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Work activity and musculoskeletal symptoms in female cashiers

Atividade laboral e sintomas osteomusculares em operadoras de caixa

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ABSTRACT | Introduction: Musculoskeletal symptoms affect several professional categories, including cashiers, who make repetitive movements. Irregular ergonomic aspects referring to poor postures cause physical and mental debilitation, leading to work-related musculoskeletal disorders. **Objectives:** To correlate musculoskeletal disorders with an ergonomic analysis of the workstation used by cashiers. **Methods:** A cross-sectional study was conducted for evaluation of female cashiers working at a supermarket chain in the city of Goiânia, state of Goiás, Brazil. The Nordic Musculoskeletal Questionnaire (NMQ), Portuguese version, was used. To assess the ergonomic position of cashiers, the Rapid Upper Limb Assessment (RULA) tool was administered. **Results:** A high prevalence of musculoskeletal pain was demonstrated in the neck, shoulders, wrists/hands, and lower and upper back in cashiers. A final RULA score of 6 was obtained, equivalent to action level 3, which indicates that a more detailed investigation and short-term changes are needed. In the RULA assessment, there was a significant correlation between legs and lower back; in the NMQ assessment, there were correlations between trunk and shoulder and between neck and elbow, among other correlations that contribute to the emergence of work-related musculoskeletal disorders. **Conclusions:** Musculoskeletal complaints correlated with an ergonomic risk of the workstation. Thus, interventions such as workplace kinesiotherapy and urgent changes in the workstation are needed to comply with the requirements of the Brazilian Regulatory Standard No. 17 and improve the workplace for cashiers.

Keywords | musculoskeletal pain; workers; occupational diseases; ergonomics.

RESUMO | Introdução: Os sintomas osteomusculares atingem diversas classes profissionais, entre elas os operadores de caixa, que realizam movimentos repetitivos. Os aspectos ergonômicos irregulares expressados por posturas inadequadas causam desgastes físicos e mentais, gerando distúrbios osteomusculares relacionados ao trabalho. **Objetivos:** Correlacionar os distúrbios osteomusculares por meio da análise ergonômica do posto de trabalho em operadoras de caixa. **Métodos:** Estudo transversal realizado com operadoras de caixa de uma rede de supermercado localizada na cidade de Goiânia, estado de Goiás. O instrumento utilizado foi o Questionário Nórdico de Sintomas Osteomusculares (QNSO). Para avaliar o posto ergonômico das operadoras de caixa, foi aplicado o questionário Rapid Upper Limb Assessment (RULA). **Resultados:** Foi demonstrada alta prevalência de dor musculoesquelética nas regiões do pescoço, ombros, punhos/mãos e partes inferior e superior das costas nas operadoras de caixa. Avaliadas pelo RULA, obteve-se resultados com pontuação final 6, equivalente ao nível de ação 3, o qual indica necessidade de investigação mais detalhada e realização de mudanças imediatas. Do RULA, verificou-se uma correlação significativa entre o item "pernas" com o item "parte inferior das costas"; do QNSO, foram correlacionados os itens "tronco" com "ombro" e "pescoço" com "cotovelo", entre outras correlações que contribuem para o surgimento de distúrbio osteomuscular relacionado ao trabalho. **Conclusões:** Foram registradas queixas osteomusculares correlacionadas ao risco ergonômico do posto de trabalho. Assim, são necessárias intervenções realizadas através da adoção da cinesioterapia laboral e de mudanças urgentes no posto de trabalho, a fim de cumprir com os requisitos da Norma Regulamentadora 17 e melhorar o ambiente de trabalho das operadoras de caixa.

Palavras-chave | dor musculoesquelética; trabalhadores; doenças ocupacionais; ergonomia.

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INTRODUCTION

Occupational diseases were given more attention in Brazil in the 1980s, when cases of repetitive strain injury (RSI) and work-related musculoskeletal disorder (WMSD) were first described in typists. WMSDs are among the major public health problems that society has faced in recent years. They are the most frequently recorded occupational diseases in many countries, affecting the quality of life of workers and accounting for significant rates of absenteeism and disability.[1]

In 1987, for the first time, the social security institution in Brazil recognized this group of conditions with the name of typist's tenosynovitis. In 1991, the term RSI was adopted in the institution's internal procedures for the assessment of disability. In 1998, based on a Technical Standard of the National Institute of Health and Social Security (Instituto Nacional de Saúde e Seguridade Social, INSS) approved by INSS/DSS Service Order No. 606, of August 5, 1998, the definition of WMSD was used to refer to these disorders.[2]

