

Musculoskeletal pain: comparison between administrative and production employees of a poultry farming company

Dor osteomuscular: uma comparação entre trabalhadores administrativos e de produção de uma indústria agroavícola

Tamyris Targas Mota Caieiro¹, Daiane Bernardi de Assis¹,
Vivian Aline Mininel¹ , Fernanda Ludmilla Rossi Rocha² , Priscilla Hortense¹ 

ABSTRACT | Background: Work-related musculoskeletal disorders are the most frequently reported group of diseases in Brazil, their occurrence being favored by work in the industrial sector. The present study is justified by the need to investigate more thoroughly the occurrence of musculoskeletal symptoms among poultry farming workers, since this subject is scarcely explored in the Brazilian literature. **Objective:** To analyze the prevalence of musculoskeletal symptoms among production and administrative employees of a poultry farming company, describe the sociodemographic and occupational profile of both groups of workers and test associations between pain and sociodemographic and occupational variables. **Methods:** Cross-sectional correlational study which included socio-demographic and occupational characterization and administration of the Nordic Musculoskeletal Questionnaire and a numeric pain rating scale. **Results:** The sample comprised 154 production employees and 24 administrative workers. Pain was the single musculoskeletal symptom reported, with prevalence of over 85% in both groups. Female production employees exhibited 2.9 times higher odds of pain compared to the males. The body sites most frequently involved were the neck and upper and lower back among the administrative employees and the shoulders and the upper and lower back among the production workers. **Conclusion:** Pain was the most prevalent musculoskeletal symptom in the analyzed sample of poultry farming workers. Statistically significant difference was not found between the groups despite their different work processes. Both groups exhibited extremely high rates of illness, which points to the need for more thorough investigation of the causal relationships of musculoskeletal symptoms.

Keywords | occupational health; food-processing industry; cumulative trauma disorders.

RESUMO | Introdução: Distúrbios osteomusculares relacionados ao trabalho constituem o grupo de doenças ocupacionais mais registradas no Brasil, sendo as indústrias ambientes favoráveis para seu desenvolvimento. Este estudo justifica-se pela necessidade de aprofundar investigações sobre a manifestação de sintomas osteomusculares no ramo industrial agroavícola, temática pouco explorada na literatura nacional. **Objetivos:** Analisar a prevalência de sintomas osteomusculares em trabalhadores da linha de produção e do setor administrativo de uma indústria agroavícola, caracterizar o perfil sociodemográfico e ocupacional dos dois grupos e identificar ocorrência de associações entre dor e variáveis sociodemográficas e ocupacionais. **Método:** Estudo correlacional e transversal, realizado por meio de caracterização sociodemográfica e ocupacional, Questionário Nórdico de Sintomas Osteomusculares e Escala Numérica de Intensidade da Dor. **Resultados:** Participaram 154 trabalhadores do setor de produção e 24 do de administração. O único sintoma osteomuscular apresentado foi a dor, com prevalência superior a 85% para ambos os setores. Mulheres do setor de produção apresentaram 2,9 vezes mais chances de terem dor do que homens. As regiões mais afetadas no setor administrativo foram pescoço e partes inferior e superior das costas. Já no setor de produção, prevaleceram a região inferior das costas e dos ombros e a parte superior das costas. **Conclusões:** A dor foi descrita como o sintoma osteomuscular mais prevalente entre os trabalhadores da indústria agroavícola. Apesar das diferenças nos processos de trabalho entre os trabalhadores administrativos e produtivos, não houve diferenças estatisticamente significativas entre os setores. Por outro lado, ambos apresentaram um altíssimo nível de adoecimento, o que sugere a necessidade de aprofundamento em estudos da relação causal desses sintomas.

Palavras-chave | saúde do trabalhador; indústria de processamento de alimentos; distúrbio osteomuscular relacionado ao trabalho.

¹Department of Nursing, Universidade Federal de São Carlos – São Carlos (SP), Brazil.

²Nursing School of Ribeirão Preto, Universidade de São Paulo – Ribeirão Preto (SP), Brazil.

DOI: 10.5327/Z1679443520190277

INTRODUCTION

The current society is characterized by rapid and intense transformations with impact on the individual and collective aspects of human life. In the industrial sector, such transformations are associated with faster pace of work and rigid controls to improve productivity, which favor the occurrence of diseases¹. The continuous changes arising from the current economy call occupational health to be aware of and intervene in the relationship between work and health-disease.

