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Relationship between Working Posture and Work Injuries in a Clothing Factory Workers in Edirne

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ABSTRACT

Straining movements, repetitive movements, vibration, staying in inappropriate posture for prolonged periods cause complaints such as pain in the in the musculoskeletal system, injuries, sprains, hernia, tears and soft tissue injuries. Complaints of excessive strain and frequent repetitions over time can suddenly arise, causing a work injury. The aim of this study is to determine the relationship between the working postures of textile factory workers and whether they affect work injuries or not. The postures of the workers during the job were analysed by videotaping them. Of all the participants (n=101), 75.2% were female, mean age was 33.4 ± 5.35 and 54.5% were high school graduate. Working experience mean was 8.53 ± 5.82 and the frequency of work injury was 18.8%. 57.8% of the workers in the textile industry exhibited a normal working position in category C1, 41.2% in C2, 0.5% in C3 and 0.1% in C4. However, it was observed that the educational level of workers who had experienced the WI was higher than the others and as the working experience increased the possibility of having injuries was statistically meaningful (p=0,014). In order to prevent work injuries in the textile industry, it is necessary to give in-service training about work safety to increase the awareness levels of females regardless of educational level.

Keywords: Work Injuries, Working Posture, Textile Workers, Repetitive Movements, Occupational Injuries.

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This study is derived from the master's thesis entitled "Edirne Merkezdeki Bir Giyim Fabrikasında Çalışan İşçilerin Çalışma Duruşlarının İş Kazaları İle İlişkisi" and with thesis number 424676 which is being written by İlker Murat Avcıbaşı under the advision of İlknur Dindar.

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I. INTRODUCTION

When work injuries, occupational safety, and employee health are in question and despite the fact that they are preventable and changeable situations, they are considered an essential part of business life considering human life as well as the computable and incomputable economic losses. According to the World Health Organization's (WHO) estimates for the year 2009, 5 percent of the world's national income is spent on work injuries [1]. When the work injuries are rated to gross domestic product, similar averages are also seen in the study in which 5 European countries are handled (2.9% - 10.2%) [2].

Even though studies are available that reach various conclusions regarding the sources of these "unexpected and unplanned" situations, it is generally accepted that 80 percent of such incidents are caused by human factors, while 18 percent and 2 percent of the same are caused by physical and mechanical factors and unexpected events, respectively [3]. The injuries result from human beings whereas the most suffered party as the result of these injuries is again the humans. Human being again resides at the focal point of work injuries considering the consequences such as death, permanent incapacity, and injuries as well as the economic distress caused by temporarily closed down workplaces [4].

Posture is the alignment of the head, torso, lower and upper extremities of the body in space without being exposed to any forces. Based on this definition, the work posture or positioning is the alignment of the body, head, torso, and upper and lower extremities according to the nature of the work during work [5, 6].

Straining movements, repetitive movements, vibration, staying in inappropriate posture for prolonged periods cause complaints such as pain in the in the musculoskeletal system, injuries, sprains, hernia, tears and soft tissue injuries [7, 8]. Complaints and frequent repetitions over time can put an employee's health at risk as well as it may suddenly arise due to excessive strain and cause serious consequences for the worker and worker's health [9-12].

In Turkey, 7.1 percent of all insured employees are of textile and garment industry. Ready-to-wear garment industry accounts for 52,81 percent of all textile workers [13]. In terms of employment, production, and exports, the Turkish textile industry ranks first in the manufacturing industry [14].

Even though the technological developments lead production to evolve to automation, man power still plays an important role in enterprises. In the textile industry, a labor-intensive sector, when the postures are unsuitable for body biomechanics risking worker health and production efficiency. It is the basis of ergonomics to maximize production by reducing fatigue, strain, injuries and stress while making use of man power [6, 15].

II. METHOD

The aim of this study is to determine the risk levels of textile factory workers in terms of their working postures and whether they affect work injuries or not.

A. Study Location and Sampling

SIt was conducted in the manufacturing plant of in Edirne from 4 to 8 August 2014. The target population of the work is formed by the blue collars working in the manufacturing section. At the time of the study, the target population included 348 workers, 32 of which are in the cutting department, 276 in the sewing department (operator), 27 in the final ironing department and 13 in the warehouse. No sampling was carried out and each worker was tried to be reached on a voluntary basis during the

date range for which permission was obtained.

B. Data Collection Process

Data collection consisted of two sections, namely the survey used to determine socio-demographic characteristics followed by the image recordings taken for the evaluation at Computerized Ovako Working Postures Analysing System (CO-OWAS).

The survey is a form consisting of a total of 14 questions that were prepared by the researcher to identify the socio-demographic characteristics of the workers and to determine their experiences of work injuries.

