Risk factors associated with musculoskeletal symptoms in footwear sewing workers

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ABSTRACT: Beyond the lack of studies on this issue, particularly in Portugal, the relationship between the prevalence of musculoskeletal symptoms and many work-related risk factors is still very unclear. Therefore, in order to contribute to a better understanding of WMSD risk factors, this study aims to analyze the association between the prevalence of musculoskeletal symptoms in sewing workers of the footwear industry and some of the work-related risk factors for the development of WMSD. Both direct observation and a questionnaire survey were performed, and SPSS was used in statistical data analysis. Some of the individual, occupational, environmental and organizational/psychosocial risk factors were found to be associated with the reported symptoms, but those were distinct in the two companies under study. The results emphasize the multifactorial nature of WMSD and the need for the implementation of new and more effective ergonomic prevention programs, more centered on the identified risk factors.

1 INTRODUCTION

Due to the present socio-economic context and globalization, the increasing workload and quality demands are threatening workers’ health and leading to high productivity losses and tremendous financial costs for both individuals and society. Particularly the impact on workers’ musculoskeletal health seems to be even more concerning.

The growing importance of this issue has led institutions and organizations such as European Commission (EC, 2010) to consistently identify Musculoskeletal Disorders (MSD) as a priority in the prevention of safety and health at the companies level.

In fact, according to the statistical data from the Bureau of Labour Statistics (2012), in 2011, MSD were responsible for 33% of all accidents and illnesses related to labour absenteeism in the United States of America (USA). Meanwhile, in Europe, according to Health and Safety Executive (2012), countries like Austria, Germany and France show a high number of lost working days due to Work-related Musculoskeletal Disorders (WMSD). The same source refers that WMSD are one of the most common causes of work absenteeism due to illness in the United Kingdom while in France, according to the European Agency for Safety and Health at Work (EU-OSHA, 2010) in the year 2006, WMSD led to 7 millions of lost working days, which represents a cost of 710 million Euro for the companies. Likewise, Woolf & Pilger (2003) referred that the expenses with the productivity and wages losses due to WMSD correspond to 2.4% and 1.3% of the gross domestic product of Canada and USA, respectively. The socio-economic impact also seems clear in the manufacturing industry (EC, 2010). In Portugal, the footwear industry represents an important part of the manufacturing industry and is responsible for a growing amount of the national exports. However, the traditional tailor-shop organization system, which is characterized by risk factors recognized in several studies as predominant for the onset of WMSD, is still adopted by most companies (Todd et al., 2008). The sewing sector is referred to as one of the sectors where the workplaces are at a higher risk (Aghidi et al., 2012; Roquelaure et al., 2004).

In this context, this study aims to check if there are statistically significant associations between the prevalence of Musculoskeletal Symptoms (MSS) reported by the workers of the footwear industry sewing sector and the studied risk factors. The study of the MSS arises as a predictor of subsequent MSD in the studied populations, therefore constituting an important step towards the WMSD prevention (Smith et al., 2009).

In the last decades, physical factors for WMSD have been widely studied in the literature. On the contrary, psychosocial factors have been neglected
and there is still a lot to explore. For that reason, they were privileged in this study while, although have been registered, some of the physical factors were not subjected to a specific analysis in this investigation.

2 MATERIALS AND METHODS

2.1 Subjects

This study was conducted in the sewing sector of two companies of the footwear industry, located in the municipality of Felgueiras. From a global population of 130 female workers, samples (54 in company A and 32 in company B) were selected through pre-established inclusion and exclusion criteria. The inclusion criterion was: individuals who had been performing duties in the company for at least one year, who were present on the day of the company's visit and who agreed to participate in the study. All the identified individuals who did not fulfil the inclusion criteria as well as those presenting musculoskeletal problems, which were not related to the job, were excluded. All the participants were informed about the objectives of the study and that all information collected would be treated as strictly confidential and anonymous.

2.2 Methods

For the characterization of the activity carried out by the workers of the sewing sector, the guide for the ergonomic analysis of workstations by the Finnish Institute of Occupations Health (FIOH), translated and adapted into Portuguese by University of Minho (Gomes-da-Cunha, 2004), was used. For data collection on the musculoskeletal symptoms reported by the workers as well as on the potential risk factors, a questionnaire was built up based on 3 validated questionnaires: Nordic Musculoskeletal Questionnaire in its translated and validated version for the Portuguese population (Mesquita et al., 2010) to evaluate health aspects; Dutch Musculoskeletal Questionnaire — extended version (Hildebrandt et al., 2001) to evaluate socio-demographic and work aspects and Copenhagen Psychosocial Questionnaire — medium size version (Kristensen et al., 2005) to evaluate psychosocial aspects.

