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The effect of physical and psychosocial occupational factors on the chronicity of low back pain in the workers of Iranian metal industry: a cohort study

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Abstract

Background: Low back pain (LBP) is one of the most common problems among the workers of different industries. The role of occupational factors in causing the LBP has been indicated previously. LBP has great socio-economic costs and most of its costs are related to the chronic LBP. The aim of this study was to identify the occupational risk factors that are related to the progression of the LBP from acute to chronic phase.

Methods: This cohort study has been conducted on 185 workers with acute LBP. Information related to their occupational exposure at baseline has been measured with a valid questionnaire using the self-report approach. Patients follow up was done monthly for three months after the start of the pain. Those workers whose occupational exposure had not changed during the follow up were divided into two groups of chronic LBP (n = 49) and cured (n = 136) according to the duration of the pain period (more or less than 3 months), and their job exposures were compared.

Results: Among the physical and psychosocial risk factors, social support (OR= 0.466, CI= 0.231-0.940) and job satisfaction (OR= 0.455, CI= 0.232-0.891), and lifting weights more than 15kg (OR=2.482, CI= 1.274-4.834) indicated a significant relationship with the chronicity of the LBP. After putting the variables into the regression model, only lifting>15kg remained statistically significant.

Conclusion: According to the observed relationship between these occupational risk factors (social support, job satisfaction, lifting>15kg) and the chronicity of the LBP, there is hope that eliminating these factors in the workers with acute LBP will prevent its progression to the chronic phase.

Keywords: Low back pain, Physical factor, Psychosocial factor, Worker.

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Introduction

Virtually every one of the general population will experience low back pain (LBP) at least once in their lifetime (1). The point prevalence of LBP among the general population of developing countries reaches 30% according to the studies. The noted prevalence in the working population is higher due to their work pressure (2).

LBP is one of the most common occupational problems and it is also the cause of a large percentage of disability, job absences and paid compensations (3). In the U.S., 149 million working days in a year are

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wasted due to LBP (4). According to surveys in European countries, annual losses due to production and health care costs related to LBP have been estimated to be 12 billion Euros (5). One third of LBP incidence rate was related to occupational exposures (6). Occupational exposures associated with LBP can be divided into physical and psychosocial subsections.

Lifting, bending, twisting, whole body vibration, sustained sitting, physical effort, and awkward back posture had been reported as main LBP physical exposures; and job control, job demand, job satisfaction, social support, and job strain can be point out as the psychosocial LBP related factors (7).

In the previous studies, the relationship between these factors and the incidence of the acute LBP has been illustrated. The variability of the measured factors, differences in occupational exposures in various industries, and also variability of the assessment tools, might have caused ambiguous and even conflicting results in some of the previous reports (8).

A very few of these studies have discussed the role of the occupational exposures in LBP chronicity. It seems that chronic LBP has higher socioeconomic consequences compared to acute ones; therefore, determining the effective factors in the progression of LBP from the acute to the chronic phase might be necessary (9).The present prospective study evaluated the role of physical and psychosocial occupational factors in the chronicity of the LBP in workers of Iranian metal industries.

Methods

This was a prospective cohort study and was carried out in one of the biggest metal-industry factories in Iran. This study was approved by the Ethical Committee of Iran University of Medical Sciences; and informed consent was obtained from all participants. From July 2012 to July 2013, eligible workers with LBP who met the study inclusion criteria and referred to the factory clinic and enrolled by their own will were included in the study.

1) The inclusion criteria were as follows: Workers should have been known as a new case of LBP; a history of at least six months pain- free period was also needed; (9),

2) LBP duration in the participating workers with acute LBP must have been at least one day, or at least one day of job absence was needed (10);

3) Current episode of LBP in the study participants should not have lasted more than one week from the onset (11).

4) Workers with specific LBP due to one of these factors including osteoporosis, tumor, infection, inflammatory process, fracture deformity and ankylosing spondylitis were excluded from the study (9).

5) The participating workers should have had a history of at least six months in their current job tasks (6). Workers with extra jobs were excluded from the study.

