

Prevalence of contact sensitisation among patients with hand eczema and factors associated with contact sensitisation and disease severity

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ABSTRACT

Introduction: Chronic hand eczema is a debilitating skin disease. The aetiology of hand eczema can be due to irritant contact, allergic contact or a manifestation of endogenous eczema. Identification of sensitisers and subsequent avoidance of relevant sensitisers may improve care of chronic hand eczema patients. We aimed to study the prevalence and pattern of sensitisation, factors associated with sensitisation and severity of hand eczema.

Materials and Methods: A cross sectional study was conducted over a six month period between January to June 2025 at the Department of Dermatology in a tertiary hospital located in the capital of Selangor. Patients with predominantly hand eczema aged above 18 years old were interviewed, examined and patch tested with Standard European Baseline Series from Chemotechnique Diagnostics. Patients with contraindications for patch test and uncertain diagnosis were excluded. Hand eczema morphology was classified according to the Danish Contact Dermatitis Group classification. Hand eczema severity was determined using Hand Eczema Severity Index (HECSI). Patch test results were interpreted according to International Contact Dermatitis Research Group (ICDRG) guidelines.

Results: A total of 54 patients aged 44± 15.29 years old participated. Female to male ratio was 2.6:1 and 79.6% had positive patch test. The most common sensitisers were nickel sulphate (29.63%), fragrance mix 1 (25.93%), potassium dichromate (14.8%) and formaldehyde (14.8%). Polysensitisation was seen in 41.6%. Sensitisation was not associated with age, history of atopy, hand washing >10 times/day, hand wetting activities > two hours/day, use of non-permeable gloves, hand sanitiser use, fragrances and smoking. Cosmetic use showed seven times increased odds of polysensitisation ($p=0.033$). Hand eczema morphology was not associated with sensitisation. HECSI was significantly higher with use of non-permeable gloves. HECSI was not associated with atopy, frequency of hand washing and duration of wet hands.

Conclusion: Patch test sensitisation was common in hand eczema patients. Polysensitisation was associated with use

of cosmetics. Use of non-permeable gloves may worsen hand eczema.

KEYWORDS:

Hand eczema; patch test; sensitisation; allergic contact dermatitis

INTRODUCTION

Chronic hand eczema has a yearly prevalence of 9.1%.¹ A significant number of patients with hand eczema in multiple studies in Europe reported persistence of disease for 12 weeks or longer, had long durations of sick days, reported inability to work, had job changes due to hand eczema and even had early retirement.¹ In Sweden, the mean duration of sick leave was 18.9 weeks while in Denmark, 44% of patients with occupational hand eczema required job change and 15% of occupational hand eczema patients went into early retirement.¹

The most common symptom in hand eczema is itching.¹ Primary acute skin lesions can include erythema, oedema, oozing, crusting papules and vesicles.¹ Secondary skin lesions that follow will include lichenification, hyperkeratosis and fissuring.¹ Chronic hand eczema is diagnosed when the eczematous changes described above last longer than three months or are recurrent within a year.¹ Involvement of the feet is present in 20% of patients.¹

The aetiology of hand eczema can be due to irritant contact, allergic contact or a manifestation of endogenous eczema.¹ There can be an overlap between these conditions. Irritant contact dermatitis is a non-specific inflammatory dermatosis mainly due to the toxicity of chemicals on the skin and does not require sensitisation.^{1,2} Allergic contact dermatitis is a delayed hypersensitivity response after sensitisation by an allergen/sensitiser and subsequently recreated by elicitation.² The process in which a patient develops an allergic contact reaction to an allergen/sensitiser is called sensitisation.

Patch testing aims to reproduce “in miniature” an eczematous reaction by applying allergens under occlusion in patients who are suspected to be allergic.² It attempts to elicit a reaction in a delayed hypersensitivity reaction and in the process, identify a “culprit” allergen. Sensitisers or

This article was accepted: 02 June 2026

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allergens are inserted into patch test chambers which are then applied to intact skin under occlusion and given time for the elicitation reaction to occur. Typically, the patch chambers with sensitisers are removed after 48 hours and the first reading is made. The second reading is made after 96 hours to determine if a significant reaction is present. A typical allergic contact reaction will present after 24-72 hours and typically worsens (crescendo pattern) before resolution over time.²

Patch testing is recommended in patients with chronic hand eczema and those who are non-responsive to adequate treatment to investigate for relevant sensitisations to aid the diagnosis of allergic contact dermatitis.¹