CO-OWAS is a method to analyse an employee's posture in terms of the poor postures and the overloads caused by it in the musculoskeletal system. The method is based on the sampling of work postures [16].

The most prominent features of OWAS method is that it is easy-to-learn/use and summarizes good/bad work postures in percentages of time [17]. The OWAS method, which allows for data recording for 4 postures of back, 3 of arm, 7 of leg and 3 postural loads, contains 252 combinations in total [18]. These postures are summarized under 4 Categories. Category 1 (C1) refers to the posture where the observed posture does not need to be improved. Category 2 (C2) indicates that the posture causes a strain but an improvement is needed in near future; Category 3 (C3) that the strain level is high and the improvement is needed in the shortest time possible and Category (C4) that improvement is needed immediately due to the strain [5, 16].

In this study, OWAS method was preferred due to the above mentioned properties of it and CO-OWAS computer package program developed by Tampere University of Technology was used to simplify coding, compiling and analysis.

C. Data Analysis

For image recordings, a total of 10 observations were made with a 15 seconds of observation duration for each worker and the data was compiled in CO-OWAS. The percentage distributions in the IBM SPSS Statistics 19.0 package program, along with the other data, were analysed using two example independent t tests and chi-square tests.

D. Ethics

Permissions from İpekyol Giyim San. Ve Tic. A. and Trakya University Non-Interventional Clinical Research Ethics Committee (TUTF-GOKAEK 2014/56) were received in order to conduct the study. The authors affirm that the article is ethical in terms of research and publication.

III. RESULTS

The study was conducted on 101 people who agreed to participate after the aim of the study was explained to them.

The youngest of the subjects was 20 years old whereas the oldest was 44 with an age average of 33.4 ± 5.35 years. 75.2% of the subjects were female (n=76), and 24.8% were male. As seen in Table 1, 54.5% were high school (n=55), 17.8% were secondary school (n=18), 16.8% were primary school (n=17) and 10.9% were university graduates (n=11). 63.4% of the employees were smokers (Table 1).

The average years of experience of the workers were determined as 8,53 ± 5,82 (Table 1), with at least 1 year and at most 25 years of experience based on the years they worked.

Since the textile industry is included in a low dangerous risk group, workers were asked about whether they had a work injury (WI), which organs of them were injured, what type of injury they had and whether this injury

caused any lost workday or not, based on their statements.

Table 1. Socio-demographic characteristics of workers (n=101)

Characteristics	Values	
Age		
Youngest	20	
Oldest	44	
Middle	33	
Average	33,4 ± 5,35	
	n	**%**
Gender		
Female	76	75.2
Male	25	24.8
Educational Background		
Primary school	17	16.8
Secondary School	18	17.8
High school	55	54.5
Associate Degree - Undergraduate	11	10.9
Smoking		
Smoker	64	63.4
Non-smoker	37	36.6
Years of experience in the industry		
Minimum	1	
Maximum	25	
Average	8,53 ± 5,82	

19 people (18.8%) stated to be involved in an injury at work, with the youngest being the 26 and the oldest being 43. 13 (68.4%) of those who were involved in injuries at work were female and 6 (31.6%) were male. The injured organs of the patients were grouped into lower extremity, upper extremity and multiple regions of the body during the data processing. According to this grouping, 73.7% of the workers had injuries of upper extremity, 15.8% of lower extremity and 10.5% of both extremities (Table 2).

The workers were asked about the types of injuries they had in the injuries they were involved in. "Cuts" was the most common work injurie with a percentage of 47.4%. 36.8% of workers who were involved in an injury at work stated that they experienced "soft tissue damage - crush injuries", 10.5% "pricks" and 5.3% "burnt" in terms of type of injuries (Table 2).

68.4% of the workers who had an injury had caused loss of labour on day basis due to injury. As seen in Table 2, the workers' average duration of stay away from work was 3.21 ± 4.25 days.

When the workers in the textile industry, which is considered to be in the low dangerous risk group, were asked about the frequency of taking safety and security measures, etc., "never" (n=39) was observed to be the most frequent response with a ratio of 38.6% and "usually" was the least frequent one with a ratio of 9.9% (n=10) (Table 2).

The postures of the workers during the job were analysed by videotaping them. Due to the fact that the worker's job completion intervals were short, their positions were recorded in CO-OWAS by stopping video once in every 15 seconds. Each worker was observed for 10 times. Upon entering the observations of each worker, the postures of the workers during work were analysed in 4 categories. 57.8% of the workers in the textile industry, which is included in the low dangerous risk group, exhibited a normal working position in category C1, 41.2% in C2, 0.5% in C3 and 0.1% in C4.

