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Allergenic Testing of Hygiene Fabrics Treated With Herbal Antimicrobials

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ABSTRACT

Some of the chemicals used in textiles including chemical additives used in fabric processing can cause allergic reactions. As all these products are in direct contact with the skin, these are required to be non-allergenic. Plant extracts can be used as alternative textile finishing agents, but should be non-allergenic to skin. Hence the tests were conducted on covering fabrics of sanitary napkins treated with natural antimicrobial agents viz. Eucalyptus citriodora, Pinus roxburghii and Woodfordia fructicosa for allergy through skin patch test on healthy volunteers to assess the usability of the functional clothing. The untreated control & treated polypropylene and polyester fabric samples were examined for allergic potential through patch sensitivity tests on 30 healthy volunteers by placing test samples of size 1" x1" each against their skin for 48 hours with hypoallergenic paper tape. No reaction was observed on all volunteers, which implies that selected plant extracts can be used in intimate contact with human skin.

KEYWORDS : allergy, herbal, patch test.

Skin allergy also called "contact dermatitis", is one of the most common skin diseases and a growing problem in the world. An allergic reaction is a hypersensitivity disorder of the immune system, when a person's immune system reacts to normally harmless substances in the environment.

Some of the chemicals used in textiles can cause allergic reactions including chemical additives used in processing the fabric, for example the textile fibre itself, dyes used in textiles, formaldehyde resins used on fabrics, friction from textiles, chemicals used in processing of the textile, flame-retardant materials and fine metallic dust particles imbedded into textiles (Ryberg, 2009).

The extracts of the plants can be used as a textile finishing agents with relatively lower incidence of the adverse reaction of the herbal products as compared to synthetic pharmaceuticals, can be exploited as an effective ecofriendly alternative to the synthetic antimicrobial agents for textile applications.

Though, there is a vast resource of antimicrobial agents derived from plants, which can be used for imparting useful antimicrobial property to the textiles substrates, yet the utilization of plant based herbal products depends upon their bulk availability, extractability, antimicrobial efficacy, durability, non-allergenic reaction to skin, shelf life and cost. As all these products are in direct contact with the skin, these are required to be non-allergenic (Davies, 2011).

The symptoms of immediate allergy to textile products include wheals, redness, rash, respiratory and circulatory problems and even anaphylactic shock to some dyes. Dermal/skin irritation is defined in Organisation for Economic Co-operation and Development (OECD) Test Guidelines 404 as "the production of reversible damage of the skin following the application of a test substance for up to 4 hours" (OECD, 2002).

Evidence of skin sensitisation and irritation in humans normally is assessed by a diagnostic patch test. For textile materials, the patch test should be performed with a textile sample which contains the suspected chemicals with the highest concentration found in the textile products. In a typical patch test protocol, certain amounts of suspected haptens are applied onto the skin for 48 hours (24 hours in some countries), and the subsequent assessment of skin reaction is done at defined time points, typically after 2, 3 and 4 days. If possible, tests should be mounted on the patient's back. Upper dorsum is the most convenient localization both for doctor and patient, and most of patch test validation is carried out in this area. The interpretations of a patch test results are coded as negative or positive (Spiewak, 2008).

Tests were conducted on the covering fabrics of sanitary napkins (polypropylene and polyester) treated with natural antimicrobial agents viz. Woodfordia fructicosa, Eucalyptus citriodora, Pinus roxburghii and Woodfordia fructicosa for allergy through skin patch test on healthy volunteers to assess the usability of the functional clothing.

Methods

Patch test, which is a method to assess skin's reaction to a variety of substances which one may contact in home, at work or during recreational activities was used.

As the source of dermatitis could be the fabric itself or the chemical additives used in processing the fabric, the control & the treated fabric samples (test samples) were examined for allergic potential through patch sensitivity tests by placing the test samples of size 1"x1" each against skin for 48 hours with hypoallergenic paper tape and the test sites were marked with indelible ink.

