



# International Journal of Dermatology, Venereology and Leprosy Sciences

E-ISSN: 2664-942X

P-ISSN: 2664-9411

[www.dermatologypaper.com](http://www.dermatologypaper.com)

Derma 2021; 4(2): 70-74

Received: 21-07-2021

Accepted: 26-09-2021

**Dr. Harsh Tahiliani**

Consultant Dermatologist,  
Dr. Tahiliani's Clinic, Mumbai,  
Maharashtra, India

**Dr. Bandhavi Muppalla**

Junior Resident, Department  
of Dermatology, Venereology  
and Leprosy, DY Patil  
Hospital, Navi Mumbai,  
Maharashtra, India

**Dr. Pooja Patel**

Junior Resident, Department  
of Dermatology, Venereology  
and Leprosy, DY Patil  
Hospital, Navi Mumbai,  
Maharashtra, India

**Dr. Reeya Patel**

Junior Resident, Department  
of Dermatology, Venereology  
and Leprosy, DY Patil  
Hospital, Navi Mumbai,  
Maharashtra, India

**Dr. Nitin Nadkarni**

Professor, Department of  
Dermatology, Venereology and  
Leprosy, DY Patil Hospital,  
Navi Mumbai, Maharashtra,  
India

**Dr. Sharmila Patil**

Professor and Head,  
Department of Dermatology,  
Venereology and Leprosy, DY  
Patil Hospital, Navi Mumbai,  
Maharashtra, India

**Corresponding Author:**

**Dr. Bandhavi Muppalla**

Junior Resident, Department  
of Dermatology, Venereology  
and Leprosy, DY Patil  
Hospital, Navi Mumbai,  
Maharashtra, India

## Patch testing in hand and foot eczema: A prospective study at a tertiary care hospital

**Harsh Tahiliani, Bandhavi Muppalla, Pooja Patel, Reeya Patel, Nitin Nadkarni and Sharmila Patil**

**DOI:** <https://doi.org/10.33545/26649411.2021.v4.i2a.97>

### Abstract

Hand and foot eczema is a common chronic, distressing skin condition with varying etiology. A patch test can be useful to confirm the presence of allergy and to identify the actual allergen. This study aimed to identify the common allergens causing hand and foot eczema with the help of patch testing. A total of 82 cases with hand and/or foot eczema underwent patch test using Indian Standard Series. Overall, the rate of positive patch test reactions reported in hand and foot eczema was 47.6%. Potassium bichromate was the common allergens in males and Nickel sulphate was the commonest allergen in females. The commonest presentation was chronic eczema in 51.22% and morphologically unspecified eczema (40.24%) followed by hyperkeratotic eczema was the most common. The rate of positive patch test reactions encountered was high. We suggest that patch test should be used to improve therapeutic outcome in hand and feet eczema.

**Keywords:** Hand, foot, eczema, dermatitis, patch test, allergens

### Introduction

Eczema is a common, chronic inflammatory, distressing skin condition with a prolonged course, remissions, exacerbations and occasional resistance to treatment<sup>[1]</sup>. Hands and feet have a crucial role in day to day social life and at work, thereby individuals with hand and foot eczema often suffers from physical as well as psychological discomfort leading to deterioration of the quality of life<sup>[2]</sup>.

The pathogenesis of hand and foot eczema is multifactorial, with a contribution of endogenous factors such as atopic dermatitis or exogenous factors such as contact dermatitis<sup>[3]</sup>. They are often associated with atopy and household or occupational exposure to allergens or irritants<sup>[3, 4, 5]</sup>. Therefore, identification and avoidance of the allergen, is important in the management of hand and foot eczema. Hence, patch testing is an important tool to confirm the presence of allergy and to identify the actual allergen.

Majority studies in literature have focused on hand eczema<sup>[6-13]</sup> and few on foot eczema<sup>[4, 5]</sup>. They have documented varying clinical pattern and different types of allergens as causative cause<sup>[4-16]</sup>. Depending on geographical, occupational, economic and social factors, allergen exposures may vary<sup>[8]</sup>. Hence this study was taken up to identify the common allergens causing hand and foot eczema with the help of patch testing in the geographical vicinity of Navi Mumbai.

