

# Assessment of hand or foot eczema and contact dermatitis among car mechanics

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**Abstract. – OBJECTIVE:** Exposure to mineral oil and petroleum derivatives is common among motor vehicle repair workers, leading to occupation-related dermatological conditions. **Objective:** We aimed to determine the prevalence of contact dermatitis among workers of car garages in the unorganized sector and to explore their personal safety measures.

**SUBJECTS AND METHODS:** This prospective community-based study was conducted among 200 workers aged 18 years and above employed at 70 car garages in Majmaah City, Saudi Arabia. Data were collected by a trained medical student using a standardized questionnaire on age, nationality, type of work, working hours, past history of dermatitis, clinical examination, personal safety equipment, and treatment-seeking behavior of workers. Descriptive analysis and chi-square test of significance were done using SPSSv25.0.

**RESULTS:** The self-reported prevalence of eczema/contact dermatitis within the past year was 14.5% (n=29), with hand lesions being the commonest (63%). Participants aged 18-30 years, working as car mechanics, and working for more than 10 hours had a statistically significant higher prevalence of contact dermatitis as compared to their counterparts. Most of them wore some or the other safety wares like safety shoes (20.9%), gloves (20.3%), Face masks (20%), earmuffs (10%), and helmets (2.8%). However, only 30% of cases sought treatment for the condition, reflecting poor healthcare-seeking behavior.

**CONCLUSIONS:** The prevalence of contact dermatitis among workers of car garages was found to be lower than in other countries in KSA, probably due to stringent implementation of Occupation and Health Safety laws. However, workers had poor treatment-seeking behavior for this condition, which needs to be improved by taking appropriate public health measures.

*Key Words:*

Occupational contact dermatitis, Motor vehicle repair workers, Car garages, Saudi Arabia.

## Introduction

Skin disorders, especially contact dermatitis, comprise more than 35% of all occupation-related diseases, affecting about one worker per thousand annually<sup>1</sup>. A study<sup>2</sup> from Egypt showed that the prevalence of contact dermatitis was 18.4% in automobile repair workers compared to 3.9% among the control group, which involved book-sellers. Much of the research pertaining to the assessment of the incidence of contact dermatitis along with its risk factors have been conducted in developed countries like USA, UK, France, Finland, and Denmark<sup>3-8</sup>.

Automobile repair workers are at high risk of developing these conditions due to their exposure to mineral oils, petroleum products and their derivatives, lubricating oil, thermal burns or vibrating power-driven hand tools<sup>3,5,9</sup>. Apart from these, lesser usage of personal protective equipment and engagement in high-risk behavior like non-usage of gloves predispose them to skin problems<sup>10</sup>. A few studies have documented low awareness levels of automobile workers towards hazardous effects of these harmful agents in the workplace<sup>10</sup>.

Kingdom of Saudi Arabia (KSA) is among World's top ten countries having the highest motor vehicular density, with an estimated six million vehicles on the road at a time. Thousands of workers work in motor vehicle repair workshops (MVRW) and fuel stations along with small workshops (referred to as car garage in this

paper) for maintaining these vehicles<sup>11</sup>. These MVRWs and car garages are registered under Municipalities of KSA (locally known as Baladiya), and the workers working here are governed by the Occupational Health and Safety (OHS) laws of the Ministry of Labor. The Ministry of Labor, along with Municipality, issue the working license to MVRW and small car garages after ensuring four basic parameters that are, health of workers, workplace and labor insurance, fire safety measures, and working conditions for the labor<sup>12-14</sup>. Studies<sup>13,14</sup> have been conducted in KSA for assessing the OHS measures in MVRWs in Jeddah and other parts. But all these studies evaluated the OHS measures pertaining to workplace infrastructure instead of personal safety norms followed by the workers. A few studies have been conducted to explore the prevalence of contact dermatitis among healthcare workers, especially during COVID-19 times, due to more usage of gloves and personal protective equipment (PPE)<sup>15</sup>.

Quantification of the disease burden is the first step towards risk identification, assessment, and mitigation. For addressing the cultural and ethnic differences among the communities, it is mandatory to study the community contexts for strong public health measures. We could not find even one study addressing the issue of contact dermatitis among workers of car garages. It is worth considering that the large-sized MVRWs fall under the organized sector, wherein the workplace and its workers are under constant surveillance for following safety standards by the governing bodies in KSA. However, the small-scale car garages, though registered with Baladiya, comes under the radar occasionally via periodic surveillance.