Common sensitisers in hand eczema include nickel sulfate, preservatives, fragrances, cobalt, rubber chemicals, potassium dichromate and p-phenylenediamine.³ Up to 63% of the patients developed sensitisation to at least one allergen.³ Sensitisation with three or more sensitisers (polysensitisation) has been linked to atopic diseases such as bronchial asthma, allergic rhinitis and hand eczema.⁴⁻⁶

Multiple factors have been associated with sensitisation. Skin barrier function, inherent skin susceptibility, size, duration and extent of allergen exposure, sensitising potency and occlusion/skin irritation are factors associated with sensitisation.⁷ Role of atopic dermatitis in the pathophysiology of contact sensitisation is unclear; atopic dermatitis being Th2 driven may impede contact sensitisation and elicitation which are Th1 driven.⁷ A meta-analysis identified frequent hand washing and long duration of wet works as risk factors for hand eczema, while suggesting use of occlusive gloves may have a role.⁸ Body piercing is associated with nickel sensitisation, which lowers the threshold for elicitation in hand eczema or presents as a secondary eruption in hand eczema.⁹ Other sources of nickel exposure include diet, accessories, utensils and occupation related exposure.⁹ Fragrance allergens are common allergens in hand eczema.¹⁰ Toiletries, perfumes, deodorants, essential oils and cosmetics are sources for fragrance allergens.¹⁰ Use of cosmetics and hand eczema was also reported by Heede et al (10) in 2016.¹¹ Severity of hand eczema has been associated with age, atopic dermatitis, and the presence of sensitisers.¹² Although no single morphological classification is universally accepted, higher rates of sensitisation have been reported in the recurrent vesicular type of hand eczema.¹³

Studies on hand eczema that report contact sensitisation, factors associated with contact sensitisation, disease severity and morphology of hand eczema are lacking. We studied the above mentioned in a local setting.

MATERIALS AND METHODS

Study Design

The study was a cross-sectional observational study conducted on patients diagnosed by dermatologists and a dermatology fellow with chronic hand eczema who were conveniently sampled from the dermatology clinic at a government tertiary hospital in Selangor from 1st January 2025 to 30th June 2025.

The patients were screened for inclusion and exclusion criteria prior to enrolment. Patients aged 18 years old or older with eczema predominantly affecting the hands were included. Patients who were contraindicated for patch testing (e.g. pregnancy, on prednisolone above 10mg per day), patients whose diagnosis was uncertain, or had concomitant conditions such as tinea manuum, scabies, or hand psoriasis were excluded. Informed consent was obtained.

The patients were interviewed to collect data on demography, eczema history, their hand washing habits, duration of hand wetting activities, use of hand sanitisers, use of non-permeable gloves, body piercing, use of fragrance, use of cosmetics and smoking habits which were deemed to be factors associated with contact sensitisation or severity of hand eczema. Hand wetting was defined as wet work activities, which were defined by having wet hands by either hand washing, performing work or tasks that contribute to wet hands. Non permeable gloves were defined by specifically asking if the patient wore rubber, nitrile or latex gloves. Fragrance use was defined as use of fragrances used in perfumes, cosmetics, soaps, lotions and sanitisers. Food preparation was defined as preparing raw ingredients and cooking.

Physical examination was performed. Hand eczema morphology was classified according to the Danish Contact Dermatitis Group classification for hand eczema morphology; recurrent vesicular, chronic fissuring, hyperkeratotic, pulpitis, interdigital, nummular and unclassified as proposed by Danish guidelines on hand eczema.¹⁴ Severity of hand eczema was assessed using Hand Eczema Severity Index (HECSI), a validated tool to measure hand eczema severity.¹⁵

Patients were then patch tested with 30 sensitisers from the standard European Baseline Series by Chemotechnique Diagnostics. Patients were required to attend the clinic on Monday for application of patch chambers. Patch test results were read on Wednesday and Friday (according to the International Contact Dermatitis Research Group Guide).² Patients with three or more positive results were categorised as polysensitisation while patients with one or two positive patch test results were categorised as oligosensitisation.

Sample size was calculated based on the primary objective to explore the prevalence of contact sensitisation using single proportion formula using the Scalex SP calculator. A systematic review reported the prevalence of contact sensitisation as 20.1%.¹⁶ For the expected prevalence of 20% among patients with hand eczema, the required sample size was 80 for the margin of error or absolute precision of $\pm 10\%$ in estimating the prevalence with 95% confidence and considering the potential loss/attrition of 20%. With this sample size, the anticipated 95% CI was 10% - 30%.