### Material and Methods

This was a prospective, cross-sectional study conducted in the out-patient department of dermatology at a tertiary teaching hospital in Navi Mumbai. The study was approved by the Institutional Ethics Committee. Informed consent was obtained from all participants included in the study.

Between December 2014 and November 2015, a total of 82 adult patients with suspected hand and/or foot dermatitis irrespective of age and gender were included in the study. Patients less than 18 years, pregnant and lactating women, immune-compromised individuals, on systemic steroids or immunosuppressive agents and not willing to consent were excluded. Patients with fungal infections confirmed on direct microscopy were excluded before performing the patch test.

In every case, a detailed history was elicited and a thorough clinical examination was carried out. Attention was paid to the presenting associated symptoms, past history of allergy, occupational history, hobbies, seasonal variation, aggravating and relieving factors, habits, co-relation with usage of particular items (like cosmetics, jewelry, soaps etc.) and duration of eczema. The distribution of the lesions along with morphology of the eruption was recorded. Patients with fungal infections confirmed on direct microscopy were excluded before performing the patch test. All the patients with hand and/or foot dermatitis were patch tested using Indian Standard Series (ISS) approved by the Contact and Occupational Dermatoses Forum of India (CODFI) and marketed by Systopic laboratories (New Delhi, India), which consisted of 20 allergens. Allergens were put in Finn chambers and applied under occlusion to the back of each patient for 48 hours. Excessive hairs were shaved prior to application of the strip. Participants were advised to avoid any strenuous work and wetting of the application. Results were recorded at 48 hours (day 2) and 120 hours (day 5) after application of Finn chambers and graded as per the guidelines of the International Contact Dermatitis Research Group (ICDRG).

An attempt was made to clinically classify the eczema as acute, sub-acute or chronic. A clinical diagnosis was also made for every patient.

Data was entered in Microsoft-Excel (version 2010) and analyzed in SPSS software (version 20). Descriptive statistics were used to describe the results. Data were expressed in frequency, percentage and mean with standard deviation.

## Results

### Entire sample

A total of 82 patients were included in this study. Out of the total, 60.97 % (50 patients) were males and 39.03% (32 patients) were females; the mean age was  $36.7 \pm 10.9$  years (range 18 - 65 years). The most common age affected group was 31-40 years (34.1%) followed by age group 21-30 years (25.6%). Majority by occupation were masons in males and housewives in females [Table 1]. In this study, 14.6 % patients had a history of atopy, while family history of atopy was present in 4.9% patients.

**Table 1:** Occupational distribution of the sample

Occupation	Male (n)	Female (n)	Overall n (%)
Housewife	0	25	25 (30.5%)
Mason	15	0	15 (18.5%)
Farmer	6	2	8 (9.8%)
Office job	6	2	8 (9.8%)
Businessman	5	0	5 (6.2%)
Mechanic	4	0	4 (4.9%)
Student	3	0	3 (3.7%)
Doctor	1	1	2 (2.5%)
Jewellery artist	1	1	2 (2.5%)
Miscellaneous	9	1	10 (12.3%)
Total	50	32	82 (100%)

The disease condition was bilaterally distributed in 64.63% (53 patients) and unilaterally distributed in 35.37% (29 patients). In our study, scaling (73.17%) was the most common skin lesion encountered followed by plaques (48.78%), xerosis (42.68%), vesicles (40.24%) and hyperpigmentation (40.24%). Most patients had more than 1 type of lesion. The commonest presentation was chronic eczema in 51.22% (42 patients) followed by acute eczema in 25.61% (21 patients) and sub-acute eczema in 23.17% (19 patients). Morphologically, most patients were classified as unspecified eczema (40.24%), closely followed by hyperkeratotic eczema, wear and tear eczema and pompholyx.

Out of the total patients, 47.6% (39 patients) had 46 positive patch test reactions in our study. Thirty three patients tested positive for a single allergen and 6 patients tested positive to more than 1 allergen. Eleven allergens yielded positive patch test reactions. The most frequent allergen that tested positive was Potassium bichromate in 15.85% (13 patients), followed by Nickel sulphate in 9.75% (8 patients), Mercaptobenzothiazole and Cobalt sulphate in 6.09% each. Potassium bichromate was the commonest allergens in male patients and nickel sulphate was the commonest allergen in female patients [Table 2] [Figure 1].

