

OWAS method analysis applied to a slaughterhouse company

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Abstract

Introduction: The Industrial Revolution was a milestone in world development, but as every innovative process, it has also brought adverse situations, especially to the health of the worker. The beginning of the industrial process was marked by the repetitiveness of movements and monotony at work. Subsequently, the automation developed and modified the form of production. However, despite the improvements in the industry, the same effort is still noted, characterized by the exhaustive repetition of movements, the requirement of the same muscular group daily and monotony, factors that cause stress, musculoskeletal injuries and occupational accidents. The objective of this research was to assess the index of workers with musculoskeletal injuries. **Methodology:** The study was developed in two sectors of a slaughterhouse located in the south of Brazil: chicken's wing cut sector and platform sector. The observation, in situ, allowed the ergonomic analysis through the Ovako Working Posture Analyzing System (OWAS) method to assess the ergonomic risks of the postures based on the position of the back, arms, and legs of the workers. Time and methods were analyzed, as well as the medical records of all workers, which were registered and assessed. For the statistical analysis, workers were divided into a) uptime, b) workers who had already exercised demanding work activity of physical exertion and/or repetition of movements and the form of removal (with medical low or without medical low) and, c) by gender. **Results and discussion:** Through the use of the OWAS method, it was verified that workers from both sectors are not exposed to ergonomic risk. Therefore, hypothetically, they would not be subjected to musculoskeletal injuries. These results were then compared with the medical records and there was disagreement between the result of the ergonomic method and the number of injured workers. Women were the most affected by the musculoskeletal injuries. Regarding the male universe, the majority of mean suffering from musculoskeletal injuries were those who had previously worked with the activities that required force and/or repetition of movements. **Conclusions:** It was determined that the index of injured workers were 25% of women in the wing cut, and 17% of men in the platform sector, which was not coherent with the application of the Ovako Working Posture Analyzing System method. It is believed the main reason is that the method does not consider the movements repetitiveness which characterises the activity. Therefore, it would be helpful for the analysis that the ergonomic study is performed using several tools, so that the result is reliable, given the dissonances that may exist between methods and means of analysis.

Keywords. Occupational Disease, Ergonomics, Fatigue, OWAS Method, Osteomuscular Injury.

INTRODUCTION

The industrial revolution was marked by the exchange of the use of tools by machines. What characterizes the industrial revolution is not the machine itself, but the machinery in the industry. The automation in the industry allowed to reduce costs, to increase production and, at the same time, the profit (Teixeira & Souza, 2013). Apart from the production and capital, the search for the profitability left, on many occasions, the worker unattended regarding well-being and safety, because of the requirement to increase and improve the production (Cohn, Hirano, Karsch, & Sato, 1985). Taylorism and Fordism, with the use of innovative technologies, are the first models of industrial production but require exhaustive repetition of movements, that may result in the excessive effort and severe fatigue, leading to the emergence of musculoskeletal injuries (Couto, 2014). These production models are still in use, thus the importance of the ergonomics study in the working environment. The work-related musculoskeletal disorders (WMSD) is a reality experienced by workers from different areas and are a result of repetitive efforts and inadequate ergonomic conditions (Lourinho, Vieira, Almeida, Quemelo, & Negreiros, 2012). Musculoskeletal injuries result from the professional risk factors such as repetitiveness, overload and/or adopted postures during work (Uva, Carnide, Serranheira, Miranda, & Lopes, 2008). When the disease result from work, they are called occupational diseases, which are defined as "the effect of continued work, causing a reversible reduction of the organism's capacity, being caused by a set of factors (Iida, 2005). The working conditions in two sectors of a slaughterhouse company in Brazil were analysed, where the work is repetitive and utterly

demanding on the upper limbs throughout the day. The study objective was to assess the index of workers with musculoskeletal injuries.

METHODOLOGY

The study was developed in two sectors of a slaughterhouse located in the south of Brazil: chicken's wing cut sector and platform sector. The company has two production shifts: one from 04:00h to 13:30h and one from 14:00h to 23:30h, with three pauses of 00:20h and one pause of 01:00h. The resting periods are destined for feeding and for muscle rest, in order to avoid muscular fatigue. The analysis was developed by observation *in situ*, registered by photographs and filming. Subsequently, the *Ovako Working Posture Analyzing System* (OWAS) method was used to analyse the registered observations (Iida, 1990). The method provides scores in ascending order of severity, according to the value assigned to the back and arms from 1 to 3, and the legs score from 1 to 7. The strength performed by the worker was also analysed. Therefore, to each posture assumed by a worker, it was attributed a 4-digit code that depended on the classification within the previous postures for each part of the body, and the respective load (Gómez-Galán, Pérez-Alonso, Callejón-Ferre, & López-Martínez, 2017). After analyzing the body and the strength, the general table of scores was used. The intersection of the results obtained generated a final numerical risk result from 1 to 4, being 1 considered a "normal posture" and 4 a "posture that requires immediate attention". Regarding the prevalence of occupational diseases, the medical records of all workers in the sector were assessed, and especially attention was provided to the following information: sex, age, admission (uptime), medical leave, number of absence days provided by social security, International Code of Diseases (ICD), social security benefits, previous function, period worked. For the statistics of the occupational diseases through the assessment of the medical documents, workers were separated into the following categories:

- ✓ Workers with less than two working years at the company;
- ✓ Workers with two to five working years at the company;
- ✓ Workers over five working years at the company.

RESULTS AND DISCUSSION

In the platform sector, the product (chickens) arrives in boxes, which are discharged by two employees and placed on a treadmill. The treadmill transports the products to the platform sector, where the chicken is hung. As the boxes go through the treadmill, the platform employees hang the product (one by one) on hooks located just above them. To hang the chicken, which is approximately 2.8 kg, the worker lifts both arms up or above the shoulders. In the wing cut sector, the products arrive hanging on the hooks. The hooks are located approximately at the height of the workers' centre of gravity (abdomen region). The worker cut the wings using his arms (at the height of the abdomen), without needing to lift them up or above the shoulders. In both sectors, employees are positioned in front of the products, with no back rotation. As for the position of the upper limbs, the arms move up and down (in the platform), forward and backward (in the wing cut), continuously. The average slaughter is 50,000 birds per shift. There are 7,500 products per hour, which equals 125 products per minute.

- ✓ Platform: there are 9 employees in the sector. The pace of work is 13.9 products per employee every minute. The population of workers in the sector is 100% male. The

weight of each product is approximately 2.8kg. Three technical actions are counted in each cycle: pick up-rotate-position, which equals 41.7 technical actions per minute;

- ✓ Wing cutting: there are 20 employees in the sector. The pace of work is 12.5 products per employee every minute. Each product has 2 wings, which equals 25 cuts per minute per employee. The population is 66.7% female and 33.3% male. The weight and dimensions of the knife used are negligible for this specific case. Two technical actions are counted in each cycle: catch the wing-cut, which equals 25 x 2 (two wings) technical actions per minute.

The images below exemplify the activity: Figure 1 shows a similar production line (Nunes, 2008) and in Figure 2 (Takeda, Oliveira, & Xavier, 2009) can be observed the knife on the right hand of the worker. Disclosure of industry images has not been authorized by the industry.



Figure 1. Platform sector



Figure 2. Cut wing sector

The scores obtained using the OWAS method are presented in Table 1 and Table 2, for the platform sector and wing cutting sector, respectively. According to the obtained results by the ergonomic analysis (OWAS), workers from both sectors are not exposed to ergonomic risk. So, hypothetically, they would not be subjected to musculoskeletal injuries. To confirm the obtained results, the medical records of all workers registered in the sectors (cutting the wing of the chicken and platform) were analyzed. It was found that there were sick leaves due to musculoskeletal injuries in both sectors. Given the information, the clearings were divided into:

- ✓ Workers with a sick leave without social security clearance (period less than 15 days);
- ✓ With social security clearance (period exceeding 15 days);
- ✓ Workers who, before joining the company, had already performed activities demanding of upper limbs (harmful function).

Table 2. OWAS method results in platform sector

Task: Platform		
Body part	Position	Pontuation
Back posture	Upright	1
Arms	Two above shoulder joint	3
Legs	Standing with one leg upright	2
ANALYSIS RESULT		1

Table 3. OWAS method results in wing cutting sector

Task: Wing cutting		
Body part	Position	Pontuation
Back posture	Upright	1
Arms	One above shoulder joint	2
Legs	Standing with one leg upright	2
ANALYSIS RESULT		1

Figures 3, 4 and 5 display graphs of the statistical of musculoskeletal injuries in men and women registered in both sectors. It was verified that the results obtained by the ergonomic analysis method (OWAS) diverge from the reality experienced by the workers since the method does not indicate postural risks. However, musculoskeletal injuries that affect workers are aggravated by repetitive activity. It is believed that the lesions are the result of upper limb overload, considering the extremely repetitive activity. The repetition of movements is daily and throughout the entire working day. Repetitive work is one of the causes of muscular fatigue (Iida, 1990). The ergonomic analysis by the OWAS method allowed to conclude that the posture adopted by the worker was not harmful (risk 1-normal posture). The analysis of medical records, on the other hand, showed that a significant percentage of workers suffer or suffered from musculoskeletal injuries. It can be said that the work is repetitive and exhaustive, factors not considered by the OWAS method. Musculoskeletal disorders occurred in both sectors. The most noted incidences occurred:

- ✓ 25% of women in the wing cut (with social security clearance);
- ✓ 17% of men in the platform sector (who had already exercised harmful activities, especially for the upper limbs);
- ✓ 8% of women in the wing cut (without social security clearance).

