Original Article

Low Back Pain among Workers in a Paint Factory

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Abstract

Background: Back pain is common among factory workers and is responsible for about 25% of workers' compensation cases. However, data on back pain among workers from paint industry in Saudi Arabia are limited.

Objectives: The objective of this study is to estimate the prevalence of low back pain and to evaluate the associated risk factors among workers of a paint factory.

Materials and Methods: This cross-sectional study used a self-administered questionnaire to elicit data regarding demography, job characteristics and prevalence of low back pain in the past 12 months among workers of a paint factory (n = 102) in the Eastern Province of Saudi Arabia. In addition, a scale of low back pain risk was generated for each department by occupational health professionals using interviews and observations.

Results: The annual prevalence of low back pain was 44.1%, and it was more common among Saudi workers (67.9%) compared with non-Saudi workers (35.1%). Multivariate analysis indicated significant associations between low back pain and nationality (relative risk [RR] = 1.93; 95% confidence interval [CI] = 1.29–2.88), smoking (RR = 1.85; 95% CI = 1.20–2.83) and aerobic exercise (RR = 2.37; 95% CI = 1.19–4.71). Spearman rank correlation showed correlation between the symptom pain scale and smoking (r_s = 0.259; P = 0.008), and exercise was associated with lower pain scale scores (r_s = −0.241, P = 0.015).

Conclusion: This study found that low back pain is common among paint factory workers in the Eastern Province of Saudi Arabia. Nationality and smoking are risk factors for low back pain and are associated with each other. Many workers did not exercise, and lack of exercise was associated with an increased risk of low back pain. Reducing smoking and increasing exercise in addition to workplace ergonomic intervention may reduce this frequently occurring problem.

Keywords: Exercise, factory, low back pain, Saudi, smoking, workers

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INTRODUCTION

Global industrial development results in multiple work-related injuries and diseases including musculoskeletal disorders (MSDs).[1] Among MSDs, low back pain (LBP), defined "as a sharp or dull pain or muscular stiffness occurring in the back, i.e., the region between the lower costal margins and gluteal folds, the pain being either localized or radiating into the lower extremities (ischialgia),"[2] is a leading cause of disability among workforce worldwide.[3-5] Occupational exposure causes 37% of the estimated LBP global burden.[1,5] Further, in industrialized countries, it accounts for about 20%–30% of all workers' compensation

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claims and about 50% of direct compensation expenses.[4,6] Physical stressors such as repeated bending and twisting and heavy lifting weights are significant risk factors associated with the occurrence of occupational LBP.[4,7] Other risk factors include age, sex, type of work, length of employment, personal factors (e.g., smoking, overweight/obesity and lack of physical exercise) and knowledge of safe lifting principles.[4]

In the United States, about 70%–85% of the population experiences back pain at least once in their lifetime, and the annual and point prevalence rates are 15%–45% and 30%, respectively.[8] Further, in the US population, back pain was the most prevalent cause of years lived with disabilities in 2016.[9]

A study evaluating back pain prevalence in Al-Qaseem, Saudi Arabia, showed that some occupations were correlated with having appreciable back pain such as unskilled worker (17.9%), skilled worker (16.1%), professional worker (24.4%), etc.[10] Similarly, in Riyadh, a study on work-related MSDs among construction workers found that 16.5% of the participants had LBP.[11]

In Saudi Arabia and other developing countries, less attention is directed toward occupational safety, workplace hazards and work-related injuries and illnesses, particularly MSDs. Despite the production, packaging and distribution of paint involving processes with moderate levels of heavy-duty physical work including lifting, pulling and pushing, reports on the paint industry occupation-related LBP in Saudi Arabia are rare. Accordingly, the present study aims to determine the prevalence of LBP among workers of a paint factory in the Eastern Province of Saudi Arabia and identify the most significant contributing risk factors. The study would provide baseline data on the prevalence of LBP and risk factors among workers in the paint industry of the region.

MATERIALS AND METHODS

This self-administered, cross-sectional survey using a convenience sample of workers from a paint factory in the Eastern Province of Saudi Arabia was conducted between March 1 and April 30, 2015.

The study included the paint factory workers aged 18–65 years with jobs that required manual handling (lifting, pushing and pulling of loads), awkward postures and driving vehicles. Only those workers that consented to participate in the study were included. Further, the workers were asked if they had a medical history of back problems (such as spinal injury, cauda equina syndrome, inflammation, tumor or osteoporosis) and those who did, were excluded from the study. In addition, office workers and those with a psychiatric illness history were also excluded from the study.