**Table 2:** Positive allergens identified according to gender

Allergens	Males (n)	Females (n)	Overall n (%)
Potassium bichromate	12	1	13 (15.85%)
Nickel sulphate	2	6	8 (9.75%)
Mercaptobenzothiazole	2	3	5 (6.09%)
Cobalt sulphate	1	1	2 (2.5%)
Paraphenylenediamine	2	1	3 (3.65%)
Black rubber mix	2	1	3 (3.65%)
Chlorocresol	2	1	3 (3.65%)
Thiuram mix	2	0	2 (2.43%)
Parthenium	1	1	2 (2.43%)
Colophony	1	0	1 (1.21%)
Epoxy resin	1	0	1 (1.21%)

Out of the total patients, 59.75% (49 patients; 27 male and 22 female) were diagnostically classified as suffering from hand eczema, 25.6% (21 patients; 13 male and 8 female) as foot eczema and 14.6% (12 patients; 10 male and 2 female) as hand and foot eczema.

### Hand eczema

Housewives and masons were the most frequently encountered occupations in subset of patients with hand eczema [Figure 2]. 'Unspecified' was the most frequently encountered morphological variant of hand eczema. Palms/palmar surfaces (65.3%) followed by fingertips (57.1%) and dorsum of the hand (51%) were the commonest sites involved in hand eczema. In this study, 44.8% (22 out of 49) of the patients with hand eczema had a positive patch test. The most frequent positively encountered allergen in subset of hand eczema was Nickel (6 patients), followed by potassium bichromate (4 patients) [Table 3].

**Table 3:** Positive allergens according to diagnostic classification

Allergens	Hand eczema (n)	Foot eczema (n)	Hand and foot eczema (n)	Overall n (%)
Potassium bichromate	4	1	8	13 (15.85%)
Nickel sulphate	6	1	1	8 (9.75%)
Mercaptobenzothiazole	3	2	0	5 (6.09%)
Cobalt sulphate	2	0	3	5 (6.09%)
Paraphenylene diamine	3	0	0	3 (3.65%)
Black rubber mix	1	2	0	3 (3.65%)
Chlorocresol	1	2	0	3 (3.65%)
Thiuram mix	1	0	1	2 (2.43%)
Parthenium	2	0	0	2 (2.43%)
Colophony	1	0	0	1 (1.21%)
Epoxy resin	1	0	0	1 (1.21%)

### Foot eczema

Housewives and farmers/semi-skilled workers were the most frequently encountered occupations in subset of patients with foot eczema. Chronic and hyperkeratotic were the commonest variants of eczema encountered [Figure 3]. Dorsum of feet (90.4%) followed by sole (76.1%) were the most common sites involved in foot eczema. Overall, 38% (8 out of 21 patients) with foot eczema had a positive patch test. Mercaptobenzothiazole, black rubber mix and chlorocresol (2 patients each) were the common positively encountered allergens in the subset of foot eczema [Table 3].

### Hand and foot eczema

In patients with hand and foot eczema, the majority were males and mason by occupation. Pompholyx was the commonest morphological variant of eczema encountered. Overall, 75% (9 out of 12 patients) with hand and foot eczema had a positive patch test. Potassium bichromate (8 patients) was the most common positively encountered allergen in hand and foot eczema [Table 3].

### Adverse effects of patch testing

Out of the total patients, adverse effects of patch testing were noted in 9.7%. Of which, miliaria rubra (3.7%) was commonest followed by Acneform eruptions (2.4%), Folliculitis (2.4%) and angry back syndrome (1.2%).

### Discussion

Hand and foot eczema is common skin disorders caused by various exogenous and endogenous factors. Patch test has emerged as an important diagnostic tool in its management. The overall rate of positive patch test reactions reported in hand and foot eczema patients in our study was 47.6%. In this study, an attempt was made to identify the common allergens causing hand and foot eczema with the help of patch test and also to study the clinical pattern of hand and foot eczema in the neighboring vicinity of Navi Mumbai.