Hence, we planned to conduct this study with the primary objective to determine the prevalence of contact dermatitis among workers of car garages in the unorganized sector and to explore the personal safety measures followed by them in Majmaah City of Kingdom of Saudi Arabia.

## Subjects and Methods

This prospective community-based cross-sectional study was carried out among garage workers in and around Al-Majmaah City of Riyadh Region in the Kingdom of Saudi Arabia from March 2020 to April 2020. The total population of this city is 0.13 million. There are about 18 million registered vehicles in KSA with 2.7 mil-

lion (15% of total) registered in Riyadh<sup>11</sup>. There are about 165 car garages constituting the unorganized sector of MVRWs, in and around City Majmaah, where on an average 3 workers were employed in every unit.

From the literature, we found that 60-90% of workers working in small MVRWs under humid conditions develop any type of contact dermatitis. Assuming the prevalence of dermatological disorders to be 85% among these workers in KSA, the minimum sample size required would be 200 to estimate the true levels of any type of contact dermatitis at 80% power and 95% Confidence Interval by using the formula  $Z^2pq/d^2$ , where Z is the value from standard normal distribution corresponding to desired confidence level ( $Z=1.96$  for 95% CI), p is expected true proportion and d is desired precision

The sampling frame comprised of workers aged 18 years and above working in garages as either car mechanics or car painters or car electricians. Workers with a history of exposure to chemicals other than at the workplace were excluded from the study. We obtained the list of 165 car garages and the workers in City Majmaah from the Municipality of Riyadh. Simple random sampling was used to select the car garages for data collection. A total of 83 car garages were visited for achieving the sample size of 200 workers, of which 13 units refused to participate in the study. Hence, the final data was collected from 70 car garages for fulfilling the sample size.

A medical student was trained by an expert dermatologist of the Institute for clinical identification of dermatitis on the hands and feet of the workers (by ruling out eczema). The operational definitions considered for 'probable' diagnosis of contact dermatitis were: presence of vesicular rash due to an external influence, probably occupational in origin on either hand or foot or both, unlike eczema rash, which is considered to be of constitutional origin and not connected with occupation. Additional information was collected by the researcher regarding the duration of exposure and presence of lesion, the occurrence of similar lesion among fellow workers within the same occupation or any similarity to other post-exposure episodes of dermatitis followed by an improvement and resolution after removal to aid in probable diagnosis.

All the study participants were administered a short version of a validated and standardized Nordic Occupational Skin Questionnaire (NOSQ-2002) for data collection<sup>16,17</sup>. The first

section of the questionnaire captured information about socio-demographic characteristics, any past history of such lesions indicative of self-reported eczema or contact dermatitis, working habits (with or without protective measures), and findings of clinical examination like erythema, scaling, papules, vesicles, and fissures, including their sites for estimating the prevalence of eczema or contact dermatitis. The second part elaborated items pertaining to risk factors like type of work, duration of work, various chemicals to which the participant was exposed, type of protective measures taken, etc.

The questionnaire was translated to Arabic before administering it to the participants. And then, it was translated to English for validating the translation. The questionnaire was pretested for its language, flow of questions, and understandability among 20 cases of contact dermatitis visiting our hospital before initiating final data collection. It took about an hour to conduct the clinical examination and record the data.

Permission for conducting this study was granted by Institute's Ethics Committee. A written informed consent was obtained from the study participants based on the ethical guidelines. Respondents were allowed to withdraw from the study at any time. Confidentiality was ensured. Health-related information was provided to the participants on the risk factors of contact dermatitis, its effect, and how this can be mitigated.

Data were entered in Microsoft Excel and analyzed using SPSS version 25. Descriptive analysis was used to present categorical variables as frequencies and percentages. Chi-square test of significance was used to find out factors significantly associated with contact dermatitis. *p*-value of less than 0.05 was considered statistically significant.

## Results

The present study was carried out among 200 individuals working in car garages, in and around Majmaah, Saudi Arabia. Most of the respondents were residents of Majmaah-117 (58.8%) Harmaah-83 (41.5%). All the individuals working in this sector were expatriates, i.e., from Yemen 58 (29%), India 42 (21%), and Bangladesh 37 (18.5%), as shown in Figure 1. More than half of respondents were in the age group of 18-30 years and 31-40 years accounting for 75 (37.5%), and 67 (33.5%), respectively (Figure 2).

