 17 female workers in a latex glove factory.⁽¹²⁾

Our evaluation of clinical symptoms disclosed respiratory symptoms in 28% of the participants. Inhalation of disseminated latex powder in the environment can cause irritation or sensitization of the airways. In this study, 20% of the workers had cutaneous problems. Aside from inhalation, a mechanical and irritant reaction to the hydrolyzed latex protein and chemical materials may lead to a breakdown of the

130 skin barrier, allowing the entry of latex allergens. In Thai workers with a high level of exposure to latex allergens, cough (39.80%) and itchy red rash (16.70%) were observed as the main symptoms.⁽⁹⁾

135 Overall, the results of the present study revealed that glove factory workers were not at high risk of occupational sensitization to latex. However, about half of them presented work-related clinical symptoms. Although the work conditions were apparently appropriate in the factories we studied, using a standard mask and protective eye glasses as well as improved chemicals used for latex processing might be useful to prevent symptoms of irritation.

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