In our study, overall male predominance was higher than female in hand and foot eczema, with male to female ratio of 1.56:1, which was similar to previous studies [4, 9, 10, 15-20]. High male predominance could be due high exposure to more complex environment and occupational risk in the vicinity due to rapid urbanization. The most common affected age group was 31-40 years, followed by 21-30 years, which could be attributed to high occupational risk exposure and cosmetic item/jewelry usage.

In this study, 14.6 % patients had a history of atopy, half of whom had positive patch test reactions. Family history of atopy was present in 4.9%, of two third patients showed

positive patch test reactions. The presence of history of atopy was on the lower side in comparison to Vigneshkarthik *et al.* [8] and Handa *et al.* [15] study. Atopy has been usually considered the major cause of hand eczema [16]. The aggravating and relieving factors were known in 25.6% and only 4.9% patients had observed a seasonal variation in their symptoms.

In this study, scaling (73.2%), followed by plaque (48.8%), xerosis (42.6%) and hyperpigmentation (40.2%) were the common skin manifestations. Chronic eczema (51.2%) was the commonest clinical variant of eczema encountered which was similar to previous studies [13, 19].

### Hand eczema

Housewives and masons were the most frequently encountered occupations with hand eczema in this study, which are similar to finding of previous hand eczema in other Indian studies. [6, 7, 10, 15] Females frequently come in contact with various detergents, soaps, chemicals and cosmetics which are predisposing factors in the development of hand eczema. Masons handle and work with cement which is a known contact sensitizer, without much protective measures and hence are more prone.

Palms/palmar surfaces followed by fingertips were the commonest sites involved in patients with hand eczema. Other studies have demonstrated the involvement of dorsum of hand as the commonest site [9, 19]. 'Unspecified' was the most frequently encountered morphological variant of hand eczema followed by hyperkeratotic and pompholyx type, which is similar to Handa *et al.* [15], but was markedly different from majority of the previous hand eczema studies from India [7, 8, 9, 15].

In this study, 44.8% of the total patients with hand eczema had a positive patch test, which was lower compared to previous Indian studies [8, 21]. A significantly higher patch test positivity (48%-82%) has been reported by most Indian studies [6, 7, 9, 10, 15]. Nickel, followed by potassium bichromate was the most frequently encountered allergen, exclusively in hand eczema similar to Suman *et al.* [6], Majid *et al.* [7] and Qayoom *et al.* [12] studies. None of our patients tested positive to fragrance mix. Other studies have demonstrated potassium bichromate as the commonest allergen in hand eczema [10, 15], followed by fragrance mix [15] and colophony [9]. Mehta *et al.* had the highest positive reactions with parthenium followed by fragrance mix and potassium bichromate in their study [13].

### Foot eczema

Housewives and farmers/semi-skilled workers were the most frequently encountered occupations with feet eczema

in this study, which is similar to the findings of previous foot and leg eczema studies [5, 18, 19].

Dorsum of feet was the commonest site involved in our study corresponding to the shape of the footwear “V-shaped chapels”, which is similar to findings of previous studies [4, 5, 14, 18, 19]. This type of footwear is usually worn without socks and is preferred by individuals living in hot and humid climate.

Overall, 38% of the total patients with foot eczema had a positive patch test. The patch test positivity in our study was comparatively lower to most of the previous Indian studies which ranged from 46% to 88% [4, 14, 18, 19]. Mercaptobenzothiazole, black rubber mix and chlorocresol were the common positively encountered allergens in foot eczema. Study by Priya *et al.* [14] documented Mercaptobenzothiazole, whereas Kumar *et al.* [18] documented Parthenium followed by Mercaptobenzothiazole to be the commonest agents to show positive patch reactions in foot eczema. These agents are usually used as footwear-chemicals or rubber-based adhesives in the foot wear industry and are apparently the cause of foot eczema.

### Hand and feet eczema

Out of the total participants, 14% had eczematous lesions on hand and foot. Mehta *et al.* [13] reported hand and foot involvement as 10%, whereas Chowdhuri *et al.* have reported 18% [22]. Majority of patients with hand and foot eczema in this study were males and mason by occupation.

Pompholyx was the commonest morphological variant of eczema encountered.

