Relationship between Non-Specific Shoulder Pain and General Health Status in Tire production Industry Workers

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ABSTRACT

Introduction: Shoulder is among the most common sites of musculoskeletal pain. Shoulder and neck pain has been widely investigated but its etiology still remains unknown. However, it appears to be multifactorial. Despite extensive studies on shoulder pain and its etiology, studies on the effect of general health status on non-specific shoulder pain are scarce. The aim of this study was to evaluate relationship between non-specific shoulder pain and general health status in Tire production industry workers.

Methods: This cross-sectional study was conducted in a large tire factory during 2013-2015 and 497 male production line workers were evaluated. Characteristics of workers at baseline were evaluated using a questionnaire covering three main domains: Demographic and occupational characteristics, general health questionnaire (GHQ) and the job content questionnaire (JCQ). subjects were followed up for developing shoulder pain for one year.

Results: At one year following the first visit, 159 (32%) subjects complained of unilateral or bilateral shoulder pain. T-test applied for quantitative variables revealed that the mean work experience, the general health questionnaire (GHQ) score and the quick exposure check (QEC) score were significantly higher in patients suffering from shoulder pain than healthy subjects ($P<0.05$). Pairwise comparison with the chi square test demonstrated that age, work experience, level of education, GHQ score and QEC score were significantly different between the two groups of with and without shoulder pain ($P<0.05$). However, based on the logistic regression analysis, only the GHQ score and age were significantly higher in subjects with shoulder pain compared to the no-pain group ($P<0.05$).

Conclusions: Based on the results of this study general health status is important in non-specific shoulder pain and should be considered in evaluation of workers with shoulder pain.

Key words: Shoulder Pain, Ergonomics, General Health, Occupational Stress

INTRODUCTION

musculoskeletal disorders (WMSDs) have a high socioeconomic burden due to high demand for health care services, absence from work, requesting disability compensation and decreased productivity [1-3]. In many countries, prevention of WMSDs is considered a national priority [4]. Shoulder is among the most common sites of musculoskeletal pain [5]. According to the statistics reported by the United States Bureau of Labor, the mean number of missed workdays due to musculoskeletal disorders (MSDs) is 9 days (per year); among these conditions, shoulder disorders with an average of 15 missed workdays are responsible for the longest period of absence from work [6]. The prevalence of shoulder pain is estimated to be 16-26% among the general population [7,8]. Work related shoulder pain is one of common types of shoulder pain [5]. Shoulder and neck disorders are important problems among the working population with prevalence rate as high as 30% [9, 10].

Shoulder pain is often non-specific in the working population. A study on a population aged 30–64 years who had held a job during the preceding 12 months, demonstrated that the prevalence of non-specific shoulder pain and chronic rotator cuff tendinitis was 12% (410 of 3,525 subjects) and 2.0% (78 of 3,909 subjects), respectively. [11].

Shoulder and neck pain has been extensively studied; but its etiology still remains unknown. However, it appears to be multifactorial [12]. Biomechanical and psychosocial occupational factors as well as the individual parameters have been reported to be the

risk factors of shoulder and neck pain [13]. Some recognized physical risk factors include heavy work load, awkward posture, working with arms above shoulder height, carrying loads on one shoulder, repetitive movements, and vibration, pushing or pulling the shoulder [5]. The cumulative effect of these factors can significantly increase the prevalence of shoulder disorders. A combination of lifting heavy loads, inappropriate work posture and occupations with repetitive movements or shakes increases the risk of shoulder pain by 80 to 150%. Literature has also demonstrated the role of psychosocial factors in development of shoulder pain. High psychological demands, poor control at work, poor social support and job dissatisfaction have been reported to be associated with increased pain complaints [5].

Considering the multifactorial nature of shoulder pain, multi-aspect studies evaluating workers for developing shoulder pain in the workplace in a short period of time would be important. Several methods of assessment have been suggested for this purpose namely questionnaires, observation and measurement of the physical load applied to muscles. Observational studies appear to be more suitable for clinicians with limited time and resources [14]. A specific method of assessment is applicable for an industry only if a specific goal is targeted and it must be reproducible as well [15]. Several observational tools are available but none seems to have superiority over the others [15]. Previous studies failed to come up with an ideal tool for the assessment of physical load [16]. Quick exposure check (QEC) is an instrument that allows the assessment of ergonomic risk factors. It has been demonstrated that the results obtained by QEC for waist and shoulders are well correlated with technical measurements made with simulated tasks [15].