Work-related musculoskeletal disorders (WSMD) are diseases caused by musculoskeletal injury which symptoms (pain, paresthesia, heaviness, fatigue, discomfort and disability) might appear separately or together. These disorders encompass a broad scope of inflammatory and degenerative conditions involving the muscles, tendons, nerves and support structures which develop in association with movements performed at work². Within the industrial sector, both administrative and production employees are exposed to WSMD.

Studies were conducted to establish the prevalence, epidemiology and impact of musculoskeletal symptoms on the lives of several populations of workers. Such studies found that the prevalence of musculoskeletal symptoms along 12 months before data collection was over 60%, which might be considered alarming³⁻⁶.

These data are highly relevant, because they depict the occupational scenario for different occupations in different cultures and promote a better understanding of musculoskeletal symptoms, their causes and consequences for the health of workers.

Upon reviewing the literature, we could find one single study that sought to establish the working conditions and prevalence of musculoskeletal pain, among 1,103 production workers, in the poultry processing industry. The results showed that 43.5% of the sample had pain in at least one of the analyzed body sites³.

As a function of the aforementioned considerations, analyzing the prevalence of musculoskeletal pain among industrial workers is necessary to understand the influence of the current work processes on the lives and health of workers.

In the present study we chose to analyze the poultry farming industry. The reason for this choice is the scarcity

of studies on the health-disease profile of workers in this particular economic activity, which has progressively expanded in Brazil, exports mainly accounting for its increased participation in the gross domestic product (GDP).

The aim of the present study was to compare musculoskeletal symptoms between production and administrative employees of a poultry farming company. It should be observed that we included production employees due to the shortage of studies on this population of workers.

METHODS

The present cross-sectional, descriptive and correlational study with quantitative approach sought to investigate the occurrence of musculoskeletal symptoms among industrial workers. Correlational studies describe variables and their natural relationships; investigators observe, describe and record several aspects of a phenomenon without manipulating any variable.

The analyzed company is located in a city in the interior of the state of Sao Paulo, Brazil, which produces and exports hatching eggs and chicks. At the time of data collection, July 2015, there were 440 production and 60 administrative employees. The main production activities in this industry are production, selection, collection, storage and transport of eggs; candling; sexing; beak trimming; feeding and weighting hens; selection, feeding and vaccinating chicks; feed production; and inspection and maintenance of farms.

The sample size was calculated based on the population-based parameter of interest with 95% of confidence and maximum error of 0.05. After the sample size (n) for a finite population was calculated, we applied a correction factor ($K=0.8$) to control for the effect of error in sampling planning. Finally we calculated proportionally stratified samples of production and administrative employees in a way to ensure that the proportional distribution of the strata was conserved. Participants were selected by convenience sampling. On the dates we established for data collection the supervisors of the analyzed units called the employees more easily available to participate in the study.

The final sample included 154 production and 24 administrative employees. The inclusion criteria were: having worked at the company for one year at least and being allocated to the production line or administrative units. Workers on leave at the time of data collection were excluded, as a function of the difficulties to contact employees away from work.

An ad hoc instrument was administered for sociodemographic and occupational characterization of the sample. The variables considered were: age, sex, educational level, length in the job, position, shifts and activities at home.

Musculoskeletal complaints were investigated by means of the Nordic Musculoskeletal Questionnaires (NMQ) validated for use in Brazil⁷. The intensity of pain in each reported body site was assessed with an 11-point numeric pain rating scale.

The Kolmogorov-Smirnov test was used to determine the normality of the data. Statistical tests were performed for comparisons; the significance level was set to 5%. The prevalence of musculoskeletal symptoms in each body site was compared between groups with the Hotelling test, which compares mean vectors of samples. The Bonferroni confidence interval was used to establish the multivariate difference obtained in the Hotelling test.

Association between the analyzed sociodemographic variables and pain was investigated by fitting a nonlinear logistic regression model in which pain was the response variable. Significance was estimated with the Wald test. Statistical analysis was performed using software R and Microsoft Excel 2010.

The present study was approved by the research ethics committee of Federal University of Sao Carlos (Certificate of Presentation for Ethical Appraisal — CAAE — no. 40428614.7.0000.5504). All the participants signed an informed consent form after having agreed to participate in the study.