Among the included workers with the mentioned criteria, workers with the following conditions were excluded from the study: Those who changed their job tasks during the follow up, those who had more than one week of continuous job absence or three weeks intermittently, those workers who had low back surgery as a therapeutic procedure in the study period and workers who had not consented to participate in the study.

Workers who come to the clinic and met the inclusion criteria were examined by one physician. The physician regarded all the pain in the area between the twelfth rib and the lower gluteal fold as LBP (10). At the same time, workers were justified the scope of this area, by showing the body manikin by physician. This was done to receive a clear response from the participants about the status of the continuance of the pain in the target area for the next follow up calls.

After the participants met the study criteria, they were asked to fill out the self-reported questionnaires. To ensure the anonymity of the participants, the noted questionnaires did not have any labels or marks. Study check lists were prepared to collect

the following information: Demographic information, LBP history of the participants and their first-degree relatives, working properties such as employment status, work experience, shift working, the kind of the job (official or non-official).

MUSIC questionnaire was used to measure the occupational exposures in the participants. MUSIC questionnaire was designed and validated in Sweden for the first time (12). Validity and reliability of the Persian version of this questionnaire was assessed and accepted in the past (13). Psychosocial occupational factors were measured in the various dimensions of job demand (5 questions), job control (6 questions), social support (6questions), and job satisfaction (4 questions). Response categories for psychological demand, control and support items were on a four-point scale. Job satisfaction category was on a five-point scale. The domain of responses for each dimension was as follows: Job demand (5-20), job control and social support (6-24), and job satisfaction (4-20). The points of each domain were summed, and using the mid-point, they were divided into two groups of low and high exposures. Job strain in people with high job demand and low control was considered positive. In the participants with positive job strain and low social support iso-strain was also considered positive.

Physical exposures such as sustained sitting, awkward back posture, whole body vibration, lifting 5-15kg, lifting >15kg, and working with hands above the shoulder were measured by questions about the duration of the exposure in a working day (physical effort was measured by visual analog scale question), on a five-point scale and were classified as two groups of low and high degrees of exposures.

Follow up was done by the researcher through monthly phone calls after the beginning of the pain. The status of the LBP of the participants was distinguished through answering the question of "Did you have a pain or a problem in the point area more than one day during the last month?' (10).

In the present study, three months duration was considered as the time limit for LBP chronic consideration (1,14). These follow up calls were carried out monthly from the beginning of the LBP to the end of the third month, and those having the pain at the end of the third month without experiencing one continuous pain-free month in this period were categorized in the chronic LBP group.

In cases where the LBP ended, the date of the last pain was asked and one month later they were contacted, and if they did not have any pain in the last month again, then they would be categorized into the improved acute LBP group and their follow up would end.

During these calls, questioned were also asked about the task of the individuals and those participants whose job task had changed during this period were checked again for their occupational exposures; and if a change was observed in their current condition, they were excluded from the study,10 people were eliminated from the study using this method.

Data were entered into the SPSS Ver. 20 statistical package, and quantitative variables were presented by mean and standard deviation; and qualitative variables were presented with frequency and percentages. Independent student t-test, Chi-square test and univariate and multiple logistic regressions were used for data analysis.

Results

In total, 218 questionnaires were collected from July 2012 to the end of July 2013. Thirty-three patients were excluded from the study: 10 participants were excluded due to change in their working conditions, 18 were excluded due to other exclusion criteria and 5 female participants were also excluded due to their small number. Finally data analysis was performed for 185 workers.

Among the participants, 111 (60%) were improved during the first month, 17 (9.2%) during the second month and 8 (4.3%) dur-

Table 1. Demographic characteristics of the metal worker cohort, overall and stratified by LBP status in employees of an Iranian metal manufacturing company, 2012-13