Despite extensive studies on the causes of shoulder pain, there is a gap of information about the effect of general health status on developing non-specific shoulder pain. Thus, this study aimed to assess the association between psychological factors, especially general health status, and shoulder pain in industrial workers taking into account the possible risk factors of shoulder pain.

MATERIALS AND METHODS

Study population:

This cross-sectional study was conducted in a large tire company during 2013-2015 and male production line workers who met the inclusion criteria were entered in the study. Of a total of 568 primary participants, 497 subjects who answered to the follow up phone interview were enrolled (drop-out rate of 12.5%). The inclusion criteria were willingness for participation in the study and no shoulder pain at the study onset. The exclusion criteria were history of any disease affecting shoulder pain or general health status of subjects like cancer, chronic rheumatologic disease, history of shoulder trauma or surgery, substance abuse and use of analgesics or narcotics due to medical reasons. At the onset of study, the Nordic Musculoskeletal Questionnaire was given to the personnel. This questionnaire asks for any pain experience in the past one year. Those who did not report any shoulder pain experience in the past year were included. Workers who reported history of shoulder pain in the past year were excluded. Those who reported episodes of shoulder pain some years ago, but not in the previous year, were also included. In total, 143 were excluded due to having shoulder pain or a confounding disease.

Prior to the study, subjects were thoroughly informed about the study design and a written informed consent was obtained from them. They were ensured about the confidentiality of information and were informed that they can quit at anytime during the course of the study. Moreover, they were reassured that their responses to the questions in the questionnaires will not affect their work position in the factory. The Ethics committee of the NRITLD (National Research Institute of Tuberculosis and Lung Diseases) approved the study.

Description of risk factors:

In this study, characteristics of workers at baseline were evaluated using a questionnaire covering three main domains: Demographic and occupational characteristics, general health questionnaire (GHQ) and the job content questionnaire (JCQ).

The instrument and its contents were designed by two occupational medicine specialists experienced in the field of musculoskeletal disorders in the workplace. Different aspects of occupational stress were evaluated using the Farsi version of JCQ [17]. Reliability and validity of the Persian (Farsi) version of the JCQ have been approved [18]. Based on this questionnaire, subjects were divided into two groups of high and low job demands and high and low job control (with a mean cut off point) according to the scores acquired in job demand and job control domains. Next, based on the binary table resulted from combining these two parameters, subjects were divided into four groups. For the purpose of analysis, subjects in the two groups of passive and high stress were assigned to the high stress group while subjects in the two groups of low stress and active were assigned to the low stress group.

To determine the general health status, 28-question GHQ was used. This questionnaire is used for the assessment of general psychological health status and covers some psychological disorders as well; but has

no diagnostic value [19]. This questionnaire is available in several forms. The GHQ-28 has 4 sections of 7 questions each addressing physical health, anxiety/ sleep disorder, impaired social function, and depression [20]. The questions include multiple-choice (never, sometimes, most of the time, always) and scale of each item are scored from zero (never) to 3 (always) [21]. For categorizing, the mean value was used as the cut off point.

Exercising was questioned as "do you exercise?" with the following answer choices: A. Yes, regularly; B. Yes, irregularly; and C. No. Type of exercise was questioned as "If answered yes to the previous question, please mention the type of exercise". Regular exercising was defined as exercising for a minimum of 30 minutes three times a week [22].

Ergonomic assessment was done for all participants using the QEC by an experienced ergonomist via direct observation. The QEC is a sensitive instrument for the assessment of physical exposure at workplace [23]. In this method, the waist, shoulders/arms, hands/wrists and neck are evaluated in terms of position and repetitive movements. Information about the duration of task, maximum weight tolerated, load applied when carrying a lift, shakes, the visual requirements of the respective work, work pace, and stressful work environment were obtained from the workers. Next, based on the scores gained, each worker was assigned to one of the four ergonomic groups of low (less than 40%), moderate (41-50%), high (51 to 70%) and very high (over 70%). For data analysis, workers were divided into two groups of not requiring urgent intervention (scores less than 50%) and requiring urgent intervention (scores of over 50%).