WMSDs are defined as temporary or permanent work disability resulting from the combination of an overload of the musculoskeletal system with a lack of time for recovery and work organization. They commonly lead to changes in different aspects of the worker's life. The presence of pain and limitations caused by these disorders contributes to the emergence of symptoms of depression and anxiety, accompanied by anguish and fear regarding an uncertain future.[3]

There is no direct cause for WMSD, but rather a complex network of biological, psychological, and sociological factors interacting under inadequate working conditions.[4] Musculoskeletal disorders include broad inflammatory and degenerative manifestations affecting muscles, tendons, ligaments, joints, cartilage, peripheral nerves, and blood vessels. The most involved body regions are the upper back, lower back, neck, shoulders, forearms, and hands. Heavy or repetitive physical work, prolonged computer work, low emotional control, high psychological demand (fast pace or deadline pressure, no breaks), job dissatisfaction, and female sex have been identified as risk factors. That is, there are multiple associated factors, both occupational and nonoccupational, affecting several professions.[5]

Currently, few professional categories are not at risk for developing some type of occupational disease. However, some professions are more likely, including bank employees, cashiers, industrial workers, and dentists, and these disorders produce changes in their lives, making it impossible for them to carry out daily and work activities. In the case of bank employees, the increase in manual tasks and repetitive actions and the need to handle machines quickly and skillfully, together with other factors, may result in excessive stress and even in the appearance of WMSD.[1] Similarly, cashiers are subject to repetitive movements and exhausting workloads.

Thus, WMSDs cause negative repercussions for workers and companies, and the factors that lead to conditions characterized by discomfort or persistent pain in muscles and tendons should be investigated and understood. This study is of great relevance to outline a better approach to this topic, with the purpose of helping prevent WMSDs and design an ergonomic workstation, thus contributing to an improvement in quality of life and adaptation to changes. The aims of this study were to evaluate the presence of WMSDs and to conduct an ergonomic analysis of the workstation used by supermarket cashiers, indicating correlations between them.

METHODS

A cross-sectional study was conducted for evaluation of cashiers working at a supermarket chain in the city of Goiânia, state of Goiás, Brazil. Thirty cashiers were invited to participate in the study; however, four were excluded because of the criteria adopted. Thus, 26 cashiers accepted the invitation and were included. Data were collected in November and December 2018 and January 2019.

The following inclusion criteria were used: female employees, aged 18 years or over, who worked as cashiers for at least 12 months. The exclusion criteria were as follows: employees who were undergoing clinical, physiotherapy, or postsurgical treatment

for any disorder of the musculoskeletal system. A convenience sample was used, and only women were included because the establishment only had female cashiers (no men).

The researchers initially provided a brief explanation about the study. Employees interested in participating underwent a structured interview, which addressed sociodemographic information and issues related to the inclusion and exclusion criteria. All participants read and signed an informed consent form. For the collection of sociodemographic data, objective and easy-to-understand questions were used to classify them as eligible for the study: name, date of birth, address, telephone number, race, marital status, occupation, level of education, and if they did any physical activity and how often.

The Nordic Musculoskeletal Questionnaire (NMQ, Portuguese version), proposed by Kuorinka et al.,[6] was used to assess musculoskeletal symptoms in the participants. The NMQ was developed to standardize the measurement of reported musculoskeletal symptoms and thus facilitate the comparison of study results, to identify work-related pain or discomfort, location, and type of complaint, and to characterize the frequency, intensity, and duration of symptoms. The questionnaire features a map of the human body divided into nine parts: neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/thighs, knees, and ankles/feet. The questions refer to each of the nine anatomical regions and address whether the participants report pain or discomfort in the past 12 months, whether they had any problem preventing them from performing daily activities in the past 12 months, whether they saw a health professional because of symptoms in the past 12 months, and whether they had any complaint related to pain or discomfort in the past seven days. The questionnaire was completed by the researchers; if the respondent did not understand any of the questions, the researcher would explain it using usual words, being careful not to induce the answer.

To conduct a fast ergonomic assessment of cashiers based on their job tasks, the validated Rapid Upper Limb Assessment (RULA) tool was used.[7] This method is indicated for analyzing overload on the neck and upper limbs, posture, strength, and movements associated with sedentary tasks such as computer work. This ergonomic tool addresses risk outcomes with a score of 1 to 7, and higher scores mean high levels of apparent risk. However, a low RULA score does not guarantee that the workplace is free from ergonomic hazards, and a high score does not ensure that the problem is severe.

