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Occupational Low Back Pain among Workers in Some Small-Sized Factories in Ardabil, Iran

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Abstract: The main purpose of this study was to assess some of the individual and occupational risk factors contributing to induction or intensification of LBP among the employees suffering from this problem in four small size factories in Ardabil, Iran. This study was a cross-sectional study that was conducted among the personnel of four industrial companies. Interview, questionnaire survey, medical examination (Lasegue test), radiographic evaluation, and ergonomic survey (using the NIOSH checklist) were the methods to collect data. The result of the study was divided into two parts: individual factors and work-related factors. The highest frequency of low back pain was observed in the age of 30–34 years old, medium height and heavy weight with 34.4, 84.4, and 33.0 percent, respectively. With regard to work-related factors, load lifting with 44.7 and body posture with 18.4 percent contributed to low back pain as the most important occupational causes among the patients. Observing recommended regulations and limitations of load lifting, modifying and optimizing ergonomic conditions in the workplace, selecting workers with suitable body strength on the basis of a pre-employment examination and implementing a continuous educational program for employees were the most important methods recommended to prevent low back pain.

Key words: Low back pain, Lifting load, Manual material handling, Musculoskeletal disorder

Introduction

Musculoskeletal disorders of the back (LBD), i.e., low back pain (LBP) is among the leading causes of occupational injury and disability in both developed and developing countries. Since 1989, the National Institute for Occupational Safety and Health (NIOSH) has listed musculoskeletal diseases as a leading priority in research and disease prevention efforts in the industrialized countries1). The Bureau of Labor Statistics (BLS internet home page: http.bls.gov.oshhome.htm) trend data for 1992–1995 indicate a general decline in injuries and illnesses requiring days away from work. For example, the incidence rate of overexertion (lifting) declined from 52.1 per 10,000 workers in 1992 to 41.1 in 1995[1)]. According to NIOSH, there may be several reasons for these declines, including general trends in reporting injury, socio-economic trends and improvements due to effective prevention and intervention programs (NIOSH, 1997)[1)]. Of 127 million active workers, 22.4 million (17.6%) reported 'back pain for a week or more' in the 12 months preceding the National Health Interview Survey (NHIS) in 1988. Work-related back pain, caused by injury or repeated activities, accounted for approximately 53% of self-reported causes[1)]. Recent reviews of epidemiology data and workplace factors, including a comprehensive review of musculoskeletal disorders by an expert panel convened by NIOSH, conclude that "strong evidence" exists for the following occupational risk factors: lifting, forceful movement and whole body vibration, and to a lesser degree for heavy physical work and awkward posture (NIOSH, 1997; Burdorf and Sorock, 1997)[1)]. Etiologic research has concentrated on identifying and quantization several personal and work-related factors, as often the exact anatomical cause of LBP cannot be identified the prevalence is highest between the ages of 32 and 55 years and there is no significant gender differences[1, 2)].

Apart from the occupational risk factors, other individual factors such as smoking, sedentary lifestyles, education and

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some psychological factors are important[1, 2]. Gender, height, weight, exercise and marital status, however, appear not to be important regarding back disorders in occupational population[1]. The epidemiology, costs to business and identification of high risk jobs or industries have been recently compiled by a Washington State agency. The highest composite incidence rates for work related musculoskeletal injuries (including lower back pain) were observed in 'wallboard installation' and 'temporary help' (24/100 full time workers), followed by roofing, moving company, garbage collection , nursing homes and beer distributors[1].

In many jobs (construction, nursing homes, hospitals, package and mail handling) heavy or frequent lifting, forceful movements, and carrying of heavy loads complicated by awkward body posture are daily elements of required tasks. If the load is too heavy or the frequency of lifting exceeds the tolerance, acute or chronic injuries (initially, mostly micro trauma) to the lumbar spine can be the consequence. However, there are no simple and solid guidelines to show how much weight is "too heavy" or how many lifts per hour are "too many". The risk of lifting-related LBP increases as the demands (force and frequency) of the lifting task increase[3–5]. The evaluating physician should consider biomechanical, physiological limiting factors of lifting. A job may be considered hazardous if the imposed loads (forces) exceed the individual's strength and endurance/tolerance, i.e., lifting of heavy loads may only be tolerated for a very short time or frequent lifting may only be tolerated for light loads[5].

Repetitive or static awkward body posture resulting form excessive bending (forward and lateral) and twisting (trunk rotation or torsion) will increase the spinal stress and disproportionate loading to spinal structures. Work in forced, extreme body posture can lead to temporary or chronic spinal postural defects and neurological compression syndromes[1].

There is growing evidence that several non-related factors such as age, gender, anthropometric, genetic and psycho-social factors have influence on the presentation, clinical outcomes of LBDs, and behavioral responses of the injured workers. Efforts to control LBP are largely unsuccessful, and better understandings of risks have been needed, especially about psychological factors[1].