Data were analysed using SPSS version 26.0. Continuous variables were presented as mean and standard deviation for normally distributed data, otherwise median and interquartile range. Categorical variables were presented as frequency and percentage. The various risk factors associated with contact sensitisation and hand eczema severity and the

Table I: Characteristics of the study participants and patch test sensitisation pattern

Characteristics		N= n(%) or mean±SD
Age in years, mean ± SD		43.76 ± 15.29
Sex, n (%)	Female	39 (72.2)
	Male	15 (27.8)
Race, n (%)	Malay	35 (64.8)
	Chinese	8 (14.8)
	Indian	9 (16.7)
	Others	2 (3.7)
Household Income, n (%)	B40 (<RM5250)	41 (75.9)
	M40 (RM5250-RM11819)	12 (22.2)
	T20 (>RM11819)	1 (1.9)
Occupation, n (%)	Unemployed	16 (29.6)
	Blue collar	12 (22.2)
	White collar	20 (37.0)
	Pink collar	4 (7.4)
	Gold collar	2 (3.7)
History of atopy, n (%)	Yes	26 (48.1)
Type of atopy	Bronchial asthma	5 (19.2)
	Allergic rhinitis	13 (50.0)
	Dermatitis	15 (57.7)
Family history of atopy, n (%)	Yes	29 (53.7)
Clinical diagnosis, n (%)	Hand eczema	33 (61.1)
	Hand and Feet eczema	21 (38.9)
Factors associated with sensitisation:		
Hand washing frequency per day, n (%)	0-9	24 (44.4)
	10-19	18 (33.3)
	>20	12 (22.2)
Duration of Hands being wet per day, n (%)	<1 hour	7 (13.0)
	1-2 hour	18 (33.3)
	>2 hour	29 (53.7)
Sanitiser use, n (%)		17 (31.5)
Non-permeable glove use, n (%)		20 (37.0)
Body piercing, n (%)		33 (61.1)
Metal braces, n (%)		14 (25.9)
Dental implant, n (%)		5 (9.3)
Metal accessories, n (%)		9 (16.7)
Cosmetic use, n (%)		22 (40.7)
Fragrance use, n (%)		45 (83.3)
Food preparation, n (%)		42 (77.8)
Care for child under 4 years old, n (%)		9 (16.7)
Gardening, n (%)		17 (31.5)
Car repair, n (%)		7 (13.0)
Building or renovation, n (%)		2 (3.7)
Smoking, n (%)		8 (14.8)
Drug allergy, n (%)		9 (16.7)
Morphology	Recurrent Vesicular	21(39.6)
	Chronic Fissuring	12(22.6)
	Nummular	7(13.2)
	Unclassified	6(11.3)
	Interdigital	4(7.5)
	Hyperkeratotic	2(3.8)
	Pulpitis	2(3.8)
Sensitisation rate, n (%)	Sensitised to at least 1 antigen	43 (79.6)
	No sensitisation	11 (20.4)
	Oligo-sensitisation	25 (46.3)
	Polysensitisation	18 (33.3)

association between morphological patterns of hand eczema with the presence of contact sensitisation were tested using independent sample t test, Mann Whitney U test, Pearson chi-squared test, Fisher Exact test and simple regression analysis. All the tests were two sided and statistical significance was denoted by $p < 0.05$.

This study was registered with the National Medical Research Registry (Research ID: RSCH ID-23-04790-YJR). Ethical approval was obtained from the Medical Research and Ethics Committee, Ministry of Health, Malaysia (Research ID: RSCH ID-23-04790-YJR).