Variable		Total (n=185)	Group 1* (n=49)	Group 2** (n=136)	p
Age (years)	Mean	35.93 (SD= 7.33)	36.55 (SD= 7.02)	35.71 (SD= 7.45)	0.49
	Min-max	23-54	23-54	23-50	
BMI	Mean	25.20 (SD= 3.86)	25.53 (SD= 4.56)	25.08 (SD= 3.59)	0.48
	Min-max	16/42-45/56	18-45.2	16.4-36.2	
Work experience (years)	Mean	10.64 (SD= 7.47)	11.59 (SD= 7.54)	10.30 (SD= 7.44)	0.30
	Min-max	1- 29	1-28	1-29	
Smoking	Yes	47(25.4%)	11(5.9%)	36(25.4%)	0.70
	No	138(74.6%)	38(20.5%)	100(54.1%)	
LBP history	Yes	79(42.7%)	24(13%)	55(29.7%)	0.31
	no	106(57.3%)	25(13.5%)	81(43.8%)	
Family history (LBP)	Yes	26(14.1%)	10(5.4%)	16(21.1%)	0.15
	No	159(85.9%)	39(8.6%)	120(64.9%)	
Marital status	Single	15(8.1%)	3(1.6%)	12(6.5%)	0.76
	Married	170(91.9%)	46(24.9%)	124(67%)	
Education	literacy and school	12(6.5%)	3(1.6%)	9(4.9%)	
	Secondary school-diploma	123(66.5%)	34(18.4%)	89(48.1%)	
	High diploma -University degree	50(27%)	12(6.5%)	38(20.5%)	0.88
Job type	Office worker	23(12.4%)	6(3.2%)	17(9.2%)	0.999
	Non official	162(87.6%)	43(23.2%)	119(64.3%)	
Shift work	rotational	49(26.5%)	14(7.6%)	35(18.9%)	0.70
	Day (fixed)	136(73.5%)	35(18.9%)	101(54.6%)	
Employment Status	Contractual recruitment	82(44.3%)	19(38.8%)	63(46.3%)	0.40
		103(55.7%)	30(61.2%)	73(52.7%)	

* Chronic LBP
** The improved LBP

ing the third month, but 49 participants (26.5%) had chronic LBP (more than 3 months).

The mean age in group 1 (chronic LBP) was 36.6 years and it was 35.7 years in group 2 (the improved LBP), which was not significantly different.

No significant differences were observed between the two groups with respect to other demographic characteristics such as BMI, history of recurrent LBP, history of recurrent LBP in the first-degree relatives of the participants, smoking and job characteristics such as shift work, type of work (official and non- official), work experience and employment status (Table 1).

With respect to psychosocial exposures, social support (OR= 0.466; CI 95%= 0.231-0.939) and job satisfaction (OR= 0.455; CI 95%= 0.232 - 0.891) showed significant differences between the two groups and exposures of job demand, job control, job strain and iso-strain had no significant association with the chronicity of LBP (Table 2).

Among the physical factors, exposure to severe & moderate degrees of lifting> 15kg (OR= 2.48 CI = 1.27-4.83) had a significant association with the chronicity of LBP. Other physical exposures showed no significant differences between the two groups (Table 3).

In multiple logistic regression analyses which was used to evaluate the association between physical and psychological exposures with chronicity of LBP, model 1 was adjusted based on the demographic variables; in model 2, in addition to the demographic variables, the characteristics of subject work and education were adjusted and in model 3 other variables related to physical and psychological exposures were also adjusted. In model 1, a significant association was found between lifting> 15kg and job satisfaction with chronicity of LBP. However, the significant association that was previously observed in social support disappeared after adjusting. In model 2, the significant association of lifting> 15kg and job satisfaction with chronicity of LBP still

Table 2. Psychosocial exposures at work and their association with LBP in employees of an Iranian metal manufacturing company, 2012-13