Work-related MSS were evaluated in terms of pain perception or discomfort of the respondents, whenever they were present in the last 12 months for at least a week (Sluiter et al., 2001), in the following body regions: neck, thoracic region, lumbar region, hips/thighs, knees, ankles/feet, shoulders, elbows and wrists/hands. SPSS® v.21.0 software was used in data statistical analysis. The Chi-Square independence test was performed to look for statistically significant associations between the prevalence of reported MSS and the observed risk factors. For those associations, the Relative Risk (RR) was performed whenever possible, while Odds Ratio (OR) was used in the remaining cases. The corresponding 95% confidence intervals (95% CI) were also estimated.

2.3 Procedures

In December 2012 the activity of sewing workers was characterized through direct observations and the support of the FIOH ergonomic analysis guide.

Subsequently, a pre-tested of the constructed questionnaire was conducted in 10 of the study participants. Then, during January 2013, the questionnaire was applied to all the selected workers by means of a structured interview. The duration of each interview was approximately 8 minutes.

3 RESULTS AND DISCUSSION

Herein, are presented and discussed the statistically significant results found in the study of the association between the prevalence of MSS (presented in the paper entitled “Prevalence of WMSD in the sewing sector of two companies of the footwear industry”) and the studied work-related socio-demographic (section 3.1), occupational (section 3.2), environmental (section 3.3) and organizational/psychosocial (section 3.4) risk factors.

3.1 Socio-demographic factors

The final sample consisted of 34 workers (significantly greater than expected (OR which mean response rates of 80% and 38%, respectively.

The workers are aged between 22 and 55 years old, on average, they are 38.9 years old (±9 years for company A and 38 ± 8 for company B.

Table 1 shows the statistically significant associations between the prevalence of MSS and the socio-demographic factors.

In company A, the number of workers under 40 years old reporting shoulders symptoms is significantly greater than expected (OR which mean response rates of 5,000; CI 95%: 1,000-24,279). This result seems to contradict the results of other studies which found an association between the prevalence of MSS and the increase in the number of the sewing workers (Oulh et al., 2012; Wang et al., 2009). On the other hand, others have found a higher prevalence of

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Region of the body</th>
<th>p</th>
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<tbody>
<tr>
<td>Company A</td>
<td>Ages</td>
<td></td>
</tr>
<tr>
<td>Shoulders</td>
<td>0.038*</td>
<td></td>
</tr>
<tr>
<td>MSS 12 months</td>
<td>0.048**</td>
<td></td>
</tr>
<tr>
<td>Lower back</td>
<td>0.046**</td>
<td></td>
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*Chi-square independence test; **Fisher's exact test.

MSS on shoulders and neck in younger workers (Roquealure et al., 2012). This situation may be explained by the workers' inexperience (Roquealure et al., 2012), though it is worth noting that the percentage of workers with less than 20 years of experience is the same in both companies and that, in company B, the prevalence of MSS was not associated with age. Another likely reason is the so-called "healthy worker effect", that is, the possible bias on results that may be due to the fact that the healthier workers remain employed longer (Benavides et al., 2006). Although the literature refers a cause and effect relationship between workers' age and MSS, this relationship is not linear and it suggests that there may be other factors involved (Guo et al., 2004).

Despite the fact that the majority of the participants are married, it can be observed that in company A, the risk of the single or widower workers (p = 0.048; RR = 4.348; CI 95%: 1,366-13,889) reporting symptoms in the last 12 months is more than four times that found for those who are married or who live together. Similar conclusion was made by Kaergaard & Andersen (2000), who found a higher risk of MSDs and shoulder symptoms in single seamstresses. On the contrary, in company B, the risk of workers with an education level up to the 4th grade (p = 0.048; RR = 8.800; CI 95%: 1,122-69.036) reporting ankles/feet symptoms is almost nine times the risk of those with a higher education level. These data seem to confirm the findings of Oulh & Est (2011), who reported a higher prevalence of MSS in workers with low education levels. This is likely due either to the increased difficulty of workers with low education levels to understand working instructions (Costa et al., 2009) or to the unclear transmission of information to the workers. However, the type of production in company A may also have influenced the development of the symptoms in those regions, since the pedal of the machine is actuated with only one foot, while in company A, the pedal is actuated with both feet simultaneously, thus eliminating the static load on one foot.
the insufficient rest breaks during work are being pointed out as a risk factor for the development of MSS in sewing workers, mainly in the neck and shoulders (Cunha et al., 2011). This situation may indicate that, in company A, the duration of rest breaks may not be enough for workers to recover from the effort of the used muscles.