Smoking was evaluated with these questions: "Do you smoke?" If the answer was

"no" next question was " did you quit?" If the answer was "yes" time of quit and its

quantity was asked. If the answer of first question was "yes", packs and years of

smoking was asked and was reported as pack/year. "shift" work was defined as work in any hours from 6:00 p.m. to 7:00 a.m. the following day [24]. Educational level was evaluated with a multi choice question and for the purpose of analysis, workers were assigned in three groups: below high school diploma, high school diploma, and upper high school diploma.

Shoulder pain:

Understudy workers were followed up for one year at three-month intervals over the phone in terms of developing unilateral or bilateral shoulder pain and its characteristics (cause, unilateral or bilateral). To decrease the risk of recall bias, the researchers made necessary coordination with the HSE unit and decided to do telephone calls every three months. Periodic examinations in this factory were done every year. First, a timetable was created. For example, the name of a worker that showed up on the 15th for periodic examination and included in the study, was written in the table and then every three months, a technician contacted the worker and asked him about the occurrence of musculoskeletal pain in the past three months. If the worker was not available on that day, he was contacted the next day. If the worker reported experience of pain, he was asked to present to the HSE unit for further assessment. For assessment of shoulder pain at the end of the one-year follow up, the Nordic Musculoskeletal Questionnaire (NMQ) was used [25]; which is a well known questionnaire for assessment of musculoskeletal pain at three time points of one week, one month and one year. We used the one-year section of Nordic questionnaire. Workers who complained of having shoulder pain were questioned about the type, intensity and characteristics of the pain by two occupational medicine specialists. Diagnostic tests and rheumatology or orthopedic consultations were also requested whenever necessary. Finally, the diagnosis of nonspecific shoulder pain was made by the factory occupational medicine specialists.

Shoulder pain complaints that were not due to trauma or systemic disease were entered in the study. A positive response was shoulder pain disrupting the worker's daily activities (work activity or daily routines).

Statistical analysis:

All analyses were run with SPSS version 20(SPSS Software, Chicago, IL). Chi square test was used for bivariate analysis of relationship between shoulder pain and demographic, occupational and psychosocial variables of the study. Independent t-test was used for comparison of means of quantitative variables with shoulder pain where normality assumptions were met. Unconditional logistic regression analysis adjusted for possible confounding factors was used to investigate the association between GHQ, QEC and JCQ scores with the probability of shoulder pain. Statistical significance was set at 0.05 for all tests. Odds ratio (OR) was reported with 95% confidence interval (95% CI).

RESULTS

A total of 497 subjects participated in this study. A total of 159 (32%) workers complained of unilateral or bilateral shoulder pain within one year following their first visit. The mean age of participants was 35.6± 4.6 years. The mean work experience of workers was 11.9± 5.4 years. The mean work hours per week was 47.6± 3.9 hours. Most participants (326

workers) worked 48 hours a week. The mean experience in their current work was 7.7±6.1 years. Workers had a mean body mass index (BMI) of 24.8±5.1 KG/m2. Eighty-five workers (17.1%) were smokers with a mean smoking rate of 10.5±6.1 cigarettes/day and 11.8± 7.6 years. Of workers, 103 (20.7%) reported regular exercising, 217 (43.7%) reported irregular exercising and 177 (35.6%) reported no exercising at all. None of the participants reported playing sports like volleyball, tennis, or basketball that require raising the arms over the head. Of workers, 135 (27.2%) were day workers and 362 (72.8%) had shift work.

The mean QEC score acquired by the participants was 53.1± 1.9. Classification of workers in the 4 groups based on their QEC score is demonstrated in Table 1. Table 2 shows the association of shoulder pain and quantitative variables using t-test. The mean work experience, GHQ score and QEC score in workers with shoulder pain were significantly higher than those in the no-pain group (P<0.05). Table 3 shows shoulder pain in participants based on various aspects of the GHQ. All aspects of GHQ were significantly higher in participants with shoulder pain.

