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BIOMEDICAL ENGINEERING | RESEARCH ARTICLE

Musculoskeletal pain among bakery workers in Lebanon: a national survey

Rima R. Habib^{1*}, Amena El-Harakeh¹ and Safa Hojeij¹

Abstract: This study examined the association of self-reports of repetitive hand movements, perceptions of the work environment, and somatization with upper extremity musculoskeletal pain among bakery workers, an understudied population globally. Surveys were conducted in 504 randomly selected bakeries across Lebanon and administered through face-to-face interviews at the workplace. The survey included items on musculoskeletal pain, general health, workplace environment, activities, and socio-demographics. The findings showed that 23% of bakery workers reported upper extremity pain. Workers who reported poor health (OR = 2.08; 95% CI = 1.12–3.87) and those who perceived that the work environment negatively affects their health (OR = 2.04; 95% CI = 1.26–3.33) were twice as likely to experience upper extremity musculoskeletal pain. Somatization was positively associated with reporting upper extremity musculoskeletal pain (OR = 1.51; 95% CI = 1.22–1.86). Workers that reported having another job were three times more likely to report upper musculoskeletal pain (OR = 2.76; 95% CI = 1.31–5.79). The need for interventions in the work environment and work strategies is evident.

Subjects: Ergonomics & Human Factors; Work Design - Ergonomics; Musculoskeletal Disorders - Ergonomics

Keywords: upper extremity pain; musculoskeletal; bakery workers; somatization; occupational health and safety; ergonomics

1. Introduction

1.1. Background information and literature review

Musculoskeletal problems are a major cause of morbidity in the working population (Bernard, 1997; Lang, Ochsmann, Kraus, & Lang, 2012; Woolf & Pfleger, 2003). Internationally, an estimated 40% of



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PUBLIC INTEREST STATEMENT

Studies assessing bakery workers' musculoskeletal problems are globally limited. This is the first national study examining musculoskeletal pain among bakery workers in Lebanon and the region. A positive association of musculoskeletal pain with negative workplace perceptions and somatization was determined. The need for interventions in bakery work environments is evident.

all injury- and disease-related costs at the workplace are due to musculoskeletal disorders (Abledu, Offei, & Abledu, 2014; Sharples & Shorrock, 2014). Research has established this problem as endemic in low- and high-income countries alike (Choobineh, Tabatabaee, & Behzadi, 2009; Shahnavaz, 1987). Around 30% of the workforce in high-income countries is exposed to working conditions that trigger or exacerbate musculoskeletal disorders, while this figure is between 50% and 70% in countries of the Global South (Kang et al., 2014; Landry, Raman, Sulway, Golightly, & Hamdan, 2008).

The literature has described musculoskeletal pain as endemic in a wide spectrum of occupational groups, including industrial workers, food and meat processors, clerks, data processors, and bakeries (Cohen, 1997; Idler & Benyamini, 1997; Melhorn, 1998). Given its high prevalence, musculoskeletal pain is a major concern as it is a cause of severe long-term pain, absenteeism, and years living with disability (Lang et al., 2012; Woolf & Pfleger, 2003).

The physical features of work have been established as impacting musculoskeletal pain prevalence. A rapid work pace, heavy physical workload, repeated and forceful manual exertions, prolonged period of awkward postures, and whole body vibration have been positively correlated with musculoskeletal pain (Neupane, Miranda, Virtanen, Siukola, & Clas-Håkan, 2013).

Research into the association between psychosocial factors and the occurrence and severity of musculoskeletal pain has burgeoned over the last two decades, identifying these links in a variety of occupational settings (Bongers, Kremer, and Laak 2002; Neupane et al., 2013; Waters, Dick, Davis-Barkley, & Krieg, 2007). Karasek Jr's (1979) job strain model provides a theoretical framework that explains the relationship between occupational psychosocial stressors and musculoskeletal pain. The model posits that in high strain situations, where workers are exposed to high levels of control, adverse psychological and physiological reactions such as musculoskeletal pain occur (Christensen, Nielsen, Finne, and Knardahl, 2018; Huang, Feuerstein, & Sauter, 2002; Karasek Jr, 1979). In their study, Waters et al. (2007) concluded that a combined effect of physical work factors and work stress contributed to the prevalence of musculoskeletal pains. Psychological distress has also been linked to musculoskeletal pain, increased severity of pain, and multi-site pain (Bongers, Kremer, and Laak 2002; Smith, Wei, Zhao, & Wang, 2004).