Table II: Positivity rate of allergens causing contact sensitisation, ranked from highest to lowest

Allergen	N	%	95% CI of %
1. Nickel sulphate	16	29.63	17.98, 43.61
2. Fragrance mix I	14	25.93	14.96, 39.65
3. Potassium dichromate	8	14.81	6.62, 27.12
4. Formaldehyde	8	14.81	6.62, 27.12
5. Methylidibromo Glutaronitrile	7	12.96	5.37, 24.90
6. Benzisothiazolinone	7	12.96	5.37, 24.90
7. Fragrance mix II	6	11.11	4.19, 22.63
8. Cobalt chloride	5	9.26	3.08, 20.30
9. Peru Balsam	5	9.26	3.08, 20.30
10. Methylisothiazolinone + Methylchloroisothiazolinone	5	9.26	3.08, 20.30
11. Methylisothiazolinone	5	9.26	3.08, 20.30
12. Colophonium	3	5.56	1.16, 15.39
13. Sodium Metabisulfite	3	5.56	1.16, 15.39
14. Propolis	3	5.56	1.16, 15.39
15. Neomycin sulphate	2	3.7	0.45, 12.75
16. Paraben mix	2	3.7	0.45, 12.75
17. N-Isopropyl-N-phenyl-p-phenylenediamine	2	3.7	0.45, 12.75
18. 2-Mercaptobenzothiazole	2	3.7	0.45, 12.75
18. Decyl glucoside	2	3.7	0.45, 12.75
19. p-Phenyldiamine	1	1.85	0.05, 9.89
20. Thiuram mix	1	1.85	0.05, 9.89
21. Caine mix	1	1.85	0.05, 9.89
22. 2-hydroxyethyl methacrylate	1	1.85	0.05, 9.89
23. Lanolin	1	1.85	0.05, 9.89

Table III: Factors associated with contact sensitisation

Factors	No sensitisation vs oligo-sensitisation		No sensitisation vs polysensitisation	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age	0.98 (0.93, 1.03)	0.406	1.00 (0.95, 1.05)	0.998
Sex				
Female	Ref		Ref	
Male	0.68 (0.15, 3.07)	0.617	0.50 (0.10, 2.62)	0.500
Race				
Malay	Ref		Ref	
Chinese	0.86 (0.12, 6.01)	0.877	0.40 (0.05, 3.53)	0.409
Indian	0.71 (0.13, 4.00)	0.702	0.13 (0.01, 1.55)	0.107
Income				
B40 (<RM5250)	Ref		Ref	
M40 (RM5220 - RM11819)	2.84 (0.30, 27.26)	0.365	3.46 (0.34, 34.84)	0.292
T20 (>RM11819)	-	-	-	-
Occupation				
Unemployed	Ref		Ref	
Blue collar	1.43 (0.24, 8.64)	0.698	1.25 (0.16, 9.92)	0.833
White collar	2.14 (0.38, 12.20)	0.390	3.33 (0.52, 21.58)	0.206
Pink collar	-	-	-	-
Gold collar	-	-	-	-
History of atopy				
No	Ref		Ref	
Yes	1.11 (0.27, 4.60)	0.888	1.20 (0.27, 5.40)	0.812
Family history of atopy				
No	Ref		Ref	
Yes	0.77 (0.19, 3.19)	0.718	1.31 (0.28, 5.98)	0.728
Hand washing frequency				
0-9	Ref		Ref	
10-19	2.55 (0.41, 15.65)	0.313	4.67 (0.70, 31.04)	0.111
≥20	1.91 (0.30, 12.26)	0.496	2.33 (0.31, 17.55)	0.410
Hand washing frequency				
<10	Ref		Ref	
≥10	2.23 (0.52, 9.59)	0.283	3.50 (0.73, 16.85)	0.118
Hand wet duration				
<1 hour	Ref		Ref	
1-2 hour	0.75 (0.09, 6.23)	0.790	4.00 (0.27, 58.56)	0.311
>2 hour	1.50 (0.21, 10.82)	0.688	3.60 (0.26, 50.33)	0.341

Table III: Factors associated with contact sensitisation (Continued)