Table 1: The Quick Exposure Check (QEC) for work related musculoskeletal risks among the participants of the study (n=497)

Risk level	QEC score[1]	N	%
low	≤40	197	39.6
moderate	41-50	22	4.4
high	51-70	166	33.4
Very high	> 70	112	22.5

[1] QEC: Quick Exposure Check

Table 2: Relationship between shoulder pain in the participants of the study and the study quantitative variables (n: 497)

Relationship between shoulder pain and the study quantitative variables	Shoulder pain				P value
	No		Yes		
	Mean	SD[2]	Mean	SD	
Age	35.5	6.1	36.0	4.8	0.321
BMI[1]	25.0	3.6	25.6	3.8	0.131
Total job experience	11.6	4.5	12.8	4.1	0.004
Current job experience	7.4	5.9	8.2	6.4	0.150
Weekly work hours	47.6	3.7	47.7	4.3	0.824
GHQ score[3]	17.8	9.8	25.0	11.8	0.000
QEC score[4]	51.0	19.0	56.8	19.3	0.002

[1] BMI: body mass index, [2] SD: standard deviation, [3] GHQ: General Health Questionnaire, [4]QEC: Quick Exposure Check

Table 3: Shoulder pain in participants based on different aspects of the General Health Questionnaire

Relationship between shoulder pain and different aspects of the GHQ	Shoulder pain				
	No (%)	Yes (%)	P value	OR	Cl95%
Somatic symptoms					
Lower than 5.60	233(68.1)	47(29.6)	-	1	-
5.60 or upper	109(31.9)	112(70.4)	<0.001	5.1	3.4-7.7
Anxiety/insomnia					
Lower than 6.0	247(72.2)	71(44.7)	-	1	-
6.0 or upper	95(27.8)	88(55.3)	<0.001	3.2	2.1-4.8
Social dysfunction					
Lower than 7.1	236(69.0)	79(49.7)	-	1	-
7.1 or upper	106(31.0)	80(50.3)	<0.001	2.2	1.5-3.3
Severe depression					
Lower than 2.3	253(74.0)	91(57.2)	-	1	-
2.3 or upper	89(26.0)	68(42.8)	<0.001	2.1	1.4-3.1

In terms of QEC score, workers were divided into two groups of ≤50 and >50. The mean GHQ score acquired by the workers was 22.01± 9.1. Table 4 shows the association of QEC and GHQ scores with the explanatory variables.

The association between shoulder pain and understudy variables analyzed by chi square test and the logistic regression model is shown in Table 5. Pairwise comparison by chi square test revealed that age, work experience, level of education, GHQ score and QEC score were different in the two groups of with and without shoulder pain (P<0.05). However, based on the logistic regression analysis, only the GHQ score and age were significantly different between workers with and without shoulder pain (P<0.05).

Table 4: QEC and GHQ score of the participants based on the study variables (n: 497)

The comparison between QEC and GHQ score of the participants based on the study variables	QEC score[1]		P	OR	CI 95%	GHQ score[2]		P	OR	CI 95%
	≤50 N (%)	>50 N (%)				≤20.0 N (%)	>20.0 N (%)			
Age										
<30	42(19.2)	23(8.3)				47(15.9)	18(9.0)			
30-39	135(61.6)	196(70.5)	0.002	-	-	187(63.2)	144(71.6)	0.055	-	-
≥40	42(19.2)	59(21.2)				64(20.9)	39(19.4)			
Total job experience										
<10	69(31.5)	49(17.6)				89(30.1)	29(14.4)			
10-15	95(43.4)	152(54.7)	0.001	-	-	141(47.6)	106(52.7)	0.000	-	-
≥15	55(25.1)	77(27.7)				66(22.3)	66(32.8)			
Weekly work hours										
≤48	197(90)	258(92.8)	-	1	-	272(91.9)	183(91.0)	-	1	-
>48	22(10)	20(7.2)	0.261	0.7	0.4-1.3	24(8.1)	18(9.0)	0.745	1.1	0.6-2.1
BMI[3]										
<25	120(54.8)	109(39.2)	-			151(51.0)	78(38.8)	-		
25-30	81(37.0)	145(52.2)	0.002	-	-	116(39.2)	110(54.7)	0.003	-	-
≥30	18(8.2)	24(8.6)				29(9.8)	13(6.5)			
Smoking										
No	187(85.5)	225(80.9)	-	1	-	255(86.1)	157(78.1)	-	1	-
Yes	32(14.6)	53(19.1)	0.230	0.7	0.4-1.2	41(13.9)	44(21.9)	0.021	1.7	1.1-2.8
Educational level										
Below high school diploma	72(32.9)	102(36.7)	- 0.000	-	-	99(33.4)	75(37.3)	- 0.628	-	-
High School Diploma	96(43.8)	149(53.6)				148(50.0)	97(48.3)			
Upper than high school diploma	51(23.3)	27(9.7)				49(16.6)	29(14.4)			
Exercise										
Yes (regularly)	58(26.5)	45(16.2)	-			65(22.0)	38(18.9)	-		
Yes(Irregularly)	89(40.6)	128(46.0)	0.019	-	-	124(41.9)	93(46.3)	0.570	-	-
No	72(32.7)	105(37.8)				107(36.1)	70(34.8)			
Shift work										
No	62(28.3)	73(26.3)	-	1	-	70(23.6)	65(32.3)	-	1	-
Yes	157(71.7)	205(73.7)	0.613	1.1	0.7-1.6	226(76.4)	136(67.7)	0.284	0.8	0.5-1.2
Job stress										
Low	180(82.2)	210(75.5)	-	1	-	234(79.1)	156(77.6)	-	1	-
High	39(17.8)	68(24.5)	0.079	1.5	0.9-2.3	62(20.9)	45(22.4)	0.739	1.1	0.7-1.7
GHQ score										
≤23	155(70.8)	141(50.7)	-	1	-	-	-	-	-	-
>23	64(29.2)	137(49.3)	0.000	2.3	1.6-3.4	-	-	-	-	-