Self-rated health has been widely used by public health professionals as a population-based measure of health status and morbidity and mortality (Eriksson, Undén, & Elofsson, 2001; Habib, Elzein, & Hojeij, 2013; Idler & Benyamini, 1997). Self-reporting has been described as the best assessment tool for pain, somatization and health beliefs (Coggon et al., 2017).

Evidence is also emerging that within populations that are culturally predisposed to chronic and disabling non-specific musculoskeletal illness, individual risk is strongly influenced by a general tendency to report and worry about common somatic symptoms (Coggon, 2005; Coggon et al., 2012, 2013; Palmer et al., 2005; Solidaki et al., 2013). Somatization has been defined as “the predisposition to amplify physiological sensations or to misclassify symptoms of emotional arousal” (Riley III, 1999), or the tendency to report distress from somatic symptoms (Palmer et al., 2005). This “somatizing tendency” can be assessed using selected questions from the Brief Symptom Inventory (BSI) (Bergström, Hagberg, Busch, Jensen, & Christina, 2014) relating to complaints such as faintness or dizziness, nausea or upset stomach and difficulty breathing (Derogatis & Melisaratos, 1983; Vargas-Prada Figueroa et al., 2013). A study carried out in England found that somatization was associated with the prevalence of musculoskeletal symptoms in study subjects (De Zotti, Larese, Bovenzi, Negro, & Molinari, 1994). Earlier reports have also provided evidence that somatization is an independent risk factor for the persistence of musculoskeletal pain (Farioli et al., 2014).

1.2. Musculoskeletal disorders among bakery workers

Bakery workers are regularly exposed to strenuous manual activities including heavy lifting, forceful exertions, and awkward postures. Forcier et al. (2008) compared musculoskeletal pain among workers in seven departments in supermarkets in Canada, finding that bakers were

the second most likely to experience pain among all groups. Two studies found that the confluence of strenuous workplace tasks and psychosocial stressors are mutually important in determining musculoskeletal pain in this worker group (Huang et al., 2002).

There are several workplace conditions and tasks performed by workers in the Lebanese industry that might contribute to symptoms, including dough handling, standing for prolonged periods next to a hot oven, continuous bending to insert heavy trays in the oven, lifting and moving of heavy items and bags sometimes up and down a staircase, working in cramped and heated spaces. Bakery workers also worked for long hours, night and early morning shifts, and under pressure to complete certain tasks in a limited time duration. Published research reported bakery workers having shifts that extend 12 h a day and being exposed to time pressure due to the pressure to finish a certain amount of tasks/items during their shift (Loudoun, 2008). These potentially harmful work practices in bakeries may lead to health issues, including respiratory, psychological as well as physical and musculoskeletal problems.

It is important to note that studies assessing musculoskeletal pain in occupational settings are limited in Lebanon and the Arab region. Moreover, most studies in the literature on the health of bakery workers have mostly focused on industrial bakeries in high-income countries, with a primary emphasis on the respiratory effects of flour dust (Boskabady et al., 2009; Meijster, Warren, Heederik, & Tielemans, 2011; Moghaddasi, Mirmohammadi, Ahmad, Nejad, & Yazdani, 2014) or the allergies and skin problems it produces (Bauer et al., 2002; Moghaddasi et al., 2014). Investigating the links between musculoskeletal pain and workplace psychosocial factors in non-industrialized bakeries is necessary in order to determine possible interventions targeting workplace improvement.

The purpose of this national cross-sectional study was to assess the magnitude of upper extremity musculoskeletal pain among Lebanese bakery workers and determine whether there are associations with physical and psychosocial variables including health beliefs and workers' individual tendency to somatize.

2. Methods

A cross-sectional study was carried out using standardized methods of data collection in the working population of bakery workers in Lebanon.

2.1. Study population

A list of 1,960 bakeries was obtained from a GIS company in Lebanon with bakeries distributed throughout five districts: North, Mount Lebanon, Beirut, South, and Nabatieh. A sample of 582 bakeries was selected proportionate to the number of bakeries within each district. A total of 504 bakeries were interviewed providing an 87% response rate. The remaining 78 bakeries were either not found, were closed, or refused to participate for reasons of lack of time or mistrust.