Factors	No sensitisation vs oligo-sensitisation		No sensitisation vs polysensitisation	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Hand wet duration				
<1hour	Ref		Ref	
≥1hour	1.17 (0.18, 7.56)	0.872	3.78 (0.30, 47.56)	0.304
Sanitiser use				
No	Ref		Ref	
Yes	0.67 (0.13, 3.47)	0.630	2.67 (0.53, 13.43)	0.234
Non-permeable glove use				
No	Ref		Ref	
Yes	1.50 (0.32, 7.12)	0.610	2.13 (0.42, 10.78)	0.359
Body piercing				
No	Ref		Ref	
Yes	1.25 (0.30, 5.23)	0.760	1.67 (0.36, 7.77)	0.515
Metal braces				
No	Ref		Ref	
Yes	2.53 (0.45, 14.37)	0.294	0.90 (0.13, 6.46)	0.917
Metal accessories				
No	Ref		Ref	
Yes	1.13 (0.18, 6.94)	0.899	0.56 (0.07, 4.70)	0.595
Cosmetic use				
No	Ref		Ref	
Yes	2.53 (0.45, 14.37)	0.294	7.07 (1.17, 42.85)	0.033
Fragrance use				
No	Ref		Ref	
Yes	0.70 (0.12, 4.20)	0.700	3.78 (0.30, 47.56)	0.304
Prepare food				
No	Ref		Ref	
Yes	0.70 (0.12, 4.20)	0.700	0.78 (0.12, 5.16)	0.795
Care for child <4 years				
No	Ref		Ref	
Yes	0.61 (0.09, 4.31)	0.624	1.29 (0.19, 8.53)	0.795
Gardening				
No	Ref		Ref	
Yes	0.82 (0.19, 3.65)	0.798	0.67 (0.14, 3.35)	0.629
Car repair				
No	Ref		Ref	
Yes	0.86 (0.13, 5.55)	0.872	0.27 (0.02, 3.33)	0.304
Smoking				
No	Ref		Ref	
Yes	1.13 (0.18, 6.94)	0.899	0.27 (0.02, 3.33)	0.304
Drug allergy				
No	Ref		Ref	
Yes	0.33 (0.07, 1.70)	0.186	0.10 (0.01, 1.09)	0.059

Simple linear regression

RESULTS

A total of 57 patients were recruited, but three dropped out as they were not able to commit to the schedule of the patch testing.

The remaining 54 patients were included in the study. Their mean age was 44±15.29 years old. Female patients outnumber male patients by a 2.6:1 ratio. The majority were Malay (64.8%) with household income in the lower socioeconomic group i.e. B40 category (75.9%). About half reported history of atopy (48.1%) and family history of atopy (53.7%). Thirty three (61.1%) presented with hand eczema, and 21 (38.9%) presented with both hand and feet eczema.

Majority of the patients wash their hands 0-9 times daily (44.4%), had their hands wet for a duration of more than 2 hours (53.7%) per day, do not use sanitiser (68.5%) and do not use non-permeable glove (63.0%). The number of patients with body piercing, metal braces, dental implant,

metal accessories, cosmetics use, and fragrance use were 33 (61.1%), 14 (25.9%), 5 (9.3%), 9 (16.7%), 22 (40.7%), and 45 (83.3%) respectively. There were 42 (77.8%) who prepared food and 9 (16.7%) cared for children under 4 years old. Seventeen (31.5%) did gardening, 7 (13.0%) did car repairs, and 2 (3.7%) were in construction related work. The characteristics of our patients are represented in Table I.

Contact sensitisers and sensitisation pattern

The most common sensitisers observed were nickel sulphate (29.63%), followed by fragrance mix 1 (25.93%), potassium dichromate and formaldehyde (both 14.81%). Other sensitisers and their frequencies are summarised in Table II. There were 11 (20.4%) patients with negative test, 25 (46.3%) had oligo-sensitisation and the rest had polysensitisation (33.3%). Forty three (79.6%) patients had at least one positive reaction in their patch test, and 58.1% were clinically relevant. Of the 43 patients who reported at least one positive patch test, 41.8% were in the polysensitisation group.

Table IV: Factors associated with severity of hand eczema

Factors	HECSI	p-value	Simple linear regression	
			Coef (95% CI)	p-value
Age (Mean $\pm$ SD)	17.07 $\pm$ 16.66	0.781 ^c	-0.04 (-0.35, 0.26)	0.781
Sex (Median (IQR)				
Female	12 (5, 24)	0.692 ^a	Ref	
Male	12 (7, 26)		4.61 (-5.57, 14.78)	0.368
History of atopy (Median (IQR)				
No	12 (6, 22)	0.671 ^a	Ref	
Yes	16 (4,30)		4.68 (-4.42, 13.78)	0.307
Family history of atopy (Median (IQR)				
No	12 (7, 27)	0.289 ^a	Ref	
Yes	12 (4, 24)		-3.81 (-12.96, 5.34)	0.407
Hand washing frequency (Median (IQR)				
0-9	11 (5, 24)	0.395 ^a	Ref	
10-19	16 (7, 30)		8.67 (-1.78, 18.92)	0.103
≥ 20	9 (5, 29)		3.79 (-7.94, 15.53)	0.520
Hand washing frequency (Mean $\pm$ SD)				
<10	13.38 $\pm$ 10.39	0.146 ^b	Ref	
≥ 10	20.03 $\pm$ 20.03		6.66 (-2.40, 15.71)	0.146
Hand wet duration (Median (IQR)				
<1 hour	4 (0, 7)	0.069 ^a	Ref	
1-2 hour	12 (6, 27)		12.36 (-2.43, 27.14)	0.099
>2 hour	12 (7, 25)		8.96 (-5.02, 22.94)	0.204
Hand wet duration (Median (IQR)				
<1 hour	4 (0, 7)	0.019 ^a	Ref	
≥ 1 hour	12 (6, 26)		10.26 (-3.11, 23.63)	0.130
Sanitiser use (Median (IQR)				
No	9 (5, 24)	0.188 ^a	Ref	
Yes	16 (9, 27)		6.50 (-3.22, 16.22)	0.185
Non-permeable glove use (Mean $\pm$ SD)				
No	12.82 $\pm$ 10.00	0.013 ^b	Ref	
Yes	24.30 $\pm$ 22.65		11.48 (0.81, 22.15)	0.013