Psychosocial variable		Total (n=185)	Group 1* (n=49)	Group 2** (n=136)	Odds ratio & CI (95%)
Job demand	High	150(81.1%)	43(87.8%)	107(78.7%)	OR= 1.942
	Low (reference)	35(18.9%)	6(12.2%)	29(21.3%)	C.I= (0.753-5.010)
Job Control	High	126(68.1%)	32(65.3%)	94(69.1%)	OR= 0.841
	Low (ref)	59(31.9%)	17(34.7%)	42(30.9%)	C.I=(0.421-1.680)
Job satisfaction	High	123(66.5%)	26(53.1%)	97(71.3%)	OR= 0.455
	Low (ref)	62(33.5%)	23(46.9%)	39(28.7%)	C.I=(0.232-0.891)
Social Support	High	135(73%)	30(61.2%)	105(77.2%)	OR= 0.466
	Low (ref)	50(27%)	19(38.8%)	31(22.8%)	C.I=(0.231-0.940)
Job Strain	Yes	45(24.3%)	13(26.5%)	32(23.5%)	OR=1.174
	No (ref)	140(75.7%)	36(73.5%)	104(76.5%)	C.I=(0.556-2.479)
Iso-strain	Yes	16(8.6%)	5(10.2%)	11(8.1%)	OR=1.291
	No (ref)	169(91.4%)	44(89.8%)	125(91.1%)	C.I=(0.452-3.924)

* Chronic LBP
** The improved LBP

Table 3. Physical exposures at work and their association with LBP in employees of an Iranian metal manufacturing company, 2012-13

Physical variable		Total (n=185)	Group1 (n=49)	Group2 (n=136)	Odds ratio & CI (95%)
Physical effort	Low (ref)	34(18.4%)	7(14.3%)	27(19.9%)	OR= 1.486
	High	151(81.6%)	42(85.7%)	109(80.1%)	C.I= (0.60-3.67)
Sustained	Low (ref)	109(58.9%)	27(55.1%)	82(60.3%)	OR= 1.237
Sitting	High	76(41.1%)	22(44.9%)	54(39.7%)	C.I= (0.64-2.39)
Whole body vibration	Low (ref)	145(78.4%)	35(71.4%)	110(80.9%)	OR= 1.69
	High	40(21.6%)	14(28.6%)	26(19.1%)	C.I= (0.79-3.59)
Awkward back posture	Low (ref)	74(40%)	17(34.7%)	57(41.9%)	OR= 1.35
	High	111(60%)	32(65.3%)	79(58.1)%)	C.I= (0.68-2.68)
Lifting (5-15kg)	Low (ref)	100(54.1%)	28(57.1%)	72(52.9%)	OR= 0.844
	High	85(45.9%)	21(42.9%)	64(47.1%)	C.I= (0.43-1.63)
Lifting (>15kg)	Low (ref)	113 (61.1%)	22(44.9%)	91(66.9%)	OR= 2.48
	High	72(38.9%)	27(55.1%)	45(33.1%)	C.I= (1.27-4.83)
Work with hand above shoulder	Low (ref)	128(69.2%)	28(57.1%)	100(73.5%)	OR= 2.08
	High	57(30.8%)	21(42.9%)	36(26.5%)	C.I= (0.98-4.12)

* Chronic LBP
** The improved LBP

remains standing. In Model 3, after adjusting other psychological and physical factors, the association between job satisfaction and chronic LBP disappeared, but a meaningful association (lifting> 15 kg) with the chronicity of LBP still remained (Table 4).

Discussion

Among185 participants of the study, 111 (60%) were improved at the end of the first month. This number reached to 128 (69.2%) at the end of the second month and to 136 (73.5 %) at the end of the third month. Forty nine patients (26.5%) were suffering from chronic LBP at the end of

Table 4. Unadjusted and adjusted OR with 95% confidence interval for psychosocial and physical factors associated with Chronicity of LBP in employees of an Iranian metal manufacturing company, 2012-13

Multiple logistic regression	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Unadjusted OR (95% CI)
High social support	0.491 (0.237-1.017)	0.483 (0.230-1.013)	0.432 (0.160-1.169)	0.466 (0.231-0.939)
High job satisfaction	0.460 (0.229-0.924)	0.456 (0.223-0.933)	0.501 (0.217-1.158)	0.455 (0.232-0.891)
Lifting >15kg	2.737 (1.375-5.448)	2.833 (1.367-5.872)	2.924 (1.202-6.683)	2.482 (1.274-4.834)

Model 1 controled for age, BMI, smoking, LBP history, family LBP history.
Model 2 = Model 1 + controled for education, shift working, job type.
Model 3 = Model 2 + controled for others physical & psychosocial factor.

the third month. This finding is consistent with that of previous studies. In a study conducted by Mellon et.al in New Zealand, persistent LBP was reported to be up to 40 % after 6 weeks (10).