2.2. Data collection

For each of the 504 bakeries, a 45-min face-to-face interview was carried out with bakery workers at the workplace after obtaining written consent from the workers and their employers. The survey included items on musculoskeletal pain, general health, workplace activities and organization, and socio-demographics. The study was approved by the Institutional Review Board (IRB ID: FHS1.03) at the American University of Beirut.

2.3. Main outcome

Upper musculoskeletal pain was measured using a modified Nordic musculoskeletal questionnaire assessing pain prevalence during a 12-month period at four body regions (neck, shoulders, elbows, and wrists) (Kuorinka et al., 1987). The Nordic Musculoskeletal questionnaire is one of the most globally used tools to screen musculoskeletal disorders in an ergonomic context and for occupational health-care services (Kuorinka et al., 1987). Workers were classified as having upper musculoskeletal pain at any of the four body sites, or not having any musculoskeletal pain at all.

2.4. Independent variables

Somatization was assessed using the somatic subscale of the BSI. The use of this scale for measuring somatizing tendency has been supported in the literature (Vargas-Prada et al., 2016). Workers were classified according to the number of symptoms out of a total of seven that had been at least moderately distressing during the past week prior to data collection following the methods adopted in the multinational Cultural and Psychosocial Influences on Disability Study by Coggon and collaborators (Coggon et al., 2012). These symptoms included: faintness or dizziness, pains in the heart or chest, nausea or upset stomach, trouble getting breath, numbness or tingling in parts of the body, feeling weak in parts of the body, and hot or cold spells.

Self-rated health was assessed by asking the worker “How do you perceive your current health status?” (Idler & Benyamini, 1997). The answers varied between “very good”, “good”, “average”, “bad”, or “very bad” (Idler & Benyamini, 1997) which were then combined into two categories, “poor” (including very poor, poor, and average), and “good” (including very good and good).

Workplace activities included working with hands above shoulder height for longer than 1 h in total per day and engaging in repeated movements of the wrist or fingers for more than 4 h in total per day.

Data were also collected on workers’ perceptions of their work environment’s negative effects on their health and whether or not they have another job.

2.5. Statistical analysis

Univariate and Bivariate analyses were carried out to examine the associations between upper musculoskeletal pain and other independent variables. In a logistic regression model, the binary outcome (musculoskeletal pain) was regressed on the independent work-related variables that showed significance with the outcome at the bivariate level ($p < 0.05$). Age and gender were adjusted for in the logistic regression model.

Models were carried out separately for males and for females for both outcomes (tables not shown). However, due to the small sample size of females ($n = 70$), there were no significant results that could be inferred. Adjusted odds ratio (OR), 95% confidence interval, and p-values were reported. Data analysis was carried out using SPSS 20.0. Since we used regression analysis, the goodness of fit of the models was assessed using the Hosmer and Lemeshow Test indicating no lack of fit. First-term interactions were tested revealing no significant terms.

3. Results

The majority of bakery workers in the study sample were males (86%) (Table 1), married or engaged (72%) and with an average of 40 years of age. Only 32% had remained in school beyond the intermediate level, and 81% viewed their economic status as bad.

Twenty-three percent of the bakery workers reported upper musculoskeletal pain and 22% indicated somatizing tendencies while around 17% perceived their health as poor.

A high number of the workers (88.7%) were involved in tasks that require repeated movements of the wrist or fingers for more than 4 h in total, 18% worked with their hands above shoulder height for longer than 1 h in total, and 38% worked under pressure to complete certain tasks.

Findings of the logistic regression showed that workplace activities as well as negative perceptions of health were significantly associated with upper musculoskeletal pain (Table 2).

Physical workloads were important mediating factors, as workers that work with their hands above shoulder height were more than twice as likely to report upper musculoskeletal pains (OR = 2.48; 95% CI = 1.44–4.29) and those involved in tasks that require repeated movements of the wrist or fingers were three times more likely to report upper musculoskeletal pains (OR = 3.00; 95%

Table 1. Description of demographics, occupational activities and perceptions of bakery workers in Lebanon (N = 504)