1 QEC: Quick Exposure Check, 2 GHQ: General Health Questionnaire, 3 BMI: body mass index,

Table 5: Relationship between shoulder pain in the participants of the study and the study variables based on chi square (crude values) and logistic regression analysis (adjusted values) (n: 497)

	Shoulder pain							
	No N (%)	Yes N (%)	Crude P value	Adjusted P value	Crude OR	Adjusted OR	Crude CI 95%	Adjusted CI 95%
Age								
<30	53(15.6)	12(7.6)						
30-39	211(62.1)	120(76.4)	0.005	0.025	-	-	-	-
≥40	76(22.4)	25(15.9)						
Total job experience								
<10	93(27.4)	25(15.9)						
10-15	164(48.2)	83(52.9)	0.016	0.364	-	-	-	-
≥15	83(24.4)	49(31.2)						
Weekly work hours								
≤48	315(92.6)	140(89.2)	-	-	1	1	-	-
>48	25(7.4)	17(10.8)	0.225	0.203	1.53	1.59	0.80-2.92	0.78-3.28
BMI[1]								
<25	169(49.7)	60(38.2)						
25-30	145(42.6)	81(51.6)	0.055	0.238	-	-	-	-
≥30	26(7.6)	16(10.2)						
Smoking								
No	287(84.4)	125(79.6)	-	-	1	1	-	-
Yes	53(15.6)	32(20.4)	0.201	0.829	1.39	1.06	0.85-2.25	0.61-1.85
Educational level								
Below high school diploma	106(31.2)	68(43.3)						
High school Diploma	176(51.8)	69(43.9)	0.028	0.091	-	-	-	-
Upper than high school diploma	58(17.1)	20(12.7)						
Exercise								
Yes (regularly)	74(21.8)	29(18.5)						
Yes(Irregularly)	142(41.8)	75(47.8)	0.434	0.712	-	-	-	-
No	124(36.5)	53(33.8)						
Shift work								
No	95(27.9)	40(25.5)	-	-	1	1	-	-
Yes	245(72.1)	117(74.5)	0.589	0.186	1.13	1.39	0.74-1.74	0.85-2.27
Job stress								
Low	270(79.4)	120(76.4)	-	-	1	1	-	-
High	70(20.6)	37(23.6)	0.482	0.445	1.19	1.22	0.76-1.87	0.73-2.05
GHQ score[2]								
≤20	236(69.4)	60(38.2)	-	-	1	1	-	-
>20	104(30.6)	97(61.8)	0.000	0.000	3.67	3.26	2.47-5.45	2.13-4.99
QEC score[3]								
≤50	165(48.5)	54(34.4)	-	-	1	1	-	-
>50	175(51.5)	103(65.6)	0.004	0.193	1.80	1.34	1.21-2.66	0.86-2.18

1 BMI: body mass index, 2 GHQ: General Health Questionnaire, 3 QEC: Quick Exposure Check

DISCUSSION

This study aimed to assess the association of psychological status and development of non-specific shoulder pain in workers during a one-year period. The results showed that shoulder pain was significantly associated with general health status (Tables 2 and 5). To the best of our knowledge, no previous study has evaluated the association of general health status and development of shoulder pain as we did in the current study. Moreover, in order to comprehensively evaluate this topic, other known risk factors of shoulder pain including physical load, ergonomics and occupational psychological stress were simultaneously evaluated in this study.