All participants were appraised of the details of the study and its outcome and a signed informed consent form was obtained (either in English or Arabic, as preferred). Respondents were informed that participation was voluntary and anonymity would always be maintained. The study was approved by the Institutional Review Board at Imam Abdulrahman Bin Faisal University (IRB-2018-03-150).

Data were collected using a modified version of a validated questionnaire (in both English and Arabic), as previously used by Behisi *et al*.[12] For this study, the section addressing back pain location and medical evaluation was excluded for the purpose of this survey, and eventually, the questionnaire contained five sections. The first section elicited information about the worker (age, nationality, education, weight, height and smoking habits) and their job characteristics (job type and employment duration by years), while the second section elicited information regarding LBP in the past 12 months. The questionnaire used skip patterns for those without LBP. The third section characterized the severity of LBP on a scale of 1–5 (1 = very mild; 5 = very severe), and sick leaves and light duty were used as indicators. The fourth section obtained information about the interference of pain with work, life and sleep (no interference, some interference or daily interference). The fifth section obtained information about exercise type (aerobic, strength exercise and no exercise program) and duration, if applicable. The questionnaire was pilot tested on 10 employees to assess the clarity of the questions and no changes were recommended, and thus these responses were also included in the final analyses. For workers with language difficulties, the questions were read out and their responses were recorded. A research staff member was available to assist in understanding questions, if required.

Three experienced occupational health professionals from the Department of Family and Community Medicine, College of Medicine, Al Khobar, Saudi Arabia, visited the worksite and independently assessed job activities in each department through interview of workers and observation of their work activities. Accordingly, the experts rated the likely risk of LBP using a scale of 1 (least risk) to 100 (greatest risk), and a mean point scale for the sum of the activities was derived for each department to produce an LBP risk scale.

Data were analyzed using SPSS version 16.0 (SPSS, Inc., Chicago, IL, USA). $P \leq 0.05$ was considered significant. Point estimates and 95% confidence interval (CI) are included when appropriate. A descriptive analysis indicating the number and percentage of subjects was calculated for questionnaire variables. Chi-square tests were used to evaluate the association of occupational risk factors and the presence of LBP.

Variables were combined to generate numerical scales. Smoking status was converted from a categorical to a single variable (smoking scale). Aerobic and strength-building exercise variables were combined to create a single exercise scale. Further, a symptom pain scale was generated after combining the interference of LBP with work, life and sleep. Spearman rank correlation was used to detect the relationships between demographic/behavioral variables and scaled variables.

RESULTS

Of the total 150 employees at the paint factory, 26 were office staff and thus excluded from the study, while 22 were not available at the time of conducting this study. All the remaining employees (N = 102) agreed to participate in the study; none had a previous medical history of back problems. Therefore, the questionnaire was administered to 102 employees and all responded. The mean age of the respondents was 35.8 ± 8.3 years and the majority of workers were non-Saudi (72.5%). Most workers (33.3%) had secondary school-level, 28.4% primary school-level and 23.5% university-level education. The body weight of most workers was either normal (41.2%) or overweight (40.2%). The mean work duration was 9.6 years. About 29% were current smokers and about 9% were former smokers. Many of the workers did not have an exercise program. About 47% and 68% did not have an aerobic and strength exercise program, respectively [Table 1]. In addition, 42 workers (41%) did not do both aerobic and strength exercises.

With respect to the type of job, most employees were either skilled workers (22.5%) or forklift operators (16.7%). Regarding shift, most workers (70.6%) had a morning shift [Table 2]. In the preceding 12 months, the annual prevalence of LBP among all workers in this paint factory was 44.1%. About 49% of workers with LBP reported moderate pain intensity and 62.2% had more than three episodes of pain in the past 12 months. Among workers with LBP, 46.7% experienced pain intensity that did not increase during work, while for 60% and 77.8%, the intensity of pain decreased a few hours after work and a week away from work, respectively [Table 3]. With respect to the impact of LBP, 40% of workers with LBP took sick leave and 31.1% required lighter assignments. In addition, pain had some interference with work in 53.3%, with life in 57.8% and with sleep in 55.6% [Table 4].