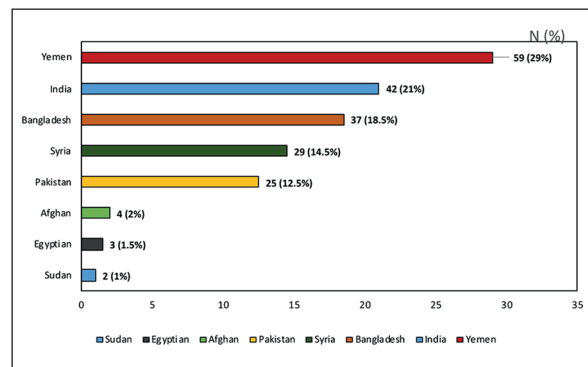


Figure 1. Nationality of participants (N=200).

Table I depicts the distribution of respondents working in a different type of car garages with most of the individuals working as car mechanics 148 (74%), followed by car painter 36 (18%) and car electrician 16 (8%). Most of the individuals were working for more than 10 hrs. (53.5%). We observed that most of them were wearing some or the other safety wares like safety shoes (20.9%), gloves (20.3%), face mask (20%), earmuffs (10%), and helmet (2.8%) (Figure 3).

As these workers are exposed to various chemicals for a prolonged duration, nearly 39 (19.5%) mechanics had a history of eczema or contact dermatitis on hand, foot or hand, and foot. Of these 39 cases, the majority of them had a history of hand eczema 25 (63.4%), foot 8 (19.5%), and involving both hand and foot 4 (11%) (Table II). Currently, about 17 (42.7%) individuals had contact dermatitis, and 10 (26.8%) respondents reported a history of contact dermatitis almost a year ago.

Those who had developed dermatitis while working didn't seek treatment (69.2%). Most of them, 28 (72.8%) observed dermatitis subsides when they are away from work and 10 (25.6%) people reported no

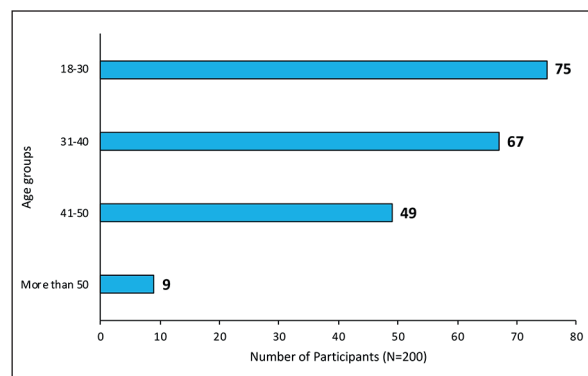


Figure 2. Age distribution.

**Table I.** Distribution of respondents based on type of work and duration of exposure (N=200).

Work type	Frequency (N = 200)	Percent
Car mechanic	148	74.0
Car painter	36	18.0
Car electrician	16	8.0
Duration of exposure		
4-7 hrs.	12	6.0
8-10 hrs.	81	40.5
More than 10 hrs.	107	53.5

improvements in symptoms even after they abstain from work. About 20 (51.2%) of respondents who had a history of contact dermatitis were able to notice that contact with certain chemicals while working made the contact dermatitis worse, out of which nearly half of the people (46.6%) considered the contact with benzene could be the reason for worsening of symptoms (Table II).

Statistically significant association was found between type of work, age group, and duration of work with contact dermatitis. Among all the workers who developed contact dermatitis, 26 (66.7%) individuals were car mechanics and least occurrence in car painters with 15.4% ( $p$ -value  $<0.05$ ). The majority of workers with contact dermatitis were in the age group of 18-30 years. Duration of work was significantly associated with the development of contact dermatitis, with 27 (69.2%) of the individuals who were working for more than 10 hours per day developed the symptoms, which was found to be significant ( $p$ -value  $<0.05$ ) (Table III).

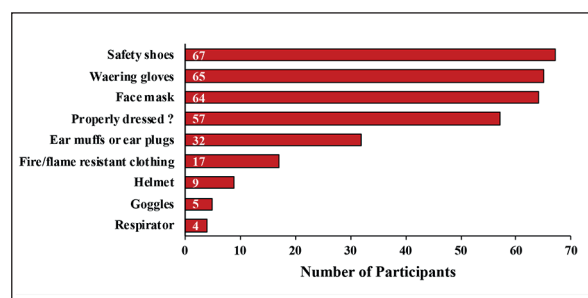
## Discussion

This is the first prospective community-based study that has been conducted in the Middle East among 200 car mechanics working in unorga-

nized sector in and around City Majmaah of Riyadh province in the Kingdom of Saudi Arabia. The majority of the participants were working as car mechanics 148 (74%), followed by car painter 36 (18%) and car electrician 16 (8%) in our study for more than 10 hours (53.5%). These participant characteristics of our study were similar to the one conducted in Iran<sup>18</sup>.