Shoulder pain poses a high economic burden among the musculoskeletal disorders. It is a major problem in occupations with a high risk of shoulder pain and it is especially important to recognize its predisposing factors. Tire factory workers are also exposed to the

risk of shoulder pain due to the nature of work in this industry. In the current study, 32% of participants complained of debilitating non-specific shoulder pain in the one-year course of study. In a previous study on rubber factory workers in an occupational setting similar to ours, the prevalence of shoulder pain was reported to be 32.2% in the past 12 months prior to the study [26]. In a study by Choobineh and Tabatabaie in a sugar factory, 48% of workers complained of shoulder pain in the past 12 months prior to the study. In their study, in terms of QEC score, none of participants had a score ≤40 (low), 0.9% had a score of 41-50 (moderate), 20.7% had a score of 51-70 (high), and 78.4% had a score of over 70 (very high) [27]. In our longitudinal study, the QEC score acquired by the workers was less than that obtained by the sugar factory workers (very high score obtained by 22.9% in our study versus 78.4% in theirs). This explains the higher prevalence of shoulder pain in their study. Moreover, we set more strict inclusion criteria for patients with non-specific shoulder pain and those with specific causes like trauma were excluded from the study.

The current study showed that the score gained by workers in ergonomic assessment (the QEC score) had a significant association with development of shoulder pain (Table 2). Such significant correlation was also observed when applying bivariate analysis for QEC score. However, multivariate analysis of all study variables found no significant association between non-specific shoulder pain and QEC score (with a cut off point of 50). The reason may be the effect of other variables like the GHQ score or classification of scores. When analyzing the variables with multivariate analysis, only age and the GHQ score were significantly correlated with shoulder pain (Table 4).

In our study, age had a significant association with shoulder pain (Table 5). The cumulative effect of shoulder trauma and shoulder degeneration by increased age may explain this finding. Bodin *et al.* demonstrated that shoulder pain had a prevalence of 11.1% among males in a large working population and age had a significant correlation with shoulder pain [28]. Such difference in prevalence of shoulder pain may be attributed to several factors. They evaluated different occupational groups and mainly service industry workers and only 33.7% of workers in their study worked in production lines. Also, shoulder pain in their study was evaluated in the past seven days prior to their primary examination and at the follow up session. Another reason is that in our study, workers who did not have shoulder pain at baseline but developed it during the course of the study and still had it at the time of follow up were considered as patients and those who developed shoulder pain at some point within this time period but fully recovered before the follow up session were not considered as patients and assigned to the "no pain" group. One previous study [26] demonstrated a significant association between work experience and shoulder pain. In our study, bivariate analysis revealed a significant association between work experience and shoulder pain ($P<0.05$)(Tables 2 and 5); but this correlation was not confirmed by multivariate analysis (Table 5).

In our study, BMI and shoulder pain were not significantly related in bivariate and multivariate analyses. In the current study, patients were divided into three groups of normal weight (<25), overweight (25-30) and obese (≥30) in terms of BMI. In the study by Bodin *et al*., BMI was not correlated with shoulder pain in male workers either [28].

It is difficult to detect and measure physical exposures that result in development or exacerbation of shoulder pain. Different ergonomic risk factors have been suggested for shoulder pain such as heavy work, awkward posture, working with arms above shoulder height, repetitive movements, carrying loads on one shoulder and shaking, pulling or pushing the shoulder. We assessed physical exposure by observation and using QEC. Our results showed that QEC score had a significant correlation with shoulder pain (Table 2). QEC assesses the physical exposure at four areas and gives a total score. Although this score is not exclusively the shoulder score, it offers a general view of the ergonomic status of the individual at work and it has been demonstrated that its high score has a good correlation with shoulder pain.