RESULTS

SOCIODEMOGRAPHIC AND OCCUPATIONAL CHARACTERISTICS: COMPARISON BETWEEN GROUPS

Table 1 describes the sociodemographic and occupational characteristics of the analyzed samples.

Both samples comprised adults of average age close to 30 years old. Length in the job was 5 years for the administrative employees and less than 3 years for the production workers. The latter were predominantly female and with low educational level (Table 1).

The main positions of the administrative employees were: fiscal analyst personal analyst, administrative assistant, accountant, buyer, human resources and personnel department analyst. These employees mainly performed office tasks, including meetings, reading documents, telephone calls and typing. They spent a large part of the working time sitting at a computer. While all the administrative employees performed office activities, there was difference in the time they spent in definite ergonomic postures as a function of their job.

The positions of the production employees at the time of data collection were: maintenance assistant, production assistant and panel operator. All the employees alternated between the activities described next. Among the main production activities at the company, production, selection, collection, storage and transport of eggs stood out, in addition to candling (external and interior inspection of eggs with a light source to detect abnormalities and follow up the development of embryos along hatching); sexing (identification and selection of chicken according to sex); beak trimming (partial removal of the beak to avoid aggression and mutilation); feeding and weighting hens; selection, feeding and vaccination of chicks; feed production; and inspection and maintenance of farms, including cleaning.

Activities such as egg collection, chick care and cleaning drinkers demand continuous bending, with consequent overload to the lower back and upper and lower limbs. To feed the chicken, the employees need to handle big feed bags and distribute it in the feeders, which heavy weight demands considerable physical effort. Egg selection is performed on conveyor belts and the employees manually separate the normal eggs from those with abnormalities. Thus they remain standing in a static position over long periods of time. For candling, the employees have to bend the elbow and keep the hands at the eye level while holding a flashlight to perform this activity better.

On statistical analysis only variable sex significantly explained the difference in the prevalence of pain. Calculation of odds ratios showed that the production female employees

exhibited 2.9 times higher odds to develop pain compared to the males.

One single administrative employee did not report pain. Since practically all the participants in this group complained of pain, statistical comparisons of the effects of sociodemographic variables on occurrence or not of pain could not be performed.

PREVALENCE OF MUSCULOSKELETAL SYMPTOMS PER BODY SITE

Since pain was the single symptom reported, in the present study musculoskeletal symptoms were represented by musculoskeletal pain.

About 85% of the 154 production employees reported pain in at least one body site in the past 12 months. Only one among the 24 administrative employees did not complain of musculoskeletal pain, the prevalence of pain in this group being 95.8%. Table 2 describes the prevalence of pain among the administrative and production employees per body site, with the corresponding confidence interval — upper (UL) and lower (LL) limits — and intergroup comparison.

The body sites most frequently involved among the administrative employees were the neck and upper and lower back. For the production employees, the highest

Table 1. Distribution of production and administrative employees at a poultry farming company according to the analyzed socio-demographic and occupational variables. São Carlos, 2016 (n=178).

| Variables | | Units | | Total |
|-----------------------|------------------------------|------------|----------------|-----------|
| | | Production | Administration | |
| Age | (mean±SD) | 29.8±11.3 | 27.8±6.3 | 29.6±10.8 |
| Length in the job | (mean±SD) | 2.6±2.6 | 5.0±5.6 | 2.9±3.2 |
| Sex (%) | Female | 59.7 | 50 | 58.4 |
| | Male | 40.2 | 50 | 41.5 |
| Marital status | Single | 53.8 | 54.1 | 53.9 |
| | Married | 27.2 | 41.6 | 29.2 |
| | Stable union | 14.9 | 4.1 | 13.4 |
| | Divorced | 2.5 | 0 | 2.2 |
| | Widowed | 1.2 | 0 | 1.1 |
| Educational level (%) | No schooling | 1.9 | 0 | 1.6 |
| | Incomplete kindergarten | 7.1 | 0 | 6.1 |
| | Complete kindergarten | 7.7 | 0 | 6.7 |
| | Incomplete elementary school | 20.1 | 0 | 17.4 |
| | Complete elementary school | 9 | 4.1 | 8.4 |
| | Incomplete secondary school | 22 | 0 | 19.1 |
| | Complete secondary school | 31.8 | 12.5 | 29.2 |
| | Incomplete higher education | 0 | 29.1 | 3.9 |
| | Complete higher education | 0 | 41.6 | 5.6 |
| Graduate school | 0 | 12.5 | 1.6 | |
| Night shift (%) | Yes | 5.1 | 12.5 | 6.1 |

SD: standard deviation.

prevalence of pain corresponded to the upper and lower back and the shoulders. It should be noticed that the latter group reported pain in all the analyzed body sites (Table 2).