	N	%
Demographics		
Age		
≤ 18	10	2.0
19 to 30	128	25.4
31 to 40	139	27.6
41 to 50	118	23.4
51 to 60	62	12.3
> 60	40	7.9
No answer	7	1.4
Mean	39.78	
Gender		
Male	434	86.1
Female	70	13.9
Marital Status		
Married/Engaged	362	71.8
Single/Widowed/Divorced	142	28.2
Education		
Primary level or below	185	36.7
Intermediate level	157	31.2
Secondary level or University	162	32.1
Worker perception of his/her economic status		
Not good	408	81.0
Good	88	17.5
Missing	8	1.6
Pain and health perceptions		
Upper Musculoskeletal Pain		
No	390	77.4
Yes	114	22.6
Somatization		
No symptoms	393	78.0
One symptom	55	10.9
Two or more symptoms	56	11.1
Self-reported health		
Good	421	83.5
Poor	83	16.5
Worker believes work environment negatively affects his/her health		
No	336	66.7
Yes	168	33.3
Occupational activities		
Worker works with hands above shoulder height for longer than one hour in total		
No	411	81.5
Yes	90	17.9
No answer	3	0.6

(Continued)

Table 1. (Continued)

	N	%
Worker involved in tasks that require repeated movements of the wrist or fingers for more than four hours in total		
No	54	10.7
Yes	447	88.7
No answer	3	0.6
Worker has another job		
No	457	90.7
Yes	47	9.3
Work under pressure to complete tasks by a fixed time		
No	304	60.3
Yes	192	38.1
No answer	8	1.6

CI = 1.17–7.71). Perceptions of worker’s health were as important; workers who perceived poor health were twice as likely to report musculoskeletal pain (OR = 2.08; 95% CI = 1.12–3.87). Furthermore, workers who perceived that the work environment negatively affects their health were also twice as likely to report upper musculoskeletal pains (OR = 2.04; 95% CI = 1.26–3.33).

Somatization was positively associated with reporting of upper musculoskeletal pains; as the number of somatizing symptoms increased, the worker was one and a half times more likely to report upper musculoskeletal pain (OR = 1.51; 95% CI = 1.22–1.86).

Moreover, those that had another job were nearly three times more likely to report upper musculoskeletal pain (OR = 2.76; 95% CI = 1.31–5.79).

4. Discussion

The present study evaluated the exposure of Lebanese bakery workers to musculoskeletal pain in 504 randomly selected bakeries across different locations in Lebanon. To our knowledge, this is the first comprehensive national study on the influence of work-related physical and psychosocial factors on the prevalence of upper musculoskeletal pain among bakery workers. The results showed that upper musculoskeletal pain was common among bakery workers (23%) who also reported somatic symptoms (22%). The link between musculoskeletal pain and somatization is consistent with results in the literature (Carugno et al., 2012; Linton, 2001; Palmer et al., 2005; Riley III, 1999). In fact, somatizing tendency, among other psychological factors, is known to be associated with musculoskeletal symptoms (Sahu, Moitra, & Maity, 2013). Our results support a potential role of somatizing tendency in predisposition to musculoskeletal pain and reflect on the association between somatizing tendency and the prediction of future incidence and persistence of pain. As indicated by previous studies, it is expected that people who are usually concerned with common somatic symptoms, are also aware of and tend to report musculoskeletal pain, an association that has recently gained international attention (Coggon et al., 2012; Sarquis et al., 2016).

Besides, the results revealed a significant association between heavy physical workload and upper musculoskeletal pain, in particular, working with hands above shoulders for more than 1 h or working with repeated wrist or fingers movement for prolonged periods. These findings confirmed the results of earlier studies in regards to the association between awkward working postures of bakery workers and musculoskeletal pain, especially in the neck, shoulders, wrist, and elbow (Sahu et al., 2013). Yet, many studies that aim to provide precautionary and safety measures for the occupational health of bakery workers focus on respiratory diseases, without giving much attention to musculoskeletal disorders (De Zotti et al., 1994; Storaas, Steinsvåg, Florvaag, Irgens, & Aasen, 2005). This might be because respiratory

Table 2. Association of upper musculoskeletal pain with work-related factors among bakery workers in Lebanon (N = 504)