The purpose of this study was to assess some of the individual and occupational risk factors contributing to induction or intensification of LBP among the employees suffering from this problem in four small size factories in Ardabil, Iran.

Material and Methods

This study was a cross-sectional study that was conducted among the personnel of four industrial companies in Ardabil, Iran. The number of workers was 1,600 people in total, working at these companies that of them, 109 persons finally claimed to have low back pain following the public announcement in which we already had for two weeks before commencing of the study in those companies. In order to collect data, different ways and methods was accordingly used consists of interview, questionnaire survey, medical examination (Lasegue test), radiographic evaluation, and ergonomic survey (NIOSH checklist survey). The research group members completed the questionnaire during the time of interview and medical examination, and then 103 of those examined were finally diagnosed as certain cases of the low back pain. The next step was radiographic evaluation of these cases to determine the type of the injury which they already had at the time of evaluation. The final stage was the ergonomic survey of the workplaces in order to identify the ergonomic hazardous factors as the more likely causes of the observed low back pain cases.

EPI-INFO 6 as a statistics software was used to collect the data and then to analyze those data.

Results

Frequencies of LBP in each factor group and characteristics of the observed cases of LBP

In the age group, as is seen in Table 1, 65.3%, which was the highest percentage, of the LBP sufferers were in their 30s, while the frequency of LBP was the lowest in "older than 40 years old".

Regarding to the distribution of LBP cases in the height category, most of the cases (84.4%) were 165–175 cm tall and people taller than 175 cm accounted for only 6.8 percent. Body weight was another individual risk factor where the percentages to show the frequency of LBP cases were found different from each other. People with body weight of 71–90 kg formed the highest LBP frequency group accounting for 63.3 percent, while 33.0 percent were lighter than 70 kg and 2.9 percent belonged to the heaviest group (more that 91 kg). The last individual variable for the observed cases of LBP was their work experience. As it is clear from Table 1, "1–5 years" and "10–15 years" showed the highest frequencies of LBP, which were 48.5 and 29.1 percent, respectively.

For further study, the correlations between the independent variables (age, height, body weight and work experience) and the dependent variables (type of LBP, duration of LBP, movement limitation and radiographic evaluation) were examined (Table 4). Pearson constant, "r" was 0.447 between age and duration of LBP, while it was 0.358 between height and type of LBP and no significant correlations were found between height and the other dependent variables. Correlations were also significant between body weight and type of LBP (r=0.189) and between body weight and duration of LBP (r=0.185). Type of LBP and movement limitation

Table 1. Frequencies of LBP in each factor group

Factors	Frequency	Percent
Age (yr)		
24–29	27	26.2
30–34	36	34.4
35–39	31	30.9
>40	9	8.7
Height (cm)		
<165	7	6.8
165–175	89	84.4
>175	7	6.8
Weight (kg)		
<60	11	10.7
61–70	23	22.3
71–80	32	30.1
81–90	34	33.0
>91	3	2.9
Work experience (yr)		
<1	5	4.9
1–5	50	48.5
5–10	30	29.1
10–15	9	8.8
>15	9	8.8
Total	103	100

Table 2. Characteristics of the observed LBP cases

Characteristics	Frequency	Percent
Type of LBP		
Arthritis	30	29.0
Disc problem	37	36.0
Paravertebral Mus. Spasm	29	28.2
Lumbarization + Sacralisation	4	3.9
Sacroiliac joint pain	3	2.9
Duration of LBP (yr)		
<1	40	38.8
1–2	33	32.0
>2	30	29.0
Movement limitation		
Flexion	35	34.3
Extension	8	7.5
Twisting	6	5.6
No limitation	54	52.9
Radiographic evaluation		
Decrease in joint distance	41	40
Sacralisation + Lumbarization	5	4.9
Steophyt formation	35	33.3
Nervous compression signs	18	17.5
Spinal canal narrowing	6	5.8
Total	103	100

had a correlation with load weight (r=0.383 and 0.293, respectively). The only dependent variable which showed a correlation with load dimension was type of LBP (r=0.195). No correlations between radiological evaluation and individual or occupational variables of the LBP cases in any of the four factories were observed. In any statistical analysis significance level was $p<0.05$.

The characteristics of the LBP cases were also examined. The first category was the type of LBP, and the first three kinds on the list in Table 2, namely arthritis, disc problem and paravertebral muscle spasm made up 93.2 percent of all the cases, while 6.8 percent were the cases of Lumbarization plus sacralisation and sacroiliac joint pain. In terms of duration of LBP, 29 percent of people were suffering from the chronic LBP for more than 2 yr, while 71 percent of them reported to have LBP for 1 yr or 1–2 yr. Movement limitation imposed on employees was another important aspect. Fifty-two point nine percent claimed no limitation in their physical movements, but less than half of the patients had a kind of limitation, mostly in flexion. As radiological characteristics, decrease in joint distance, steophyt formation and nervous compression signs were observed in 40, 33.3 and 17.5 percent of the patients, respectively.