In this study, 75% patients with hand and foot eczema had a positive patch test. The patch test positivity in our study was quite high. However, due to paucity of data in the literature we were not able to compare this finding in this subset of patients. The patch test reaction was positive in majority for Potassium bichromates. Study by Chowdhuri *et al.* has documented potassium bichromate as frequent allergen in foot wear dermatitis [22]. The probable reasons for this higher incidence of Potassium bichromate sensitivity in our study could be due to the fact that the majority were mason by occupation, involved in cement /infrastructure work in the vicinity and may have inadequate protective measures/gears.

Overall in the entire sample, the rate of positive patch test reactions reported in hand and foot eczema patients in this study was 47.6%. Potassium bichromate was the common allergens in males and Nickel sulphate was the commonest allergen in females in the entire sample. This observation was consistent with other studies [17, 20]. In literature, a high positive rate of patch test and different types of allergens as causative cause is also documented (Table 4).

Thus, we suggest that patch test should be used to improve therapeutic outcome in the management of hand and foot eczema. Also counseling the patients about possible occupational exposure, lifestyle modifications and preventive measures should be an integral part of its management.

**Table 4:** Comparison of patch test results with previous studies

Author	Eczema	Patch test positivity	Most common positive allergens
Aithal V <i>et al.</i> (2019) [4]	Foot eczema	60%	Parthenium, Mercaptobenzothiazole, Potassium Dichromate
Suman M <i>et al.</i> (2003) [6]	Hand eczema	67%	Nickel Sulphate, Potassium Dichromate
Majid I (2016) [7]	Hand eczema	48.5%	Nickel Sulphate, Potassium Dichromate
Vigneshkarthik N <i>et al.</i> (2016) [8]	Hand eczema	37%	Nickel Sulphate, Para-Phenylenediamine, Potassium Dichromate
Laxmisha C <i>et al.</i> (2008) [9]	Hand eczema	52.78%	Potassium Dichromate
Kishore NB <i>et al.</i> (2005) [10]	Hand eczema	82%	Potassium Dichromate, Nickel Sulphate,
Qayoom S <i>et al.</i> (2018) [12]	Hand eczema	72.41%	Nickel Sulphate, Potassium Dichromate, Balsam of Peeru, Cobalt Sulphate, Paraphylene Diamine
Mehta MJ <i>et al.</i> (2015) [13]	Hand, head-neck and feet eczema	51.33%	Parthenium, Fragrance Mix
Priya KS <i>et al.</i> (2008) [14]	Foot eczema	88%	Mercaptobenzothiazole, Colophony, 4-Phenylenediamine Base, Potassium Dichromate, Formaldehyde, Nickel Sulfate
Handa S <i>et al.</i> (2012) [15]	Hand eczema	65%	Potassium Dichromate, Fragrance Mix, Nickel Sulphate
Kumar BV <i>et al.</i> (2019) [18]	Lower extremity eczema	75%	Potassium Dichromate, Nickel Sulfate, Mercapto Mix, Mercaptobenzothiazole
John V <i>et al.</i> (2014) [19]	Lower leg and foot eczema	46%	Potassium Dichromate, Paraben Mix Nickel Sulfate
Agarwal US <i>et al.</i> (2010) [21]	Hand eczema	30%	Potassium Dichromate, Nickel Sulfate
Present study	Hand and foot eczema	47.6%	Potassium Dichromate, Nickel Sulfate, Mercaptobenzothiazole, Black Rubber Mix, Chlorocresol



**Fig 1:** Positive patch test (+3) reaction as per ICDRG grading



**Fig 2:** Hyperkeratotic hand eczema in a mason





**Fig 3:** Chronic foot eczema

### Limitation of the study

The sample size was limited; inclusion of larger sample size would have definitely increased the validity of the conclusions. In this study, Indian standard series was used which is standard for common allergens, but does not contain many allergens that may be relevant to hand and foot eczema; thereby individualized modifications should be considered.

### Conclusion

In conclusion, hand and foot eczema has a variable clinical profile and etiology. The rate of positive patch test reactions reported in hand and foot eczema patients was 47.6%. Potassium bichromate and Nickel sulphate were the common allergens identified in the majority of patients. We suggest that patch test should be used to improve therapeutic outcome in the management of hand and feet eczema.