The body is segmented into parts that form groups A and B. Group A includes arms, forearms, and wrists, and group B includes neck, trunk, and legs. There are four action levels: level 1 (score 1 or 2), posture is acceptable if not maintained or repeated for long periods; level 2 (score 3 or 4), posture needs investigation and possibly changes; level 3 (score 5 or 6): posture needs investigation and changes soon; level 4 (score 7 or over), posture needs investigation and changes immediately. The study was conducted according to the guidelines and regulatory standards for research involving human beings (Brazilian National Health Council Resolution No. 466/2012) and was approved by the Research Ethics Committee of Pontifícia Universidade Católica de Goiás, with Opinion No. 3.002.438.

RESULTS

Data were analyzed with the Statistical Package for the Social Sciences (SPSS), version 20.0. Quantitative variables were reported as means and standard deviations, and qualitative variables, as frequencies and proportions. The Shapiro-Wilk test was used to assess distribution of the sample. Correlations were analyzed with Pearson or Spearman correlation tests (according to the type of variables). In the analysis, a 95% confidence interval and a 5% significance level ($p < 0.05$) were adopted. Table 1 shows the results for sociodemographic profile.

Twenty-six female cashiers were evaluated, and their age ranged from 18 to 45 years. A prevalence of eight (30.8%) young workers was found, with an average age between 21 and 25 years. Regarding education, 19 (73.1%), or the majority, had completed high school. Thirteen (50%) were single. Most participants were

neither smokers (n = 24, 92.2%) nor alcoholics (n = 21, 80.8%), and did not do any physical activity frequently (n = 20, 76.9%).

As shown in Table 2, the questionnaire revealed that, in the past 12 months, 10 participants (38.5%) had complaints referring to the shoulders, nine (34.6%), to the lower back, and eight, to the upper back (30.8%).

Two participants (7.7%) were on leave or unable to perform activities of daily living because of musculoskeletal problems in the neck. Five participants (19.2%) saw a specialist because of shoulder pain, 3 (11.5%), because of neck pain, and 2 (7.7%), because of hip/thigh pain.

As shown in Table 3, in the assessment of the past 7 days, five participants had symptoms in the shoulders, upper back, and wrists/hands (19.2% each), and four, in the lower back (15.4%). In the RULA tool, 96.2% of employees obtained a final score of 6, which is equivalent to action level 3, indicating that a more detailed investigation and short-term changes are needed. The items that most contributed to the scores were postures of the arm (4.81%), wrist (3.81%), and trunk (3.19%).

According to Table 4, the correlation analysis of RULA and NMQ scores referring to complaints of pain in the past 12 months, significant correlations between

Table 1. Sociodemographic profile of the participants (n = 26)

Study variables	n	%
Age range (years)		
18-20	1	3.8
21-25	8	30.8
26-30	6	23.1
31-35	4	15.4
36-40	2	7.7
41-45	5	19.2
Education		
Complete high school	19	73.1
Incomplete higher education	4	15.4
Complete higher education	3	11.5
Marital status		
Single	13	50.0
Married	9	34.6
Divorced	4	15.4
Smoker		
No	24	92.3
Yes	2	7.7
Alcoholic		
No	21	80.8
Yes	5	19.2
Physical activity		
No	20	76.9
Yes	6	23.1

Table 2. Reported problems (such as pain or tingling/numbness) in the past 12 months

Study variables	n	%
Neck	7	26.9
Shoulders	10	38.5
Upper back	8	30.8
Elbows	1	3.8
Wrists/hands	6	23.1
Lower back	9	34.6
Hip/thighs	7	26.9
Knees	6	23.1
Ankles/feet	5	19.2

Table 3. Reported problems (such as pain or tingling/numbness) in the past 7 days

Study variables	n	%
Neck	2	7.7
Shoulders	5	19.2
Upper back	5	19.2
Elbows	0	0.0
Wrists/hands	5	19.2
Lower back	4	15.4
Hip/thighs	3	11.5
Knees	2	7.7
Ankles/feet	2	7.7

legs and lower back, trunk and shoulder, and neck and elbow were found.

In the correlation analysis of RULA and QNSO scores referring to the past 7 days, significant correlations between lower limb force and lower back, lower limb force and knee, and trunk and ankle/foot were found (Table 5).