Multivariate analyses indicate significant associations between LBP and nationality (relative risk [RR] = 1.93, 95% CI = 1.29–2.88), smoking (RR = 1.85, 95% CI = 1.20–2.83) and aerobic exercise (RR = 2.37, 95% CI = 1.19–4.71). LBP

Table 1: Characteristics of the recruited population

Characteristic	*n* (%)
Age (years)	
<30	30 (29.4)
30-40	38 (37.3)
>40	34 (33.3)
BMI	
Underweight (<18.5)	3 (2.9)
Normal (18.5-24.9)	42 (41.2)
Overweight (25.0-29.9)	41 (40.2)
Obese (≥30)	16 (15.7)
Nationality	
Saudi	28 (27.5)
Non-Saudi	74 (72.5)
Education	
Did not attend school	3 (2.9)
Primary school	29 (28.4)
Secondary school	34 (33.3)
Technical training	12 (11.9)
University	24 (23.5)
Work duration (years)	
<10	63 (61.8)
10-20	26 (25.5)
>20.0	13 (12.7)
Smoking	
Never	63 (61.8
Ex-smoker	9 (8.8
Current smoker	30 (29.4)
Aerobic exercise	
None	48 (47.1)
≤3 days/week	23 (22.5)
>3 days/week	31 (30.4)
Strength exercise	
None	67 (65.7)
≤3 days/week	21 (20.6)
>3 days/week	14 (13.7)

BMI – Body mass index

Table 2: Work characteristics

Characteristic	*n* (%)
Job type	
Worker	13 (12.7)
Skilled worker	23 (22.5)
Filling operator	13 (12.7)
Mixing operator	13 (12.7)
Forklift operator	17 (16.7)
Technician	5 (4.9)
Storekeeper	3 (2.9)
Sale order processor	3 (2.9)
Supervisor	12 (11.8)
Shift type	
Morning	72 (70.6)
Evening	30 (29.4)

Table 3: Characteristics of low back pain in the study population

Characteristic	*n* (%)
LBP	
Yes	45 (44.1)
No	57 (55.9)
Pain severity	
Very mild	6 (13.3)
Mild	10 (22.2)
Moderate	22 (48.9)
Severe	6 (13.3)
Very severe	1 (2.2)
Episodes of pain	
One	1 (2.2)
Two to three	16 (35.6)
More than three	28 (62.2)
Back pain during work	
Lesser	12 (26.7)
Same	21 (46.7)
Worse	12 (26.7)
Back pain few hours after work	
Lesser	27 (60.0)
Same	17 (37.8)
Worse	1 (2.2)
Back pain after a week away from work	
Lesser	35 (77.8)
Same	9 (20.0)
Worse	1 (2.2)

LBP – Low back pain

Table 4: Characteristics of low back pain impact

Characteristic	*n* (%)
Sick leave	
Yes	18 (40.0)
No	27 (60.0)
Light duty	
Yes	14 (31.1)
No	31 (68.9)
Back pain interference with work	
No interference	12 (26.7)
Some interference	24 (53.3)
Had to take time off work because of pain	9 (20.0)
Back pain interference with life	
No interference	14 (31.1)
Some interference	26 (57.8)
A lot of interference	5 (11.1)
Back pain interference with sleep	
No interference	16 (35.6)
Some interference	25 (55.6)
Affects every night	4 (8.9)

risk was 1.93 times higher for Saudis than for non-Saudis, 1.85 times higher for smokers than non-smokers and 2.37 times higher for those performing aerobic exercises <3 days/week than those performing aerobic exercises >3 days/week [Table 5].

This study found that LBP was more common among Saudi workers (n = 19/28; 67.9%) than among non-Saudi workers (n = 26/74; 35.1%). Most Saudi workers were low skilled (67.9%), while the majority of non-Saudi workers were high skilled (67.6%). Low-skilled labor is generally characterized by lower educational attainment such as a high school diploma, which typically results in lower wages. Further, the majority of Saudi workers were overweight/obese (60.7%) and a current or former smoker (57.1%). A higher proportion of non-Saudi workers were found to engage in aerobic (56.8%) and strength (40.5%) exercises than Saudi workers (42.9% and 17.9%, respectively). Owing of LBP, about 74% of Saudi workers took sick leave, while 63.2% of them required light duty. LBP interfered with the work, life and sleep of 89.5%, 94.7% and 84.2% of the Saudi workers. Chi-square comparisons among Saudi and non-Saudi were significant ($P = 0.05$) for the following factors: type of job, smoking status, strength exercise, sick leave, light duty and LBP interfering with work, life and sleep [Table 6].