The main hypothesis of this study, which is "There is no relationship between work injuries and work postures" was tested among the workers who had a WI and those not, in 4 categories. No significant difference was found in the data.

An examination of WI by gender showed that 68.4% of the women in this work place had an injury while the ratio of men who had injury was 31.6% and gender has no effect on the injury incidents ($p > 0.566$).

The statistical relevance of the educational backgrounds workers, as shown in Table 1, with having a WI was assessed. It was observed that there was no statistical relevance between the WI and the workers who had primary school and lower level of education and those who had secondary

school and upper level of the workers (p=1.00).

Table 2. Data on occupational injurys at workplace, as reported by workers

	Values	
Characteristics	**n**	**%**
At the Workplace		
Did not have an injury	82	81.2
Had an injury	19	18.8
Type of İnjury*		
Cut	9	47.4
Soft tissue injury - Bruise	7	36.8
Prick	2	10.5
Burn	1	5.3
Injured Zone*		
Upper extremity	14	73.7
Lower extremity	3	15.8
More than one zone	2	10.5
Taking preventive, safety, etc. measures		
Always	11	10.9
Usually	10	9.9
Sometimes	20	19.8
Rarely	21	20.8
Never	39	38.6
Ages of the İnjury Sufferers		
Minimum	26	
Maximum	43	
Average	35,05 ± 4,88	
Lost Workdays*		
Minimum	0	
Maximum	15	
Average	3,21 ± 4,25	

Workers who are smokers may experience deprivation due to long working hours and as a result, may be affected by some psychological and metabolic conditions. Workers were asked about their smoking habits and the probability of having a WI was tested. No statistical relevance was found between the smokers and non-smokers with regard to being involved in WI.

The mean work experience of those who had an occupational accident was 11.47 ± 6.08 years, and 7.58 ± 5.58 years for those who did not. Increasing work experience affects having had work injury (p=0.014).

Even though it is included in a low dangerous risk group, it is important that preventive measures are taken for the injuries possible to be experienced in the textile industry and protective measures for the injuries that have already been experienced. Table 2 shows that the majority of the workers do not take such measures. A statistical assessment was made for those who take protective and security measures, etc. and those who reported that they do not take such measures. A p value of 0.729 implied that taking protective, security, etc. measures had no impact on work injuries.

IV. DISCUSSION AND CONCLUSION

It is thought that occurrence of work injuries is associated with gender due to the fact that those who are involved in work injuries are mostly male. Çelik et al. [19] and Aras et al. [20] reported that over %80 of those who were referred to a healthcare institution upon having a work injury were male. Men are more involved in fatal work injuries than women [21]. When we look at the work injuries in the textile industry in which the majority of the workers are female, we see many different results. The study also showed 68.4% of those who were involved in injury at work were female. It is also plausible that the majority of those having a work injury are women in an industry where workers are predominantly female. It is seen that women experience work injury that cause loss of work days more than men [4]. Although this idea is supported by the study of Nakata et al. [22] and Çelik et al. [19], reveals that there is no association between work injuries and gender.

There exists variety of methods in the literature with the thought that the posture of the worker at work before or during the injury may constitute a factor playing a role in the occurrence of work injuries [23-26]. Lee et al. [26] observed the workers in the construction industry using the OWAS method and showed that their working postures, which, they think, could cause work injuries, form about 25% of all working postures. As the construction industry is classified as very dangerous workplace, it is nor-

mal that it involves body postures of the group C3 and C4. The studies conducted on the people who do works such as cleaning, making beds, etc. at short time accommodation properties that are considered to be low dangerous workplaces delivered similar results as in this study. In the paper by Salwe et al. [24], the frequency of work injuries due to these straining movements which are not fit to body posture is about 4%. In this study of us, it is statistically shown that there is no correlation between the working postures of the workers and work injuries in the textile industry, which is considered to be included in low dangerous class. The multi-variable analysis performed by Craig et al. [23] revealed that lifting loads hourly, lifting loads daily, frequency of lifting load and bending of trachea were the work postures that could have an impact on work injuries. The less frequency of the aforementioned load lifting-related working postures in the textile industry and the fact that the tracheal flexion and the duration of flexion, except for the bending of trachea, does not constitute any risk factor are compatible with the results achieved by our study.

It was found out that the most frequently injured body region was the upper extremity with a ratio of 73.7% based on the statements by the workers who were involved in a work injury. In a study covering all industries, Özkan et al. [27] reported that the upper extremity is the most injured body region during the work injuries with a ratio of 56.6%. Serinken et al. [27] also investigated work injuries on textile workers and as a result, reported that the most injured region of body in work injuries was the upper extremity with a ratio of 75.1%. The study is compatible with the literature in this regard.