Mann Whitney U test; bIndependent sample t test; cPearson correlation; dSimple linear regression

Table V: Association between presence of contact sensitisation with morphological pattern of hand eczema

	Morphology, n (%)							p-value
	Chronic Fissuring	Hyper-keratotic	Interdigital	Nummular	Pulpitis	Recurrent vascular	Unclassified	
Sensitisation								
No	4 (33.3)	0 (0.0)	0 (0.0)	1 (14.3)	0 (0.0)	5 (23.8)	1 (16.7)	0.874
Oligosensitisation	6 (50.0)	2 (100.0)	3 (75.0)	3 (42.9)	1 (50.0)	7 (33.3)	3 (50.0)	
Polysensitisation	2 (16.7)	0 (0.0)	1 (25.0)	3 (42.9)	1 (50.0)	9 (42.9)	2 (33.3)	
Sensitisation								
No	4 (33.3)	0 (0.0)	0 (0.0)	1 (14.3)	0 (0.0)	5 (23.8)	1 (16.7)	0.910
Yes	8 (66.7)	2 (100.0)	4 (100.0)	6 (85.7)	2 (100.0)	16 (76.2)	5 (83.3)	

Fisher Exact test

Factors associated with contact sensitisation

There was no significant association in age, gender, presence of atopy, family history of atopy, hand washing ≥ 10 times a day, duration of hand wetting of $\geq$ one hour a day, non-permeable glove use, sanitiser use, body piercing, metal braces/dental implants, metal accessories use, fragrance use and smoking with oligosensitisation or polysensitisation groups. Cosmetics use was observed to significantly increase the odds for polysensitisation by 7.07 times rather than no sensitisation [OR (95% CI): 7.07 (1.17, 42.85); $p=0.033$]. The results are presented in Table III.

Factors associated with hand eczema severity

The use of non-permeable gloves was significantly associated with a higher HECSI score (12.82 $\pm$ 10.00 vs 24.30 $\pm$ 22.65; $p=0.013$).

Hand eczema severity was not significantly associated with age, gender, presence of atopy, family history of atopy, frequency of hand washing ≥ 10 times a day, duration of wet hands of $\geq$ one hour a day and presence of at least one sensitiser. The results are presented in Table IV.

Morphology

The morphological types of hand eczema observed in our study population were as follows: Twenty one (38.9%) patients had recurrent vesicular eczema, 12 (22.2%) chronic fissuring, 7 (13.0%) nummular, 6 (11.1%) unclassified, 4 (7.4%) interdigital, 2 (3.7%) hyperkeratotic and 2 (3.7%) had pulpitis. Morphology was not associated with a positive patch test (p value = 0.910) and no one particular sensitiser was associated with any morphology. The breakdown of hand eczema morphology is presented in Table I. The association with sensitisers was shown in Table V.