The LBP risk scale developed by the experts was used to examine its relationship with jobs performed in each department. The LBP risk scale was found to be significantly inversely correlated with age ($r_s = -0.213$, $P = 0.032$) and work duration ($r_s = -0.295$, $P = 0.003$). From the symptom pain scale regarding the interference of pain with work, life activities and sleep, a harmful association was found with smoking ($r_s = 0.259$, $P = 0.008$) and a protective relationship with exercise ($r_s = -0.241$, $P = 0.015$).

DISCUSSION

Back pain is a common problem worldwide among industrial workers exposed to physical exertion, repeated bending, twisting and heavy lifting at work.[3,4] However, in Saudi Arabia, there are few studies addressing LBP among factory workers. This study addressed LBP within a paint factory in Saudi Arabia and found that 44.1% of the respondents had LBP. The prevalence of LBP in similar industries worldwide ranges from 11.5% to 69.7%.[4,7,13-32]

This study found that for the presence of LBP, nationality was a contributing factor, with Saudi workers being twice at risk of LBP. Further, smoking is almost twice as high among Saudi workers compared with non-Saudi workers. Our study also found a significant relationship between smoking (both current and former smokers) and LBP, and this result is consistent with findings of previous studies.[4,33,34] Smoking causes degeneration of the intervertebral discs by interference with disc metabolism, proteoglycan and collagen synthesis, likely resulting in back pain.[4,33,35,36]

Similar to the findings of Behisi *et al*.[12] this study found that performing aerobic exercises <3 days/week is a risk

Table 5: Personal and occupational risk factors associated with lower back pain in the preceding year

Independent variable	Back pain in the past year		*P*	Relative risk
	No, *n* (%)	Yes, *n* (%)		
Age (years)				
≤30.0*	17 (56.7)	13 (43.3)	0.908	0.9686
30.1-40.0	21 (55.3)	17 (44.7)	0.949	0.9822
>40.0	19 (55.9)	15 (44.1)		
Nationality				
Saudi	9 (32.1)	19 (67.9)	0.003	1.9313
Non-Saudi*	48 (64.9)	26 (35.1)		
Education				
Less than secondary*	19 (59.4)	13 (40.6)	0.600	0.8633
Secondary	18 (52.9)	16 (47.1)	0.751	0.9141
More than secondary	20 (55.6)	16 (44.4)		
Job type				
Low skilled workers*	25 (58.1)	18 (41.9)	0.695	0.9147
High skilled workers	32 (54.2)	27 (45.8)		
Work duration (years)				
≤10.0*	35 (55.6)	28 (44.4)	0.882	0.9630
10.1-20.0	14 (53.8)	12 (46.2)	0.734	0.8889
>20.0	8 (61.5)	5 (38.5)		
Shift type				
Morning	41 (56.9)	31 (43.1)	0.735	1.0839
Evening*	16 (53.3)	14 (46.7)		
BMI				
Underweight/normal	25 (55.6)	20 (44.4)	0.953	0.9868
Overweight/obese*	32 (56.1)	25 (43.9)		
Smoking				
Never	42 (66.7)	21 (33.3)	0.005	1.8462
Ex-/current smoker*	15 (38.5)	24 (61.5)		
Aerobic exercise				
None/≤3 days weekly*	33 (46.5)	38 (53.5)	0.0138	2.3702
>3 days weekly	24 (77.4)	7 (22.6)		
Strength exercise				
None/≤3 days weekly*	48 (54.5)	40 (45.5)	0.522	1.2727
>3 days weekly	9 (64.3)	5 (35.7)		