The Bonferroni confidence intervals provided statistical proof for the fact that only the prevalence of pain in the neck differed between the groups, being higher among the administrative employees. All the other analyzed body sites exhibited statistically similar prevalence (Table 2).

Fifty-three of the 154 production employees, *i.e.*, 34%, reported musculoskeletal pain in the past seven days. In turn, occurrence of musculoskeletal pain in some body site in the past seven days was reported by 10 of the 24 administrative employees, corresponding to a rate of 42%. Statistical comparison between the groups to analyze equivalences between the proportions of employees with pain in the past seven days yielded $p=0.64$ (>0.05) leading to reject the hypothesis of difference between the groups. One might thus conclude that the proportion of workers with pain in some body site in the past seven days was similar between the administrative and production employees (Table 2).

PAIN INTENSITY AND LOCATION: INTERGROUP COMPARISONS

Pain was rated moderate for most analyzed body sites in both groups, except for the upper and lower back, which was rated strong by most production employees.

Comparative analysis of the intensity of pain in each analyzed body site by means of the Mann-Whitney test evidenced that upper ($p=0.005826$) and lower ($p=0.004581$) back pain was stronger among the production workers compared to the administrative employees. Relative to the remainder of the analyzed body sites there was not any evidence to reject similarity in the average intensity of pain between the groups.

DISCUSSION

The results indicate that although the analyzed sample was young, the prevalence of pain was high, which is a cause of concern since the participants were at the beginning of their productive life. Musculoskeletal pain was reported by 85% of the production and 95.8% of the administrative employees, which points to extremely high rates of pain among poultry farming workers.

The sex distribution was similar among the administrative employees, but females predominated among the production workers, probably as a function of the tasks involved — handling eggs — which are delicate and demand much care.

The average length in the job was higher for the administrative (5 years) compared to the production

Table 2. Prevalence of musculoskeletal pain per body site and comparison between production and administrative employees at a poultry farming company. São Carlos, 2016 (n=178).

| | Administration | | | Production | | | Difference | |
|--------------|----------------|---------|----------|------------|---------|----------|------------|------|
| | N (%) | LL* (%) | UL** (%) | N (%) | LL* (%) | UL** (%) | LL* | UL** |
| Neck | 54 | 34 | 74 | 24 | 17 | 30 | 4 | 60 |
| Shoulders | 38 | 18 | 57 | 47 | 39 | 55 | -40 | 22 |
| Upper back | 42 | 22 | 61 | 31 | 23 | 38 | -18 | 40 |
| Elbows | 0 | 0 | 0 | 7 | 3 | 11 | -22 | 8 |
| Wrists/hands | 21 | 5 | 37 | 29 | 22 | 36 | -36 | 19 |
| Lower back | 46 | 26 | 66 | 49 | 41 | 57 | -34 | 27 |
| Hips/thighs | 0 | 0 | 0 | 18 | 12 | 24 | -39 | 4 |
| Knees | 25 | 8 | 42 | 22 | 16 | 29 | -23 | 29 |
| Ankles/feet | 17 | 2 | 32 | 18 | 12 | 24 | -24 | 23 |

LL: lower limit; UL: upper limit; *confidence interval lower limit; **confidence interval upper limits.

(2.6 years) employees, which suggest high turnover among the latter. A study that analyzed the characteristics of poultry farming work and their relationship to the health of workers found that high turnover was associated with the hard working conditions inherent to this economic activity¹.

The highest prevalence of pain corresponded to the neck and upper and lower back among the administrative employees and to the upper and lower back and the shoulders among the production workers.

For the production employees, comparative analysis with the results of other studies was not possible as a function of the specificities of the work process in poultry farming. The available studies analyzed poultry farming companies that perform slaughter and processing, which activities include cutting, evisceration, chilling and packaging^{3,8}. None of these activities correspond to the work process at the analyzed company, which focuses on poultry production, growth and maintenance.