DISCUSSION

The overall rate of patch test positivity among our study population is comparable to previous results from this region, which was between 76.6%-81.2%.^{17,18} The most common sensitisers in our study were similar to those previously observed locally and in neighbouring countries.^{17,18} Globally, preservatives had a more significant presence as a common sensitiser alongside metals and fragrance which ranked 4th and 5th in our study.¹⁹

Polysensitisation in hand eczema was reported to be higher by Gosnell, Schmotzer, and Nedorost²⁰ at 48% and in our study (41.7%) compared to the 16.7% expected by Carlsen et al⁴ of all positive patch test results.^{4,20} The higher incidence of polysensitisation in hand eczema could be due to the hands being the primary way in which the patients interact with the environment.²⁰ Data from the Spanish Contact Dermatitis Registry showed hand dermatitis had 46% higher risk of developing polysensitisation compared to facial dermatitis.¹⁹

Factors associated with sensitisation

We did not find any significant differences in patient-related factors between non sensitised, oligosensitised and polysensitised groups in contrast to other studies showing the highest sensitisation rates among middle aged adults with facial, hand and leg dermatitis.²¹ There were significantly higher percentages of females who were sensitised in other studies attributed to higher prevalence of cosmetics and topical products use and better health seeking habits among female patients.²² Although females outnumber males, no significant correlation with gender was seen in our study.

We found no significant association between atopy/family history of atopy with sensitisation which echoes the findings of Boonchai & Iamtharachai.¹⁸ An earlier longitudinal study by Uehara & Sawai²³ found severity of atopic dermatitis to be negatively associated with contact sensitisation with dinitrochlorobenzene, suggesting suppressed contact sensitivity in patients with atopic dermatitis.²³ To further elaborate, contact sensitisation and elicitation are primarily driven by Th1 which can be suppressed by atopic dermatitis which is Th2 driven.⁷ In contrast, Kirchof and de Gannes²⁴ found atopy to be associated with sensitisation, emphasising the combination of barrier dysfunction from filaggrin mutation and exposure to irritants and allergens to be important factors in contact sensitisation.²⁴ The above contrasting views highlight the unclear relationship between atopic dermatitis and contact sensitisation. It is also possible that mild atopic dermatitis is associated with higher sensitisation while moderate to severe atopic dermatitis is associated with lower sensitisation.⁷ However, the above is not covered in our study.

A meta-analysis of 45 studies identified hand washing habits, wet work, and occlusion to be risk factors for hand eczema while use of alcohol based hand rubs was not associated with hand eczema.⁸ These risk factors likely contribute to hand eczema through their effect on the skin barrier function and subsequent irritant contact dermatitis. Yüksel⁷ proposed a disrupted skin barrier to facilitate entry of allergens for sensitisation of T cells leading to allergic contact dermatitis but we did not find a significant association between these

factors and sensitisation.⁷ It is possible that frequent hand washing and prolonged hand wetting activities have an indirect association with sensitisation but are more highly associated with irritant contact dermatitis rather than allergic contact dermatitis. Hamnerius et al²⁵ reported kitchen work to be associated with hand eczema while caring for children below five was not.²⁵ We did not find any statistically significant association between caring for children aged four and below, or kitchen work with sensitisation.

We did not find any significant association between sanitiser use and sensitisation. Contact allergy to alcohol in sanitisers is deemed rare although possible.²⁶ This is supported by data from a 10-year surveillance study in Switzerland which reported no documented contact allergy (estimated incidence density of 1:35,000 person-years) to commercial alcohol based hand rubs.²⁷ Impurities and non-active ingredients such as fragrances, tocopherol and sodium benzoate can contribute to contact allergy as well.²⁶ However, there is less allergen per sanitiser product compared to water based soaps and some sanitisers were in fact declared allergen free as per list from American Contact Dermatitis Society.²⁸

Nickel sensitisation is complex and has been shown to be higher in patients with body piercings.^{9,29} However, pinpointing a single source of sensitisation and elicitation in nickel allergies is difficult as multiple sources such as jewellery, occupational, diet and implants can contribute simultaneously and hand eczema can be a presentation of secondary eruption in nickel allergy.⁹ Conversely, early oral exposure to nickel may confer a protective benefit against nickel sensitisation.⁹ While the mechanism is not fully understood, it was observed that patients who develop tolerance to nickel from oral exposure were patients who have CD4 T helper cells stimulated in isolation, leading to IL-10 expression which was anti-inflammatory.⁹

We did not find a significant association between body piercing, dental brace or use of metal accessories with sensitisation. Beyond contact with nickel, frequency and duration of contact with nickel, presence of occlusion, sweating, dose of nickel released from the source and diet may have affected the results of this study.⁹ There were discrepant findings on the association between nickel contact allergy and smoking.³⁰⁻³² Thyssen et al.³⁰ showed a positive association between smoking and nickel sensitisation but smoking was not an independent risk factor in that study.³¹ Our study results did not show an association but the number of smokers in our study was small.