*Reference group. BMI – Body mass index

Table 6: Comparison between Saudi and non-Saudi workers

Parameters	Nationality		*P*
	Saudi (*n* = 28), *n* (%)	Non-Saudi (*n* = 74)	
Prevalence of LBP	19 (67.9)	26 (35.1)	
Independent variable			
Job type			
Low-skilled workers	19 (67.9)	24 (32.4)	0.001
High-skilled workers	9 (32.1)	50 (67.6)	
BMI			
Underweight/normal	11 (39.3)	34 (45.9)	0.545
Overweight/obese	17 (60.7)	40 (54.1)	
Smoking			
Never	12 (42.9)	51 (68.9)	0.016
Ex-/current smoker	16 (57.1)	23 (31.1)	
Aerobic exercise			
None	16 (57.1)	32 (43.2)	0.209
≥3 days/week	12 (42.9)	42 (56.8)	
Strength exercise			
None	23 (82.1)	44 (59.5)	0.031
≥3 days/week	5 (17.9)	30 (40.5)	
Sick leave			
Yes	14 (73.7)	4 (15.4)	0.000
No	5 (26.3)	22 (84.6)	
Light duty			
Yes	12 (63.2)	2 (7.7)	0.000
No	7 (36.8)	24 (92.3)	
Back pain interference with work			
Interference	17 (89.5)	16 (61.5)	0.036
No interference	2 (10.5)	10 (38.5)	
Back pain interference with life			
Interference	18 (94.7)	13 (50.0)	0.001
No interference	1 (5.3)	13 (50.0)	
Back pain interference with sleep			
Interference	16 (84.2)	13 (50.0)	0.018
No interference	3 (15.8)	13 (50.0)	

BMI – Body mass index

factor for LBP. Further, this study also found that the combination of aerobic and strength exercise reduced the likeliness of LBP. However, strength exercise was not found to reduce the likeliness of LBP, which contrasts with the findings of Behisi *et al.*,[12] who found that performing strength exercises >3 days/week reduced back pain risk.

There was only a slightly higher proportion of overweight/obesity among Saudi workers compared with non-Saudi workers (60.7% vs. 54.1%, respectively). However, non-Saudi workers perform aerobic exercise about 24% more than Saudi workers and twice as much strength exercise. These differences underlie the importance of nationality as a predictive risk factor associated with LBP among Saudi workers. However, due to additional job security, Saudi workers may have been more comfortable in reporting LBP and asking for sick leaves compared with non-Saudi workers, who may fear losing their jobs. Irrespectively, overweight and obesity are independent risk factors for MSDs.[37] Lord *et al.*[38] and Fernand and Fox[39] have found that the shape and geometry of the lumbosacral spine are important in the occurrence of LBP. The relationship between changes in the lumbar spine angles and LBP was examined in several studies, with varying results.[40-41] Further, other studies have found that individuals with a high BMI and waist–hip ratio have increased lumbosacral angles, which increases the risk and incidence of LBP through biomechanical changes in the lumbosacral spine.[37,40,41]

From the LBP risk scale, this study found that an increase in age and work tenure were inversely proportional to the frequency of LBP. These findings are consistent with that of a study where work tenure has been indicated to be protective.[4] This is likely because over a period, production-line workers may move to office-based jobs owing to LBP or as a promotion or administrative reassignment, which would result in less physically demanding work.[4]

Occupational studies have rarely been undertaken in Saudi paint factories. Therefore, this study identifies a small-scale

paint factory and adds to the cumulative knowledge of small business occupational exposures. This study has few limitations. First, the responses were limited to a single factory. Second, administration of a questionnaire to a diverse workforce speaking multiple languages could have resulted in some unreliable responses. Third, the study depends on self-reporting LBP, and thus there is a lack of objective clinical measures of LBP. Fourth, as this is a cross-sectional study, workers with severe LBP may have already left employment before the study was conducted.

This study has important implications for the near-term economic development in the Kingdom of Saudi Arabia. The findings indicate that occupational LBP is more common among Saudi workers than non-Saudi workers, and that the amount of aerobic exercise by Saudi workers is less. Therefore, the authors recommend that policymakers should implement programs that promote aerobic exercise, proper nutrition and smoking cessation among workers, especially Saudis. This is even more important considering that in the coming years, Saudis would represent a greater proportion of the industrial workforce, including in physically demanding jobs. Economic development in Saudi Arabia may concurrently result in workplaces instituting LBP prevention programs, which in turn could significantly improve productivity and decrease compensation costs.

CONCLUSION

This study demonstrates that LBP is common among factory workers. Smoking is common and is associated with LBP. Many workers did not exercise, and lack of exercise was associated with an increased risk of LBP. Furthermore, LBP was more frequent among Saudi than non-Saudi workers. These results have important implications for preventive efforts.

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Conflicts of interest
There are no conflicts of interest.

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