The administrative employees exhibited statistically significant higher prevalence of neck pain compared to the production workers, however both groups rated the intensity of pain moderate.

A study conducted with 103 Iranian office employees found that 69.2% of the participants had neck pain, this being the body site with the highest prevalence of pain in the analyzed population⁴. High prevalence of neck pain might be associated with excessive neck extension during office work, previous history of neck pain, inadequate chair adjustment, persistent muscle tension in the neck and lifting and carrying heavy loads⁹.

About 49% of the production employees reported low back pain, this being the body site with the highest prevalence of pain for this group. About 46% of the administrative employees reported low back pain, which was the body site with the second highest prevalence of pain.

The production employees perform egg collection and fumigation (chemical disinfection with vapor), namely repetitive activities which demand continuous bending. Also cleaning drinkers demands bending, in addition to manually scrubbing the water reservoir, with consequent overload to the lower back and the upper and lower limbs. Employees in rearing farms are charged of beak trimming, vaccinating and weighting the animals, which require continuous bending to catch them and might also overload the lower back.

The present and international studies show that the highest prevalence of pain among active administrative employees corresponds to the neck and lower back^{4,10}. These findings point to a possible association between the specificities of administrative work and pain in these body sites. Most of the tasks performed by administrative employees are related to office work and they remain sitting at the computer over long periods of time. For this reason, one might not rule out the possibility of these symptoms being related to a sedentary lifestyle, a variable which was not analyzed in the present study.

The authors of a study conducted in Japan observed that musculoskeletal pain increased to become a social problem following the introduction of automated systems into offices. This equipment compels employees to perform repetitive movements, with consequent higher risk of occurrence of musculoskeletal injury¹¹.

Administrative work is a sedentary activity which demands uncomfortable body postures, usually sitting, over long periods of time and performing repetitive manual activities, such as typing. These activities might contribute to the development of psychological stress, chronic and heart diseases, obesity, insulin resistance, sudden illness, poor metabolic function, depression and chronic pain¹².

A study performed in the Brazilian South region with 273 employees of a farming company found association between low back pain and demands of excessive physical strength¹³. The movements most frequently performed by the production employees were bending and lumbar flexion, which are required in several routine tasks, such as collecting eggs in nests and drinker cleaning.

The predominance of neck pain among the administrative employees and of low back pain among the production workers evidences the influence of work activities and ergonomic hazards on the health of workers, in association with the adoption of body postures which demand activating specific muscle groups. These findings reinforce the relevance of analysis and intervention measures on workstations to minimize the impact of definite tasks on the musculoskeletal system.

The shoulders were the body site with the second highest prevalence of musculoskeletal pain among the production workers and the fourth highest among the administrative employees. About 19% of the production

employees rated the intensity of shoulder pain mild, which might indicate the onset of local complications, since pain might be potentiated by aging and occupation. In turn, 53% of these employees rated the intensity of pain moderate.

Studies conducted abroad reported high rates of musculoskeletal pain involving the shoulders among administrative employees and related to the activities they perform at work^{4,10}. Shoulder pain was quite prevalent among the production employees, a part of whose tasks are developed in the hatchery, where egg classification, candling and *in ovo* vaccination are performed. Candling consists in inspecting the content of eggs, one by one, with the help of a flashlight. Therefore, it requires repetitive movements of shoulder abduction and elbow flexion to handle the flashlight, while the hands should be kept at the eye level.

About 41% of the administrative and 31% of the production employees reported upper back pain, which was the body site with the third highest prevalence of pain in both groups. The intensity of upper back pain significantly differed between the groups, being strong to unbearable for 60% of the production employees and moderate for 90% of the administrative workers. Therefore, although the prevalence of musculoskeletal pain was lower among the production employees, its intensity was perceived as stronger compared to the administrative workers.

The strong pain in the upper back reported by the production employees might be accounted for by tasks involving manual transport of heavy loads, which are not required from administrative workers. To feed the animals, the employees need to handle 20-kg bags and manually distribute the feed into the feeders, which heavy weight demand considerable physical effort. Jobs in poultry farming characteristically include repetitive tasks mainly involving the upper half of the body⁸. This is why the frequency of pain in the upper half of the body was higher compared to other body sites among this population of workers.