Incidentally, all the car mechanics who participated in this study were expatriates, that is, of non-Saudi origin. The majority of them (68.5%) were from Yemen, India, and Bangladesh, aged below 50 years (96%). According to a labor force survey conducted by the Ministry of Labor in the 2<sup>nd</sup> quarter of 2016, the majority of the labor force (64%) working in all sectors of construction, MVRWs, etc., were expatriates in KSA<sup>19</sup>. This clearly reflected upon the finding that this proportion of the non-Saudi population working in MVRWs, especially in small garages constituting an unorganized sector, is significantly higher than in counterpart sectors. As we had followed the random sampling method for the selection of study units, that is, garages, the possibility of selection bias should be ruled out.

Of the 200 car workers, 39 (19.5%) reported having suffered from either eczema or contact dermatitis in the past, either within one year or more than one-year duration. Of these, 42.7% (17 cases out of 39) had eczema/contact dermatitis at the time of data collection, evident through clinical examination of these workers. The self-reported prevalence of eczema/contact dermatitis within the past one year was 14.5% ( $n=29$  of 200 cases). Of these 39 cases, the majority of them had a history of hand eczema 25 (63.4%), Foot 8 (19.5%), and involving both hand and foot 4 (11%). A study<sup>20</sup> conducted in the Netherlands in 1993 already established that the prevalence ratio of contact dermatitis was 2.4 to 2.8 among males working in a chemical company as compared to office workers, which represented the CD prevalence of the general population.



**Figure 3.** Safety wares used during work. \*Multiple responses recorded.

**Table II.** Distribution of respondents based on site, duration, and probable cause of Contact dermatitis.

	Frequency	Percent
<b>Past history of CD/eczema?</b>		
No	161	80.5
Yes	39	19.5
Total	200	100
If yes, where? (N=39)		
Hands	25	63.4
Foot	8	19.5
Hand and foot	4	11
Other parts of the body	2	6.1
Total	39	100
<b>When did you last have CD/Eczema on your hands/foot/hands and foot?</b>		
I Have it just now	17	42.7
Not just now but within the past 3 months	7	18.3
Between 3-12 months ago	5	12.2
More than 12 months ago	10	26.8
Total	39	100
Received treatment?		
Yes	12	30.7
No	27	69.2
Total	39	100
<b>Does your CD/Eczema improve when you are away from your normal work?</b>		
Yes, usually	14	36.6
Yes, sometimes	14	35.4
No	10	25.6
Do not know	1	2.4
Total	39	100
<b>Have you noticed that contact with certain materials, chemicals or anything else in your work makes your CD/Eczema worse?</b>		
Do not know	4	10.2
No	15	38.4
Yes	20	51.2
Total	39	100
If yes, What?		
Benzene	7	46.6
Dust, oils, benzene	3	20
Engine oils	3	20
Oil, benzene	1	6.6
Paste	1	6.6
Total	15	100

A study conducted in Iran<sup>18</sup> reported the prevalence of hand dermatitis within the last year among automotive and motorcycle technicians to be 19% as compared to the non-exposed group as 7.9%. They considered all cases of dryness and roughness as cases of hand dermatitis, whereas in our study, participants presenting with the presence of vesicular rash were considered to have probable contact dermatitis. The differences in the operational definition from their study could have led to the underestimation of eczema or contact dermatitis, but with a more precise diagnosis in our study. Similarly, a study<sup>2</sup> conducted in Egypt also found a higher prevalence of CD (18.4%) as compared to controls (3.9%).

It was observed that most of them were wearing some or the other safety wares like safety shoes (20.9%), gloves (20.3%), face mask (20%), earmuffs (10%), and helmet (2.8%). In the study<sup>18</sup> conducted in Iran, safety ware, especially gloves, was used by only 15% of the workers. This could be another reason for the lower prevalence of Contact dermatitis in our study population as the Occupational Health & Safety measures (OHS) are strictly implemented by Baladiya in KSA.