All the test samples were applied in duplicate in random order to validate the results. Observations were made regarding the symptoms reported on removal of test samples after 48 hours of application and after 48 hours of the removal of the test samples from the test site.

Test was conducted to find whether the untreated control or herbal treated fabrics caused allergic skin irritation (contact dermatitis).

Exclusion criteria- Individuals taking medicines, such as some tricyclic antidepressants and antihistamines such as cetirizine, fexofenadine (Allegra) and loratadine (Claritin), antacids (ranitidine) and asthma medication (omalizumab) were excluded from the study as these medicines could interfere with the results of the study.

Sample size: A total of 30 healthy volunteers were selected for testing the skin allergies against the control and treated fabric samples. Consent for voluntary participation by the participants was taken before administering the Patch Test.

Tool: An observation checklist was prepared as per guidelines given by Spiewak (2008) for participants of the study for allergic reaction to the herbal treated fabrics.

Ethical considerations: Before administering the test patches on the back of the participants, informed consent for voluntary participation was obtained and test guidelines were explained to each participant through the prepared general instruction sheet.

The interpretations of a patch test results was done as per Annex 1.

Results

After 48 hours of administering the test and control patches of polypropylene and polyester on the skin of volunteers, the test patches were removed and observations were noted as per interpretation guidelines given by Spiewak (2008). As there was no change observed in the test area of any participant, no reaction was noted for all the volunteers for all the patches administered. The patch test sites were again observed after 48 hours of removal of the test patches and again no reaction was observed at that time also on any of the patch test site.

The results of the patch test indicated that no allergic reaction was observed after administering the test patches of the treated and untreated fabric samples on volunteers' skin. This implies that all the plant extracts selected for treating the selected fabrics for antibacterial properties can be used in intimate contact with human skin.

Fig 1: Skin sensitivity test of untreated control and herbal treated fabrics

Patches of untreated and treated fabrics administered on the skin

Test site just after removal of patches

Test site after 48 hours of removal of patches

Discussion

No indication of any type of allergic reaction of the herbal extract treated patches was observed after removal of the patches. Similar observations were made by Jayalakshmi & Manjusha (2011) where the patches of cotton fabric treated with various herbs viz. aloe vera, neem, turmeric, devadaru, bhringraj, niligiri taila, shatapushpa, walnut, lajjalu and kayaputi were tested randomly on volunteers for allergic reactions and no irritant reaction was observed. Eunjou & Yoo (2010 b) also investigated the skin irritancy with unripe Citrus grandis Osbeck extract and observed a marked clinical improvement of atopic dermatitis in the human subjects wearing the dyed underclothes as compared with the undyed clothes & it was observed that a marked clinical improvement of atopic dermatitis indicated.

Conclusions

No allergic reaction of the herbal extract treated patches napkins (polypropylene and polyester) was observed after removal of the patches. The cotton, polyester and polypropylene fabrics treated with aqueous extracts of Eucalyptus citriodora, Pinus roxburghii and Woodfordia fructicosa can be used in intimate contact of skin.

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Annex 1: The interpretations of a patch test results

Allergy skin tests	
Interpretation	Symptoms
Normal (negative):	No raised red areas (called wheals) are created by the allergen.
Abnormal (positive):	A wheal created by the allergen is at least 1/8 inch (3 mm) larger than the reaction to the negative control. The larger the wheal, the more certain it is that the person is allergic to that specific allergen.

Any reaction seen was scored according to the International Contact Dermatitis Research Group system (Spiewak, 2008) as follows:

Sr. No.	Notation	Symptoms	Interpretation
1.	-	No reaction	No changes in the tested area
2.	+?	Mild redness only	Faint or doubtful reaction
3.	+	Red and slightly thickened skin	Weak, positive reaction
4.	++	Red, swollen skin with individual small water blisters	Strong positive reaction

5.	+++	Intense redness and swelling with coalesced large blisters or spreading reaction	Extreme positive reaction
6.	IR	Red skin improves once patch is removed	Irritant reaction
7.	NT	Not tested	

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