Analyzing musculoskeletal symptoms within the occupational context, considering activities and tasks included in the work process which expose workers to ergonomic hazards, enables putting forward causal hypotheses, which might be investigated to ground strategies to change the current situation.

In regard to the number of involved body sites, among the administrative employees one single participant did not report pain in any site, half of them in two and 24% in three. Musculoskeletal pain affecting more than one body site is frequently reported in studies conducted abroad with employees in administration or similar departments^{4,9,10}. Among the production employees, 23 (15%) did not report pain in any body site, 27% in one, 16% in two, 13% in three, 17% in four, 6% in five, 3% in six and 3% in more than seven.

Intergroup comparison further showed that some production employees reported pain in up to nine different body sites, while the largest number of involved body sites reported by administrative workers was six. This difference might be possibly related to the variety of tasks performed by the former and which require pushing/pulling and transporting heavy loads, remaining in the same posture over a long period of time or excessive physical strength. All of these conditions are associated with significant risk for development of musculoskeletal disorders in several body sites¹⁴.

Association analysis of the prevalence of musculoskeletal pain and the sociodemographic profile showed that the odds of pain were 2.9 times higher among the female production employees compared to the males. Similar data were reported in other studies^{3,10,15}. This finding might be accounted for by the aforementioned characteristics of production work in poultry farming allied to some female biological characteristics (lower bone mass, lower muscle resistance and higher joint instability) which contribute to increase the frequency of pain. In addition, one should also consider the double burden, *i.e.*, performance of household chores in addition to paid work, to which the Brazilian women are subjected.

Most participants reported musculoskeletal pain in some body site, without significant difference in frequency between the administrative and production employees. These findings suggest that the peculiarities of production-related tasks in poultry farming notwithstanding, they do not necessarily involve ergonomic risk for pain compared to administrative work, as we had expected. In turn, administrative work in the poultry farming industry is similar to that in other types of organizations, this is to say, the tasks have no specificity whatsoever. Future studies are needed within the poultry farming setting to confirm the results of the present study.

Despite the patent trend for occurrence of musculoskeletal disorders in the current occupational scenario, investigating musculoskeletal symptoms poses a continuous challenge to investigators, mainly in the industrial sector. Problems in the access to employees and methodological difficulties in the analysis of occupational exposure to physical and psychological demands are barriers which oppose the efforts of researchers seeking to explore this subject. This situation contributes to make the true magnitude of musculoskeletal disorders among active industrial workers poorly known.

CONCLUSION

The prevalence of musculoskeletal pain was high in the analyzed population, with rates of 85 and 95.8% among the production and administrative employees, respectively. On intergroup comparison, the body sites most frequently involved were the neck and upper and lower back among the administrative employees and the upper and lower back and shoulders among the production workers. However,

statistical significance was only found for the higher prevalence of neck pain among the administrative employees. Pain was reported in almost all the analyzed body sites, and was rated moderate in most cases. Female production employees exhibited 2.9 times higher odds of pain compared to the males.

One limitation of the present study is selection bias, because workers on leave were not considered for inclusion. Then, we analyzed production employees allocated to various positions with different work processes involving variable demands.

Nevertheless, the present study represents an advance as it analyzed the occupational environment and musculoskeletal health conditions of poultry farming workers, which currently represent a gap in the Brazilian scientific literature.

We recommend for future studies to consider other methodological approaches and analyze occupational exposures relative to the various steps of the production process, sex and other diseases, including intervention to improve the ergonomic and working conditions of this population of workers.