Donovan et al<sup>10</sup> found that majority of car workers didn't wear gloves due to a feeling of loss of dexterity. But they concluded that in their study, only 10-19% of workers were using protective gloves but when the workers were made aware by the team that the lesions on their hands were

**Table III.** Association of Contact dermatitis with different variables.

Type of work	CD/Eczema			Chi-Square; <i>p</i> -value
	No	Yes	Total	
Car mechanic	122 (75.8%)	26 (66.7%)	148 (74.0%)	6.530; 0.038*
Car painter	30 (18.6%)	6 (15.4%)	36 (18.0%)	
Car electrician	9 (5.6%)	7 (17.9%)	16 (8.0%)	
Total	161 (100%)	39 (100%)	200 (100.0%)	
<b>Association of CD/eczema with age</b>				
18-30 years	52 (32.3%)	23 (59.0%)	75 (37.5%)	9.573 0.022*
31-40 years	58 (36.0%)	9 (23.1%)	67 (33.5%)	
41-50 years	43 (26.7%)	6 (15.4%)	49 (24.5%)	
older than 50 years	8 (5.0%)	1 (2.6%)	9 (4.5%)	
Total	161 (100%)	39 (100%)	200 (100.0%)	
<b>Association of CD/eczema with workplace</b>				
4-7 hrs.	9 (5.6%)	3 (7.7%)	12 (6.0%)	4.436; < 0.035*
8-10 hrs.	72 (44.7%)	9 (23.1%)	81 (40.5%)	
More than 10 hrs.	80 (49.7%)	27 (69.2%)	107 (53.5%)	
Total	161 (100%)	39 (100%)	200 (100.0%)	

\*Statistically significant at  $p < 0.05$ .

contact dermatitis, the majority of them starting using gloves. Thus, re-iterating the importance of educating workers about the condition and emphasizing upon the protective behavior to address the issue.

Like Attwa et al<sup>2</sup> reported a significant association between the prevalence of CD with age, smoking, duration of work and atopic background, we found its association with young age garage workers working as car mechanics for more than 10 hours in a day. These factors are modifiable risk factors which if addressed, can reduce the prevalence of contact dermatitis.

Only 30% (n=11) of the 39 participants who had contact dermatitis sought treatment for the condition. This finding reflects upon the poor treatment-seeking behavior of car mechanics for the illness. However, 72% (n=28) of respondents felt that the symptoms improve if they remain away from the usual work. This strongly suggested that car workers might be taking leaves from their work, thus impacting loss of work and daily wages.

This is the first study to the best of our knowledge, which has tried to estimate the prevalence of contact dermatitis among workers of car garages, specifically among unorganized sector not only in KSA but among Middle East countries. The prospective community-based study design is another strength of this study. This is because it helped us to understand the profile of study participants better, and also real-time observations

in terms of actual safety measures taken up by the workers helped us to have insight for drawing practical recommendations. This is also the first study to explore the healthcare-seeking behavior of these workers for contact dermatitis, for laying down better public health measures.

However, our assumption to expect the prevalence of contact dermatitis to be around 85% and thereby, a sample size of 200 has proved to be underpowered, thereby adding to the study limitation. But as already discussed, this is the first study to be conducted in the Middle East; this should be considered as a "pilot study." Another possible limitation of this study could be our inability to carry out the patch test for all study participants due to resource constraints.

Based on this, it is recommended that future research should focus on large sample-sized, sufficiently powered cohort studies to compare the prevalence of contact dermatitis among workers in car garages and general population, and to explore risk factors associated with this. More research is required to understand the reasons for poor treatment-seeking behavior among workers.

Another grey area is to educate the workers not only on the signs and symptoms of contact dermatitis and its risk factors, but also on the importance of treatment-seeking for this condition for preventing morbidity and wage loss. The garage workers need to be made aware of the skin clinics available in their vicinity for seeking treatment.

## Conclusions

To sum up, it was found that all the workers of car garages were expatriates, below the age of 50 years, working for more than 10 hours a day. The self-reported prevalence of eczema/contact dermatitis within the past one year was 14.5% (n=29), with hand lesions being the commonest (63%). Participants aged 18-30 years, working as car mechanics, and working for more than 10 hours had a statistically significant higher prevalence of contact dermatitis as compared to their counterparts. Most of them wore some or the other safety wares like safety shoes (20.9%), gloves (20.3%), face masks (20%), earmuffs (10%), and helmets (2.8%). However, only 30% of cases sought treatment for the condition, reflecting poor healthcare-seeking behavior.

## Conflict of Interest

The Authors declare that they have no conflict of interests.

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## Data Sharing Statement

All data will be made available to facilitate research reproducibility, while protecting patient privacy and confidentiality.

## Authors' Contribution

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