The result of occupational and environmental survey

As the main part of the study an observational method using the NIOSH ergonomics checklist was applied. Related data indispensable for the analysis (Table 3 and the following statements) had already been collected. Of all the occupational factors those related to manual material handling accounted for 76.7 percent in total (lifting 44.7 percent, awkward body posture 18.4 percent and repetitive motion 13.6 percent). Owing to the importance of lifting load in this study, the weight and dimension of the objects handled by the employees were also measured. It is notable that nearly 80 percent of the examined employees were carrying load heavier than 25 kg. Likewise, nearly 90 percent of them were manually handling large stuff the shortest side of which was longer than 45 cm. Moreover, it was revealed that employees claimed to have problems such as job unsatifaction, often sensitive relationship with their employers and low income as psychological issues. Skill-attaining or training schedules in the field of occupational health and safety in public or in preventive programs for LBP in particular, were not considered at all in any of the studied companies. Lastly, considering environmental conditions, except for the environmental temperature during the cold season, no certain points affecting LBP were observed.

Table 3. The result of Environmental and Occupational survey

Characteristics	Frequency	Percent
Occupational factors		
Lifting	46	44.7
Pulling	14	13.6
Pushing	9	8.7
Repetitive motion	14	13.6
Falling (Accident)	1	0.1
Body postures	19	18.4
Total	103	100
Load weight (kg)		
<25	10	22.0
25–50	18	39.0
50–75	12	26.0
>75	6	13.0
Total	46	100
Load dimension (cm)		
30– 48	4	9.0
45–72	33	72.0
60–96	9	19.0
Total	46	100

Table 4. Correlations between variables (Pearson constant "r")

	Type of LBP LBP	Duration of limitation	Movement
Age	—	0.447	—
Height	0.358	—	—
Weight	0.189	0.185	—
Workplace	—	0.345	—
Load weight	0.383	—	0.293
Load dimension	0.195	—	—

$P<0.05$

Discussion

Individual factors

A review of 57 original industrial-based surveillance studies indicate that personal factors were the most frequently investigated risk factor for LBP. In terms of the age, the duration of LBP was longer in older people than the others (r=0.447). It is thought that human's general ability declines past 20 and that these people, owing to haste and hurry to do tough jobs and to carry load, are also more likely to have LBP[3]. For our aging workforce, flexion, twisting and lifting activities generate fatal loads on the spine that is low in bone mineral density[4]. LBP typically begins at a relatively young age with the highest frequency of symptoms occurring between 35 and 55[4]. Height or stature of employees was another important individual factor that although there is little consensus among studies, some have associated stature with greater risk of LBP. The ability of carrying load steadily declines with increase in the height of people, and tall people are more susceptible to LBP than the others[5]. The body weight is an important factor to carry load. As the body weight increases, energy consumption and metabolism also increase. This means that in a similar job individuals with heavier weight have to bear more stress physiologically because it causes fatigue and cardio-vascular problems. Obesity is associated with a greater risk of LBP[6–8].

In respect of work experience, how long a person is able to do a manual work depends on his/her tolerance. The earlier study showed that by increasing the duration of working time the metabolism also increased, which then lowered the tolerance of the person and his/her heart rate increases. In other surveys it has been cleared that workers with a long work time desire to decrease the weight of load[7, 8]. Granta *et al*. found the weight, task asymmetry, and job experience (level of experience) affected the magnitude and variability of spinal load during repeated lifting exertions[7, 9].

Occupational and environmental factors

As Table 3 shows, lifting load contributes more to the LBP problem than the other occupational risk factors. This can be explained from some different viewpoints which are all of importance to this study. Firstly, as the dimension increases, the oxygen consumption rate also increases. Secondly, the factors (length and width) making up the dimension cause the hands to be placed away from the central line of the body and this balance shift toward load is important. What is more, in this research, the majority of loads being carried by the employees were broad and large and required more force and change in their body posture, so that lifting eventually caused such LBP. With increase in weight of loads, the compression on spines and discs is considered to become higher. In this research this factor as well as load dimension had correlations not only with type of LBP, but with movement limitation (Table 4). According to Table 3, 78 percent of the observed cases were carrying loads more than allowable amount (ILO and NIOSH standard), which was also remarkable.

In respect of the body posture, carrying different loads requires various postures. Potvin *et al*. pointed out that while lifting, the risk of injury to the spine might be increased more by the degree of lumbar flexion than by the choice of stoop or squat technique[10].

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