REFERENCES

1. Magro MLPD, Coutinho MC, Blanch JM, Moré CLOO. Intensificação e prolongamento da jornada de trabalho nas indústrias de abate e processamento de carnes e seus impactos na saúde dos trabalhadores. *Cad Psicol Social Trabalho*. 2014;17(1):67-83. <https://doi.org/10.11606/issn.1981-0490.v17i1p67-83>
2. Brasil. Ministério da Saúde. Secretaria de Vigilância em Saúde. Departamento de Vigilância em Saúde Ambiental e Saúde do Trabalhador. Dor relacionada ao trabalho. Lesões por esforços repetitivos (LER). Distúrbios osteomusculares relacionados ao trabalho (Dort). Brasília: Editora do Ministério da Saúde; 2012.
3. Barro D, Olinto MT, Macagnan JB, Henn RL, Pattussi MP, Faoro MW, et al. Job characteristics and musculoskeletal pain among shift workers of a poultry processing plant in Southern Brazil. *J Occup Health*. 2015;57(5):448-56. <https://doi.org/10.1539/joh.14-0201-OA>
4. Loghmani A, Golshiri P, Zamani A, Kheirmand M, Jafari N. Musculoskeletal symptoms and job satisfaction among office-workers: a cross-sectional study from Iran. *Acta Med Acad*. 2013;42(1):46-54. <https://doi.org/10.5644/ama2006-124.70>
5. Mikkelsen S, Lassen CF, Vilstrup I, Kryger AI, Brandt LP, Thomsen JF, et al. Does computer use affect the incidence of distal arm pain? A one-year prospective study using objective measures of computer use. *Int Arch Occup Environ Health*. 2012;85(2):139-52. <https://doi.org/10.1007/s00420-011-0648-1>
6. Keawduangdee P, Puntumetakul R, Swangnetr M, Laohasiriwong W, Settheetham D, Yamauchi J, et al. Prevalence of low back pain and associated factors among farmers during the rice transplanting process. *J Phys Ther Sci*. 2015;27(7):2239-45. <https://dx.doi.org/10.1589%2Fjpts.27.2239>
7. Pinheiro FA, Tróccoli BT, Carvalho CC. Validação do Questionário Nórdico de Sintomas Osteomusculares como medida de morbidade. *Rev Saúde Pública*. 2002;36(3):307-12. <http://dx.doi.org/10.1590/S0034-89102002000300008>
8. Schulz MR, Grzywacz JG, Chen H, Mora DC, Arcury TA, Marín AJ, et al. Upper body musculoskeletal symptoms of Latino poultry processing workers and a comparison group of Latino manual workers. *Am J Ind Med*. 2013;56(2):197-205. <https://doi.org/10.1002/ajim.22100>
9. Paksaichol A, Janwantanakul P, Lawsirirat C. Development of a Neck Pain Risk Score for Predicting Nonspecific Neck Pain With Disability in Office Workers: A 1-Year Prospective Cohort Study. *J Manipulative Physiol Ther*. 2014;37(7):468-75. <https://doi.org/10.1016/j.jmpt.2014.07.004>
10. Cho CY, Hwang YS, Cherng RJ. Musculoskeletal symptoms and associated risk factor among office workers with high workload computer use. *J Manipulative Physiol Ther*. 2012;35(7):534-40. <https://doi.org/10.1016/j.jmpt.2012.07.004>

11. Oha K, Animägi L, Pääsuke M, Coggon D, Merisalu E. Individual and work-related risk factors for musculoskeletal pain: a cross-sectional study among Estonian computer users. *BMC Musculoskelet Disord.* 2014;15:181. <https://doi.org/10.1186/1471-2474-15-181>
12. Kim EA, Nakata M. Work-related musculoskeletal disorders in Korea and Japan: a comparative description. *Ann Occup Environ Med.* 2014;26:17. <https://dx.doi.org/10.1186%2F2052-4374-26-17>
13. Graves L, Murphy R, Shepherd SO, Cabot J, Hopkins ND. Evaluation of sit-stand workstations in an office setting: a randomised controlled trial. *BMC Public Health.* 2015;15:1145. <https://doi.org/10.1186/s12889-015-2469-8>
14. van Niekerk S, Louw QA, Hillier S. The effectiveness of a chair intervention in the workplace to reduce musculoskeletal symptoms. A systematic review. *BMC Musculoskelet Disord.* 2012;13:145. <https://doi.org/10.1186/1471-2474-13-145>
15. Quandt SA, Grzywacz JG, Marín A, Carrillo L, Coates ML, Burke B, et al. Illnesses and injuries reported by Latino poultry workers in western North Carolina. *Am J Ind Med.* 2006;49(5):343-51. <https://doi.org/10.1002/ajim.20299>

Corresponding address: Priscilla Hortense - Departamento de Enfermagem, Universidade Federal de São Carlos - Rodovia Washington Luís, km 235, SP-310 - CEP: 13565-90 - São Carlos (SP), Brazil - E-mail: priscillaufscar@gmail.com