### References

- Katellaris CH, Peake JE. Allergy and the skin: eczema and chronic urticaria. *Med J Aust*. 2006;185(9):517-22.
- Agrawal PV, Kumar A, Sharma YK, Deora M, Ranpariya RH. Comparative Analysis of Epidemiological Data as Well as Quality of Life in Patients having Hand Eczema vis-à-vis Foot Eczema. *Indian Dermatol Online J*. 2019;10:519-23.
- Agarwal US, Besarwal RK, Gupta R, Agarwal P, Napalia S. Hand eczema. *Indian J Dermatol*. 2014;59:213-24.
- Aithal V, Jacob MA. Foot eczema and footwear dermatitis: Role of patch test using Indian standard series and footwear series. *Clin Dermatol Rev*. 2019;3:62-7.
- Chougule A, Thappa DM. Patterns of lower leg and foot eczema in south India. *Indian J Dermatol Venereol Leprol*. 2008;74:458-61.
- Suman M, Reddy BS. Pattern of contact sensitivity in Indian patients with hand eczema. *J Dermatol*. 2003;30:649-54.
- Majid I. Contact Allergens Causing Hand Eczema in Ethnic Kashmiri Population: A Study of 7-years. *Indian J Dermatol*. 2016;61:119.
- Vigneshkarthik N, Ganguly S, Kuruvila S. Patch Test as a Diagnostic Tool in Hand Eczema. *J Clin Diagn Res*. 2016;10:WC04-WC07.
- Laxmisha C, Kumar S, Nath AK, Thappa DM. Patch testing in hand eczema at a tertiary care center. *Indian J Dermatol Venereol Leprol*. 2008;74:498-9.
- Kishore NB, Belliappa AD, Shetty NJ, Sukumar D, Ravi S. Hand eczema-Clinical patterns and role of patch testing. *Indian J Dermatol Venereol Leprol*. 2005;71:207-8.
- Boonstra MB, Christoffers WA, Coenraads PJ, Schuttelaar ML. Patch test results of hand eczema patients: relation to clinical types. *J Eur Acad Dermatol Venereol*. 2015;29:940-7.
- Qayoom S, Rather SR, Khan K. Patch testing in hand eczema: a cross-sectional study from a teaching hospital of North India. *Int J Res Med Sci*. 2018;6:567-71.
- Mehta MJ, Diwan NG, Nair PA, Vora RV. Experience and feasibility of patch testing in allergic contact dermatitis in rural population. *Indian J Allergy Asthma Immunol*. 2015;29:40-5.
- Priya KS, Kamath G, Martis JDS, Shetty NJ, Bhat RM, Kishore BN. Foot eczema: the role of patch test in determining the causative agent using standard series. *Indian J Dermatol*. 2008;53:68-9.
- Handa S, Kaur I, Gupta T, Jindal R. Hand eczema: correlation of morphologic patterns, atopy, contact sensitization and disease severity. *Indian J Dermatol Venereol Leprol*. 2012 Mar-Apr;78:153-8.
- Simpson EL, Thompson MM, Hanifin JM. Prevalence and morphology of hand eczema in patients with atopic dermatitis. *Dermatitis*. 2006;17:123-7.
- Bajaj AK, Saraswat A, Mukhija G, Rastogi S, Yadav S. Patch testing experience with 1000 patients. *Indian J Dermatol Venereol Leprol*. 2007;73:313-8.
- Kumar BV, Ashwini PK, Kanthraj GR, Jayadev BB. Patch testing in allergic contact dermatitis over the lower extremities. *Indian J Dermatol*. 2019;64:164.
- John V, Srinivas M. A clinical study of lower leg and foot eczema and relevance of patch test in determination of its causative agents. *Journal of Evolution of Medical and Dental Sciences*. 2014;3:13823-34.
- Handa S, Jindal R. Patch test results from a contact dermatitis clinic in North India. *Indian J Dermatol Venereol Leprol*. 2011;77:194-6.
- Agarwal US, Panse GG. Relevance of patch testing in hand eczema--comment. *Indian J Dermatol Venereol Leprol*. 2010;76:59-60.
- Chowdhuri S, Ghosh S. Epidemio-allergological study in 155 cases of footwear dermatitis. *Indian J Dermatol Venereol Leprol*. 2007;73:319-22.