	Unadjusted		Adjusted	
	OR (95% CI)	p-Value	OR (95% CI)	p-Value
Age	1.02 (1.00–1.04)	0.019	1.02 (0.99–1.04)	0.058
Gender				
Male	1		1	
Female	1.57 (0.90–2.75)	0.114	1.17 (0.60–2.30)	0.644
Worker works with hands above shoulder height for longer than one hour in total				
No	1		1	
Yes	2.71 (1.66–4.44)	0.000	2.48 (1.44–4.29)	0.001
Worker involved in tasks that require repeated movements of the wrist or fingers for more than four hours in total				
No	1		1	
Yes	2.09 (0.92–4.76)	0.080	3.00 (1.17–7.71)	0.023
Worker's self-reported health				
Good	1		1	
Poor	4.09 (2.49–6.73)	0.000	2.08 (1.12–3.87)	0.021
Worker believes work environment negatively affects his/her health				
No	1		1	
Yes	2.90 (1.89–4.46)	0.000	2.04 (1.26–3.33)	0.004
Somatization	1.68 (1.40–2.03)	0.000	1.51 (1.22–1.86)	0.000
Worker has another job				
No	1		1	
Yes	1.70 (0.88–3.26)	0.113	2.76 (1.31–5.79)	0.007

diseases are easier than musculoskeletal pain to identify and report among bakery workers due to their high exposure to flour dust. However, studies have shown that musculoskeletal pain among bakery workers leads to absenteeism and loss of productivity due to disability (Bergström et al., 2014; Giahi, Ebrahemzadih, & Khoubi, 2015; Koopmanschap, Burdorf, and Lötters 2013; Zoer, Frings-Dresen, & Sluiter, 2014). Although musculoskeletal pain has not been heavily researched, particularly in low-income countries, it should be better addressed at a national level to reduce the financial burden and health outcomes associated with it.

In addition to the role of the hazardous physical factors that has been well described in many studies, there is a growing attention to psychosocial characteristics that can be associated with the development and progression of musculoskeletal pain among workers. In our study, the significant psychosocial predictors of musculoskeletal pain were the bakery workers' perception of their health status and the health effects of their work environment. These factors are critical because health beliefs (in which workers assumed that their health status is poor) as well as their perception that the work environment

had negative effects on their health were shown to be significantly associated with the prevalence of musculoskeletal pain among bakery workers. The link between psychosocial factors and increased risk of musculoskeletal pain was consistent with findings from previous studies (Carugno et al., 2012; Huang et al., 2002; Kuorinka et al., 1987). Moreover, evidence from a systematic review supported the association between psychosocial characteristics and back pain (Abareshi, Yarahmadi, Solhi, & Farshad, 2015).

The above results show that musculoskeletal pain is not only linked to physical hazards and the heavy physical workload; it is also associated with other significant psychological factors that contribute to the increase in the incidence of musculoskeletal pain among bakery workers. In addition, workers that reported having another job are three times more likely to report upper musculoskeletal pain; the necessity to have multiple jobs in Lebanon is on the rise considering the strained economic conditions in the country. These results indicate a need to focus interventions on improving workplace ergonomic conditions and implement workplace safety training in Lebanese bakeries.

The main limitation of our study was its cross-sectional design. A further limitation was the use of self-reported health information. The effects of such a bias would be the inflation of the reported ORs. For example, a bakery worker who was distressed during the data collection period might report stressful activities more frequently. Additionally, a limitation of the study was that only male participants were included, which limited our ability to carry out a gender-sensitive analysis. However, this does not represent a selection bias as it reflects the underlying nature of this occupation that is predominated by males in Lebanon.

Finally, we tried in this study to examine the associations between physical and psychosocial factors and upper musculoskeletal pain. However, the variation in the magnitude of upper musculoskeletal pain among Lebanese bakery workers could also be possibly associated with other unmeasured variables.

5. Conclusion

In the absence of a national occupational health program and a national policy that covers the health and safety of workers let alone bakery workers in Lebanon, this issue remains of high relevance in the local context. The exposure of this workforce to ergonomic hazards and musculoskeletal disorders intensifies the need for a public policy addressing work strategies that protects bakery workers and puts this issue on the top of occupational health priorities. This study has demonstrated that a number of physical and psychosocial factors increase the prevalence of upper musculoskeletal pain among bakery workers. Based on our findings, comprehensive intervention programs that target both physical and psychosocial factors need to be implemented. These include individual and collective preventive and control measures, strengthening the coping ability of workers by increasing their control over their tasks, enhancing social support systems for workers, and improving organizational communication. Hence, future studies should focus on the need for prevention and treatment programs to protect vulnerable workers involved in precarious jobs from the effects of musculoskeletal pain including the risk of disability and loss of productivity.

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