Some studies have suggested exercising as a risk factor for shoulder pain [29,30]; while some others [31] did not show such relationship. On the other hand, it has been discussed that lack of physical activity may be a risk factor for neck pain [32]. The current study found no association between exercising and non-specific shoulder pain. We tried to exclusively investigate this possible association by asking about the type of exercise but precise assessment of the role of exercise could not be done due to the lack of an accurate classification and absence of workers practicing heavy exercise with repetitive movements of the arms above the head or vigorous shoulder movements. Role of exercising in this respect must be investigated exclusively in studies with sport-medicine approach. Studies like the current one cannot comprehensively assess all aspects of exercise movements.

Several studies have investigated the role of occupational factors in development of shoulder pain. Occupational factors like high psychological demands [33, 34, 35], poor control at work [33, 36],

poor social support [33], job dissatisfaction [33] and mental stress [37] may play a role in development of shoulder pain.

Non-occupational factors may also play a role in occurrence of shoulder pain. Role of several occupational and non-occupational factors such as family burden, psychological stress and physical strain has been confirmed in development of musculoskeletal pain [38]. In the current study, GHQ has been used to assess all occupational and non-occupational factors affecting general health status. The results showed that high GHQ score is a strong predictor of shoulder pain in the upcoming year. General health status includes all psychological, physical and socioeconomical aspects of one's life; for instance, an elderly man that has a 10kg weight child and has to carry him for many hours during the day or has to walk a long distance to get to work every day. Some of these factors are not considered in standard occupational questionnaires but have a great impact on the lifestyle and musculoskeletal disorders. GHQ is a questionnaire that evaluates all factors as gross and indirectly considers all these factors and can determine the general health status and shoulder pain.

Several points must be taken into account when interpreting the results of the current study: one problem of assessing shoulder pain in our study was unclear borders of the classification system used. This classification becomes more difficult when relationship with work is taken into account [5]. On the other hand, in workplaces, occupational medicine specialists always have limitations for changing the position of the personnel and must carefully decide whether the work condition has caused shoulder pain or not. Malingering is another problem often encountered in an industrial setting and is part of the process of pain description. Workers often exaggerate or minimize the existing problem and all these factors result in indefinite diagnosis.

Another problem encountered when assessing the relationship of shoulder pain with work was that the classification of shoulder pain often depends on the clinical judgment of the examining physician and therefore has limited sensitivity, specificity and reproducibility [5]. This issue is especially important in studies on shoulder pain because it can result in erroneous classification of patients and eventual uncertainty about the cause. In the current study, a clear classification system has been used for patient; however, the possibility of the occurrence of this error cannot be completely denied.

Strength points: Despite extensive studies on shoulder pain, to the best of our knowledge, this study is among the very few to assess the role of general health in development of non-specific shoulder pain. In order to minimize inter-observer variability, one experienced researcher evaluated the QEC of the workers.

Limitations: This study aimed to assess the effect of general health as well as the ergonomic status on development of shoulder pain in a group of workers with shoulder pain risk factors. One important factor not evaluated in the current study was occupational traumas to the shoulder. Although these injuries comprise a very small percentage statistically [5], they must be evaluated in future studies with larger sample sizes.

Duration of follow up in the current study was short. The authors did not have the opportunity to follow up the participants for a longer period; however, studies with longer follow ups and larger sample sizes may yield more accurate results.

Participants in the current study were all males and thus, we would not be able to assess the effect of gender in this respect. Also, all workers had the same type of insurance and we would not be able to compare them in terms of insurance coverage.

CONCLUSION

Shoulder pain is a challenging issue in occupational settings especially whenever upper extremity physical activity is highly required. Early occupational and medical interventions can prevent chronicity and subsequent complications for both the employees and employers. It seems that general health status is important in non-specific shoulder pain and should be considered in evaluation of workers with shoulder pain.

ETHICAL ISSUES

Ethical issues such as plagiarism have been observed by the authors.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest in relation to this article.

AUTHORS' CONTRIBUTION

Morteza Rahbar Taramsary and Seyed Mohammad Seyedmehdi had the original idea, designed and performed the study. Mohammad Namvar, Majid Golabadi, and , Elham Farid read and approved the study design and protocol, and assist the study to run. Seyed Mohammad Seyedmehdi wrote the manuscript. Other authors read and approved the manuscript.

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