In the correlation analysis of RULA and NMQ scores referring to medical appointments for pain in the past 12 months, significant correlations between neck and elbow and between neck and wrists/hands were found (Table 6).

Table 4. Correlation of RULA scores with complaints of pain in the past 12 months

RULA versus NMQ	r	p-value
Legs versus lower back	0.462	0.018
Trunk versus shoulder	0.437	0.025
Neck versus elbow	0.461	0.018

RULA = Rapid Upper Limb Assessment; NMQ = Nordic Musculoskeletal Questionnaire; r = Pearson correlation coefficient.

Table 5. Correlation of RULA scores with complaints of pain in the past 7 days

RULA versus NMQ	r	p-value
Lower limb force versus lower back	0.677	0.000
Lower limb force versus knee	0.458	0.019
Trunk versus ankle/foot	0.419	0.033

RULA = Rapid Upper Limb Assessment; NMQ = Nordic Musculoskeletal Questionnaire; r = Pearson correlation coefficient.

Table 6. Correlation of RULA scores with medical appointments in the past 12 months

RULA versus NMQ	r	p-value
Neck versus elbow	0.461	0.018
Neck versus wrists/hands	0.461	0.018

RULA = Rapid Upper Limb Assessment; NMQ = Nordic Musculoskeletal Questionnaire; r = Pearson correlation coefficient.

DISCUSSION

This study found a predominance of single women aged between 21 and 25 years and between 26 and 30 years, which is consistent with the findings of a study conducted by Carlos et al.[8]

Two-thirds of employees in industrialized countries are estimated to use computers in their work activities. Over 50% report musculoskeletal symptoms in the neck and upper limbs. Other studies report that the risk of developing such symptoms is greater in workers who use a computer for at least three-quarters of their working hours.[9,10]

A predominance of musculoskeletal pain in the shoulders, lower back, and upper back was also found in a study conducted by Batiz et al.[11] They noted that the working conditions for supermarket checkout operators have been a matter of concern to specialists in recent years, and the aim of the study was to investigate these conditions and detect risk factors to propose measures to eliminate or minimize the appearance of adverse effects on workers. The body regions with highest incidence of muscle pain were lower back (81%), shoulders (54%), upper back (50%), and neck (49%).[11]

Regarding painful complaints, Trelha et al.[13] found a high prevalence of musculoskeletal symptoms in checkout operators, both in the past 12 months and in the past 7 days. The reported data demonstrate that these workers are exposed to significant physical and mental loads, which affect them and lead to symptoms of pain and discomfort.[12] A consequence of these symptoms may be absenteeism[12]; in our study, two employees (7.7%) were on leave or unable to perform activities of daily living because of musculoskeletal problems in the neck. In other studies addressing biomechanical loads, sitting posture and constant head and trunk movements were highlighted,[13] as they generate localized pressure on musculoskeletal structures with repercussions for muscle groups in the shoulders and neck.[14]

Regarding low back pain and sedentary behavior, our study showed that 76.9% of participants did no physical activity and 34.6% had musculoskeletal pain in the lower back. According to Thorbjörnsson et al.,[15]

both sedentary behavior and heavy physical load are risk indicators for low back pain. The purpose of their study was to identify occupational factors related to low back pain and to study how the interactions between psychosocial, physical, work-related, and leisure factors affect low back pain in women and men. The results showed that, among women, heavy physical workload, sedentary work, smoking, and the combination of whole-body vibrations and low influence over working conditions are associated with a higher risk for low back pain.[15] Other workers, such as bank employees, also suffer from pain in the upper and lower back (41.67%), wrists and hands (33.33%), and shoulders and neck (25%).[16]

To detect and record poor postures at work, Motta[17] used the RULA tool, a posture analysis method, and was able to identify the most critical postures in workers during the assembly of digital files in a digital prepress department of a printing factory. The study showed that no posture used during the activities is fully acceptable, which warrants further investigation.[17]

Our study demonstrated a correlation between ergonomic factors and musculoskeletal symptoms, including significant relationships between legs and lower back, trunk and shoulder, and neck and elbow. The results reported by Batiz et al.[11] are in line with ours; the most urgent activities in their study were checking out products using an optical scanner (47.4%) and charging the customer (33.9%), for which the workstation proved to be inadequate because of anthropometric characteristics, inadequate postures, and lack of breaks. Our study is similar, with the exception of breaks, which were allowed when there were fewer customers.[5]