3.3 Environmental factors

In company A, the risk of workers reporting MSS in the lumbar region (p = 0.032; RR = 2.160; CI 95%: 1.152–2.053), in neck (p = 0.006; RR = 2.778; CI 95%: 1.500–5.145), and in shoulders (p = 0.033; RR = 3.333; CI 95%: 1.342–8.281) is higher for those who perceive to be exposed to extreme temperatures. In fact, during the observation of the working environment in both companies, the room temperature seemed to be relatively higher in company A than in company B. In this context, it is likely that the symptoms reported by the workers in those body regions may be explained by a significant increase of temperature while carrying out their tasks. Similar results were found by Gold et al. (2009), which referred that the exposure to extreme temperatures was associated with the occurrence of MSS. However, further studies, that are not used in company A is not adjustable, forcing workers to perform the activity in an uncomfortable position which may explain the higher prevalence of symptoms in those regions (Rempel et al., 2007; Wang et al., 2008). On the other hand, the workers of company B who consider to be exposed to poor lighting conditions show a risk of reporting MSS in the neck region of 6.5 times (p = 0.034; RR = 6.500; CI 95%: 1.375–30.731), 4.5 times in 15 times (p = 0.015; RR = 13.000; CI 95%: 1.621–104.247) the risk of those who do not consider to be exposed to that risk factor. In fact, Purimal et al. (2007) referred that the prevalence of back pain in sewing workers might be associated with inadequate positions due to poor lighting. It is important to highlight that the sewing activity is a precision work; therefore, when the lighting is inadequate, the workers’ visual fatigue may predispose to inadequate positions, such as the flexion of the neck and back (Institut National de Recherche et de Sécurité, 2011). In this context, it was observed that, although there was a greater amount of natural light in company B, the artificial lighting levels could be lower, especially due to the fact that the luminaire support was too high, forcing workers to lean forward to improve their view of the work plane and, thus, contribute to the development of MSS in the reference regions.

3.4 Organizational and psychosocial factors

Table 3 shows the statistically significant associations between the prevalence of MSS and the psychosocial factors.

<table>
<thead>
<tr>
<th>Company</th>
<th>Low leadership</th>
<th>Difficulties of expression at work</th>
<th>Very fast work pace</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSS 12 months</td>
<td>0.001*</td>
<td>0.029*</td>
<td>0.022**</td>
</tr>
<tr>
<td>Wrist/heads</td>
<td>0.041**</td>
<td></td>
<td></td>
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</table>

-Chi-square independence test; **Fisher's exact test.

4 CONCLUSIONS

The risk factors associated with the reported MSS were distinct in the two companies, which seems to indicate the multiplicative nature of WMSSD. This situation demonstrates that, in general, the prevalence of MSS in both companies is due to the adoption of the tailor production system, which continues to prevail in the Portuguese footwear industry, as well as other important individual and psychosocial work aspects. However, despite the interesting conclusions made, the results must be carefully interpreted because of the reduced sample size.

This exploratory study seeks to point out to the need for the implementation of a prevention program centered on the identified risk factors, as well as for more research about the influence of each risk factor individually on the prevalence of MSS. In this context, it would be interesting to carry out an extensive study, including a larger number of companies and including also workers from the remaining sectors of this particular economic activity in order to be able to extrapolate the results with greater reliability to the studied populations.

ACKNOWLEDGMENTS

The authors would like to thank Master in Occupational Safety and Hygiene Engineering (MSSHO), of the Faculty of Engineering of the University of Porto (FEUP), all the support in the development and international dissemination of this work.

REFERENCES


1 INTRODUCTION

One of the challenges for job security in the new millennium are the issues of occupational health and safety (Jayaprakash, 2003) which have demanded the synergistic efforts of several countries (Anziziri et al., 2010), among which environmental risks emerge as critical issues for most rulers (Yousef et al., 2011). Currently, numerous human activities, which are linked by different levels of complexity, cause most of the risks (Bohm and Pfister, 2005) which have deleterious effects on the physical and mental health of human beings (Chen et al., 2013).

In this context, the experts in health and safety at work search for a place of work which is safe and healthy and is free from risks, among which we can mention: accidents, physical, chemical, biological and ergonomic problems. Therefore, the present study aims to conduct a systematic review of environmental risks, focusing on the risks of accidents, physical, chemical, biological and ergonomic, highlighting the characteristics of the causal agents and the prevailing trends in this field.

2 METHODOLOGICAL PROCEDURES

In order to achieve the proposed goal, the literature was reviewed in a systematic way, covering current topics which are relevant, and checking the data and information that arises from an analysis of environmental risks. The study was based on online surveys of different search portals which are integrated in the MetaLib tool from Ex Libris®. According to Zhonghua and Ling (2013), the MetaLib® streamlines the discovery process, presenting users with content from multiple providers of information, using a clear and familiar interface.

From the above, scientific journals that had undergone a systematic peer review process were selected. This process has been used for decades in order to ensure the quality, readability and relevance of manuscripts, whilst filtering poorer studies, as well as to ensure a fair and impartial assessment of a manuscript (Busner and Larson, 2012). Moreover, another quality factor was considered when it was decided to select only papers, and exclude editorials, letters to the editor, conferences, special issues for conferences, opinion pieces for articles and magazines from the study. As such, all the 26 portals studied are shown in Table 1.

In order to investigate the scientific articles dealing with environmental risks, four combinations of keywords were used, as these would be located in the publication's title. Given this, the search for the articles was divided into four stages as outlined in Table 2.

Looking at Table 2, it can be seen that the keywords alternate between the terms risk(s) and hazard(s) and environmental/occupational due to conceptual variations in the literature. These concepts are very similar, however, and depending on the perspective