Unlike the results of other previous studies indicating an increased risk for chronic LBP with age and work experience (15), the obtained results of our study did not indicate such a finding, and perhaps the healthy worker effect could be an appropriate justification. However, several studies have also been conducted in the past that revealed similar results like the study conducted by Sadeghi and colleagues in 2003 in Iran on the steel industry workers. There was no association between age, work experience and smoking in patients with chronic LBP (16).

Unlike the study conducted in Finland in 2010 by Kaaria et.al, in our study, no association was found between the history of acute or chronic LBP in the past with the chronicity of the current episode LBP (17). Perhaps this can be explained by the fact that those participants with more potential of having recurrent episode of LBP also have greater awareness about prevention and treatment principles of LBP.

One of the most important results of this study was the fact that exposure with low social support and low job satisfaction had a significant association with chronicity of LBP among the metal industry workers. In a study conducted by Davis et.al, job satisfaction was more associated with acute LBP compared to job demand and job control (18). In a study conducted by Melloh et.al in New Zealand, an association was found between depression and maladaptive cognition with chronic back pain (10). The relationship between social support and job satisfaction with chronicity of LBP in our results could be explained by the fact that if a person feels happy in their work environment and they are supported favorably by others, it is unlikely for them to get depression and such a person with a better mood can adhere to the principles of the pain management and perform their duties by taking advantage of the help of their colleagues when necessary.

In studying physical factors, the association of lifting> 15kg with the chronicity of LBP was significant; however, the other factors did not have any significant association despite the increasing probability.

In a study conducted by Vandergrift in the United States, there was an association between the incidence of acute LBP with factors such as awkward back posture, hand force, physical effort and whole body vibration. However, the effect of these factors in chronic LBP has not been studied (8). In a study conducted in Nigeria, an association was found between lifting and sustained sitting with acute LBP. (19) In a study conducted in Iran in the past, the only factor related to absence from work due to back pain was lifting (7). Our study results based on the lack of association between awkward back posture, lifting 5-15 kg, sustained sitting with chronicity of LBP can be explained taking this approach that perhaps performing ergonomic principles can reduce the harmful effects of the factors mentioned but lifting> 15kg, even with ergonomic lifting principles shows its respective problems due to the heavy nature of the work performed. According to the significant association of lifting> 15kg with chronicity of LBP after making adjustments in different models, it seems that its effect is independent of other physical and psychological factors.

Some strengths of the study are as follows: This was a longitudinal study which makes the causality relationship more valuable before the onset of the outcome. According to the inclusion criteria of worker's job task remaining unchanged for six months prior to the onset of LBP and also during the follow up (Excluding those participants with change in exposures), it has been tried that these exposures remain unchanged during this period, so the causality would not be altered. Workers examined in this study were homogeneous in terms of demographic characteristics and living conditions. There has been relative con-

sistency of the obtained results with studies that have been done in the past.

Limitations of this study were as follows: Small sample size and a self-report questionnaire. Although assessing the exposures, particularly physical types by objective methods, increased the study quality, we could not do it due its high cost. In interpreting the results, it may be helpful to study the psychosocial exposures assessment along with the general psychological situation of the workers (depression and maladaptive cognition).

The type of treatment and the amount of sickness absence (due to the LBP) can be the possible confounder in the relation between occupational exposures and chronicity of LBP. Because the accurate specification of these factors during the period of follow up was not possible, in this study we tried to eliminate the confounding effect of these factors by excluding the patients that received surgical treatments for their LBP and those with sickness absence of more than one continuous week (or 3 alternative weeks) during the follow up.

Conclusion

Few prospective studies have been done on the impact of occupational risk factors in the development of acute LBP to chronic LBP. In this study, we observed a significant relationship between having low social support, low job satisfaction and high degrees of lifting> 15kg with chronicity of LBP. It is suggested that similar studies be conducted with larger sample size and in different industries, and if similar results were obtained we can hope to prevent the chronicity of low back pain by eliminating these exposures in workers with acute LBP.

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