It is important to emphasize some differences in both sectors:

- ✓ On the platform sector, the worker does the abduction of upper limbs, the elevation of load and 41 technical actions per minute;
- ✓ On the wing-cut, the worker performs 50 technical actions per minute. However, he does not perform abduction of upper limbs or elevation of loads.



Figure 3. Women with social security (wing cut)

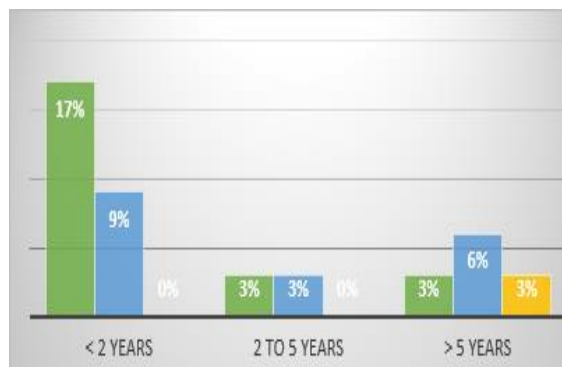


Figure 4. Men (platform sector)

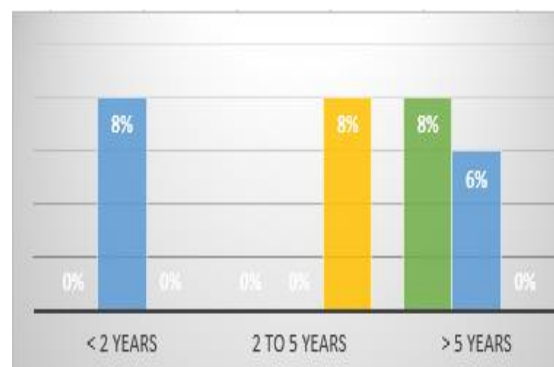


Figure 5. Women without social security (wing cut)

Whereas, although the worker in the wing cutting exercises more technical actions per minute, the activity is less painful. Still, women were the most affected by musculoskeletal injuries. However, in the male universe, who most suffered from musculoskeletal injuries were those who had previously worked with the activities that required force and/or repetition of movements. It can be said that musculoskeletal injuries are chronic because most of the work-related musculoskeletal injuries develop over time (EU-OSHA, 2018). The same European document reports that such injuries often result from the combination of several factors, including the movement of loads and repetitive or repetitive movements, cases that fall into reality under analysis. On the other hand, men who perform the less painful activity and did not have realized demanding activities were injured less, although there were injuries to this population. According to Cezar-vaz, *et al* (2012) these diseases develop due to excessive overloads of the muscles, exposed to repetitive movements and localized efforts. They are usually originated by repetitive movements that overcome the resistance capacity of the components of the locomotor system, such as bones, tendons, ligaments and muscles, often associated. The repetitive movements is evidently a demanding activity that deserves attention. It should be noted that the company analyzed performs three pauses of twenty minutes along the journey beyond the lunch/dinner hours, in order to allow the rest of the member required. However, the measure adopted is not sufficient to neutralize the injuries. Measures of avoiding or reducing the cadence of repetitive movements can be studied, as well as activity rotation is important.

CONCLUSIONS

The analysis by *Ovako Working Posture Analyzing System* method considered that the postures adopted are ergonomically normal, without risk to the workers' musculoskeletal structure. However, the medical records verification has demonstrated that in both sectors there are incidence of musculoskeletal injuries, being more clear in the female population (25% of women in the wing cut), followed by the male population (17% of men in the platform sector) who had already worked on demanding activities and/or with the repetitiveness of movements. It can be said that medical records reflect the reality experienced by the workers. The assessment of medical records made it clear that the employees who have previously engaged in harmful activities are more susceptible to injury because the requirement of a certain muscle group for a continuous period tends to be harmful to the physical structure. Thus, the rotation of activities, avoiding monotony and muscular fatigue, is extremely important. However, knowing that the human body is not an exact machine, it is important to do analyse using other complementary methods. Therefore, the analysis of medical records proved to be important. Musculoskeletal injuries occurred mainly due to the exhaustive repetition of movements of the upper limbs, a fact not considered in the analysis of through the *Ovako Working Posture Analyzing System* method.

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