Despite our high collective positive rate of 44% of patients with fragrance allergy compared to previous local studies, we did not find a significant association between fragrance use and sensitisation. We infer that sensitisation to fragrances is beyond exposure to products specifically used for the purpose of smelling nice but due to hidden fragrances added to mask the 'chemical odour' of most skin care products which may have been missed during the interview with our patients.

We found that polysensitisation was associated with cosmetic use. Polysensitisation frequently involved fragrances and preservatives which are common allergenic ingredients in

cosmetic products as reported by the European Surveillance System on Contact Allergies 2009-2014.³³⁻³⁴ We observed the same trend as our most common sensitisers excluding nickel in the polysensitisation group were fragrances and preservatives. While we are unsure if fragrances or preservatives have intrinsic properties that promote polysensitisation, we propose polysensitisation in cosmetics to be associated with the habitual use of multiple products in cosmetics.

Factors associated with hand eczema severity

Hand eczema severity has been associated with older age, atopic dermatitis, frequent eruptions, wet works > five hours, presence of chapped fingers, higher transepidermal water loss and presence of at least one positive patch test.^{12,35-36} However, these associations were not consistently observed.³⁵⁻³⁶

Our study found non significantly higher HECSI scores in patients with atopy, frequent hand washing and duration of hand wetting. The lack of statistical significance with hand wetting may be related to the duration, as a significant increase in HECSI scores was reported with duration > five hours a day while we recorded up to two hours or longer.³⁶

We showed significantly higher HECSI scores in patients who used non permeable gloves which may be explained by increased transepidermal water loss and increased *Staphylococcus* colonisation observed in some other studies.³⁷ However, there were inconsistent findings with regards to the effect of *Staphylococcus* colonisation and severity of hand eczema. Nørreslet et al³⁸ did not find an association while Mernelius et al³⁹ found otherwise.³⁸⁻³⁹

The lack of association between the presence of at least one sensitiser and higher HECSI scores in our study is in line with previous reports and reiterates the importance of evaluating irritants as well as allergens in patients with hand eczema.

Relationship between morphology of hand eczema with risk of sensitisation

Recurrent vesicular hand eczema compared to other hand eczema morphologies was reported by Boonstra et al¹³ to have a higher risk for contact allergy.¹³ Sensitisation was less likely with hyperkeratotic palmar eczema and pulpitis.¹³ The most common hand eczema morphologies are recurrent vesicular and chronic fissuring which are also seen in our patients.¹³ However, we did not find any morphology to be significantly associated with sensitisation.

LIMITATIONS

Clinical relevance was assessed based on patients' recall which was subject to recall bias. Some relevant sensitisations may have been missed with the use of a single standard series without additional relevant extended series or testing with own products. Cross reacting sensitisers were still included as polysensitisation, as there is no reliable method with this study design to ascertain cross reactivity from true polysensitisation and this may overestimate the number of patients with polysensitisation. This study is underpowered as the sample size for power of 80% was not achieved.

CONCLUSION

The prevalence of sensitisation in hand eczema patients was very high. Nickel, fragrance mix 1, potassium dichromate and formaldehyde were the most common sensitisers. Atopy, family history of atopy, frequency of hand washing, morphology of hand eczema and duration of hand wetting activity were not associated with sensitisation. Polysensitisation was associated with cosmetics use. Use of non-permeable gloves was associated with increased hand eczema severity. Patients with hand eczema should be subjected to patch testing as part of their management to identify possible irritants or allergens which may be avoided to improve their condition.

ACKNOWLEDGEMENTS

The authors would like to thank the Director General of Health Malaysia for his permission to publish this article. We would also like to thank the Director, Head of Department, the clinical and administrative staff of the Dermatology Department at a tertiary hospital in the capital of Selangor for their support throughout the study. Special thanks are also given to the patients who participated in this study.

CONFLICT OF INTEREST

None declared.

FUNDING

No funding was received for conducting this study.

ETHICAL APPROVAL

Approval from the Medical Research and Ethics Committee (MREC) of the Ministry of Health (MOH) Malaysia was obtained prior to initiation of the study (Research ID: RSCH ID-23-04790-YJR). The study was conducted in compliance with ethical principles outlines in the Declaration of Helsinki and Malaysian Good Clinical Practice guidelines.

DATA AVAILABILITY

Data are available on request from the authors.

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