When Çelik et al. [19] examined the work injuries, they stated that the most frequent type of injury observed was the cuts with a ratio of 36.4% while Özkan and et al. [27], however, indicated the most frequent type of injury as the operator's body parts getting caught in the machines with a ratio of 31.5%. According to Özkan et al. [27], obtuse object injury ranks second with a ratio of 21.5% whereas cuts ranks the fourth as the most common type of injury with a ratio of 17%. It is unusual to come across such a result when all industries are taken into consideration. Serinken et al. [28] describe the types of injuries of textile workers as cuts with a ratio of 55.6%, ranking first, followed by crushes with a ratio of 19%. This study shows the similarity in terms of the first two ranking types of injuries, with proportional differences (47.4%, 36.8%, respectively).

In this study, it was revealed that those with more work experience had a WI (the work experience of those who had a WI was ~11.5 years). This shows that a person with an average of 11.5 years of work experience has had a WI at least once in his work life. In other words, as work experience decreases, the risk of WI increases. It is thought that inexperienced workers act more carefully or the occupational safety training they receive at the beginning of the job has an effect on this. Confidence that comes with increasing experience, and when occupational safety training has not been repeated the risk of WI is reflected in the statistics [29]. Studies also report that young workers are disadvantaged by a lack of experience and safety training, or because they believe they are immune to hazards and do not take them seriously, resulting in non-compliance with safety regulations [30, 31]. As a weakness of this study, the participants were not asked about their age or work experience at the time of the injury. Occupational Health and Safety Law was published in Turkey in 2012 [32]. Improvements were made regarding occupational health and WI, especially occupational safety training. These improvements made in the field of occupational safety had a greater effect on less experienced people. Our study shows that it is reaso-

nable for more experienced people to have had a WI.

The relationship between workers' education level and their experiences of being involved in work injuries is another topic of interest for researchers. Whether in the textile industry or not, scientists have examined workers' level of education and their frequency of being involved in work injuries and sometimes introduced different results to the literature. In the literature review. In recent studies, there are studies showing that as the level of education increases, the number of occupational accidents decreases [29, 33], and there are also studies showing that it does not affect them [34, 35]. Contrast, this study shows that those who are involved in work injuries mostly have an education level equivalent to secondary school or a level upper level of education. Although it is expected that work injuries decrease with a higher level of education, in a small number of studies observed that such a hypothesis is not valid. Berhan [36], Nakata et al. [22] and Çopur et al. [37] also pointed out that work injuries occurred more frequently among the workers having an education level of secondary school and upper. The increasing level of education should not mean an increase in WI. Confidence given by the level of education or being recruited in a job that is not suitable for their education may cause this situation. Regardless of the education level of the employees, it is generally accepted to provide in-service training for WI [38-41].

The workers refuse to use the personal protective equipment provided to them and comply with the safety measures to which they are subject to on the grounds that the same slows down the production or limits productivity or due to personal reasons. In the study of Çopur et al. [37], it is reported that 95.8% of the workers have taken measures against work injuries but in spite of this, 1 in 5 of them were involved in work injuries. Serinken et al. [28], who studied work injuries in the textile industry, reported that 74.3% of those who have experienced work injuries used personal protective equipment. 61.38% of the workers who were asked about whether they comply with protective, security measures etc. responded affirmatively but it was, however, observed that 1 in 5 of the workers were involved in work injuries. As Akintayo [42] said, personal protective equipment alone was not enough; there was a combination of careless attitudes of workers and misused/non-used safety rules. Even though similar to the few studies in the literature, this resulting negative outlook, must not give rise to the thought that the measures taken against work injuries are of no use. It should be admitted that they help to overcome the consequences of any injuries to be experienced. Proper use of personal protective equipment not only prevents accidents, but also reduces post-accident losses [30, 43].

According to the OWAS assessment, 57.8% of the working postures of the workers were formed by the movements of category C1, 41.2% of C2, 0.5% of C3, and 0.1% of C4. It was observed that the movements that needs to be corrected urgently were found to be at the level of 6 per thousand (of categories C3 and C4), whereas the movements were concentrated in the category that could be regarded as safe (category C1). In fact, according to the communique published in the Resmi Gazete dated 26 December 2012 and numbered 28509, job descriptions in this workplace are shown in the low dangerous risk group [44]. It's also shown by this results why the textile industry is included in the low dangerous workplace group. It was indicated that there was no statistical correlation between working posture and work injuries.

V. RECOMMENDATION

It is suggested for future studies be conducted in the light of these conclusions, to establish a system that enables

an analysis of the working postures of the worker/workers immediately prior to the occurrence of work injuries. Lastly, it has been suggested that this situation should be taken into account in workplaces where female employees are the majority at the secondary education level and in-service training about work safety should be given.

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