Lourinho et al.[18] conducted a study of musculoskeletal injury risks in a shoe manufacturer. According to RULA scores, 96% of employees were classified as level 3 or 4, and only 4% were classified as level 2. These findings are related, to a greater extent, to shoulder abduction and wrist deviation movements combined with static contraction and, to a lesser extent, to trunk and head flexion and rotation movements. Regarding the prevalence of musculoskeletal discomfort, 80% of workers reported discomfort, with a higher prevalence in the upper limbs, spine, and lower limbs.[18]

Another study referring to the correlation of legs with the lower back and the sitting position and the appearance of low back pain was that of Lake,[19] who reported that dentists spend 75% of service time with the trunk flexed between 19-54º, which generates a disc protrusion and partly explains the presence of low back pain in this professional category. In addition, prolonged sitting can relax the abdominal muscles and overburden the spine, increasing the tension on spinal ligaments and muscles. Thus, if this posture is used for long periods, it will probably cause muscle fatigue, tension on the spinal ligaments, and stress on the fibers of the intervertebral disc, and, consequently, back pain.[19]

In the correlation between RULA and NMQ scores regarding medical appointments in the past 12 months, significant correlations between neck and elbow and between neck and wrists/hands were noted. Excessive typing and manipulation of documents, money, and numbers may be related to these painful complaints, as they require static muscle exertion, which generates fatigue and pain that may progress to inflammation in musculoskeletal structures.

In a study conducted by Loffy et al.,[20] symptoms of carpal tunnel syndrome (CTS) were identified in information system students. Seventy-two college students who attended the first and the last terms participated. Based on questionnaire responses, 68% of students reported feeling some symptoms of CTS. According to the RULA tool, risk postures were observed during typing, requiring an intervention soon. These results indicate that CTS symptoms are already present in students and may be related to a double burden and a lack of guidance regarding prevention.[20]

Another important finding that helps explaining pain was that of Khan and Chew,[21] who reported a significant association between pain in the upper limbs (shoulder, elbow, and wrist) and shoulder position and use of forceful movements during activities. They also found an association between number of working hours and emergence of discomfort in the wrists and hands/fingers.[21] In total, 575 dentists participated in that study regarding pain and positioning during practical activities related to professional performance. Ninety-

five percent of participants reported pain in different body regions (women more frequently than men), with the neck and lower back showing the highest prevalences of painful symptoms.[21]

For preventive purposes, these workers must be informed of occupational risks, and workplace kinesiotherapy should be used as a secondary prevention measure to address the problem. Therefore, primary prevention measures are needed. Such measures include the development and implementation of ergonomic interventions with the aim of minimizing inappropriate postures and excessive biomechanical exposures, the remodeling of workstations and work tools, and the provision of education and training to workers with the aim of maximizing biomechanics and reducing excessive exertion during occupational activities, as suggested by Vieira,[22] to attenuate risks for workers.

During this study, some limitations prevented us from elaborating some aspects in more detail. Such limitations are related to the RULA tool, which is a difficult approach because of the scarcity of studies using this method. Given that few studies were found, a more comprehensive comparison of results for cashiers' workstations was not possible.

CONCLUSIONS

Our results demonstrate the early onset of disease in cashiers, showing the need for better working conditions and early interventions, as their musculoskeletal complaints correlate with ergonomic risks. The necessary interventions consist of adoption of kinesiotherapy for employees and ergonomic adjustment of their workstation. These procedures are feasible, as long as they are performed by a trained professional, preferably a physical therapist focused on that area.

Thus, this study highlights the relevance of workplace kinesiotherapy and ergonomics, together with compliance with the Brazilian Regulatory Standard No. 17, which will likely change current conditions in order to improve the safety, health, and quality of life of workers. Additional studies are required to quantify on a large scale the damage caused by the lack of workplace kinesiotherapy and ergonomic analysis for this population and others performing repetitive tasks with static postures.

AUTHOR CONTRIBUTIONS

GCR was responsible for study conceptualization, data curation, formal analysis, supervision, validation, and visualization. LCR was responsible for study funding acquisition, data curation, formal analysis, resources, visualization, and writing – review & editing. ACD was responsible for study software and writing – review & editing. ZMA was responsible for study conceptualization, supervision, validation, and writing – original draft and review & editing. All authors approved the final version submitted and assume public responsibility for all aspects of the work.

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