

## **Postural analysis of pork special cuts in a typical slaughterhouse in Brazil**

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**Abstract.** Nowadays, with the most competitive market, companies have sought new ergonomic strategies. This study was conducted in a typical slaughterhouse from the Brazilian swine industry, in order to perform a postural ergonomics analysis, followed by proposals to minimize or eliminate identified risks. Among the various sectors of the productive processes in the slaughterhouse the one that presented greatest need was selected: the special cuts sector (sausages). It is believed that the analysis of postural assessment and recommendations presented in this paper, will allow the production process of the slaughterhouse to become more efficient and provide greater welfare to the employees.

**Keywords:** slaughterhouse; ergonomics; postural analysis; OWAS method.

### **1. Introduction**

As businesses are in a very competitive market, they are in search of strategies to hold or improve their position in the current market. One of these strategies is related to ensuring the welfare and safety of the employees. This strategy can be applied in all types of business, especially those with many repetitive and monotonous in its production line, such as meat processing plants and slaughterhouses (EVANGELISTA; COSTA, 2013). The slaughterhouse sector consists of a continuous center line of disassembly of animals (poultry, pigs, cattle), which extends from receiving the animals to shipping the final product. According to studies, the employees in this sector are exposed to various ergonomic hazards (COSTELLA; MASSON, 2012).

In the search to provide greater convenience for employees, facilitating the work performed by them, a science called ergonomics emerged. Iida (1997, p.1) quotes a definition of Ergonomics written by the Ergonomics Research Society, "Ergonomics is the study of the relationship between man and his work, equipment and environment, and particularly the application of knowledge of anatomy, physiology and psychology in solving the problems found in this relationship."

Ergonomics can be applied through the Ergonomic Work Analysis (EWA). The EWA focuses its objectives, methods and theoretical developments in physical or cognitive difficulties, working conditions and the way the individual performs his work (Salerno, 2000). In EWA there are several techniques that can be used to study a particular task, such as Postural Analysis.

According to Iida (2005), Postural Analysis is a study based on the analysis of the positioning of body parts like the head, trunk and limbs while performing a task. The work which presents no discomfort or stress is done with good posture.

To perform the postural analysis one of the methods used was the OWAS (Ovako Working Posture Analysing System). This method is based on the numeric representation of the positions of the arms, legs and back posture assumed by the adopted posture and the value of the loaded weight, this numerical representation is formed by a four-digit code (Evangelista, 2011). At Figure 1 one can see the positions.

|        |                            |                                      |                                 |                       |   |  |
|--------|----------------------------|--------------------------------------|---------------------------------|-----------------------|---|--|
| DORSO  |                            |                                      |                                 |                       | ex: 2151 RF                                       |  |
|        | 1 Reto                     | 2 Inclinado                          | 3 Reto e torcido                | 4 Inclinado e torcido |   |  |
|        |                            |                                      |                                 |                       |   | DORSO inclinado 2<br>BRAÇOS Dois para baixo 1<br>PERNAS Uma perna ajoelhada 5<br>PESO Até 10 kg 1<br>LOCAL Remoção de retugos RF |
|        |                            |                                      |                                 |                       |   |  |
|        |                            |                                      |                                 |                       |   |  |
| BRAÇOS |                            |                                      |                                 |                       |   |  |
|        | 1 Dois braços para baixo   | 2 Um braço para cima                 | 3 Dois braços para cima         |                       |   |  |
|        |                            |                                      |                                 |                       |   |  |
| PERNAS |                            |                                      |                                 |                       |   |  |
|        | 1 Duas pernas retas        | 2 Uma perna reta                     | 3 Duas pernas flexionadas       |                       |   |  |
|        |                            |                                      |                                 |                       |   |  |
|        |                            |                                      |                                 |                       |   |  |
| CARGA  |                            |                                      |                                 |                       | xy<br>Código do local ou seção onde foi observado |  |
|        | 1 Carga ou força até 10 kg | 2 Carga ou força entre 10 kg e 20 kg | 3 Carga ou força acima de 20 kg |                       |   |  |
|        |                            |                                      |                                 |                       |   |  |
|        |                            |                                      |                                 |                       |   |  |

Figure 1: OWAS system used to register the posture. Source: IIDA, 2005. p. 170.

According to Iida (2005), a specific posture can be classified by the combination of the four variables. The classification is based on figure 2.

| DORSO | BRAÇO | PERNAS |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|-------|-------|--------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|       |       | 1      |   |   |   |   |   |   | 2 |   |   |   |   |   |   | 3 |   |   |   |   |   |   |
|       |       | CARGA  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|       |       | 1      | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| 1     | 1     | 1      | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
|       | 2     | 1      | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
|       | 3     | 1      | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 |
| 2     | 1     | 2      | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 |   |
|       | 2     | 2      | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 2 | 3 | 4 |
|       | 3     | 3      | 3 | 4 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |   |
| 3     | 1     | 1      | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 |
|       | 2     | 2      | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 1 | 1 | 1 |
|       | 3     | 2      | 2 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 1 | 1 | 1 |   |
| 4     | 1     | 2      | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |   |
|       | 2     | 3      | 3 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |   |
|       | 3     | 4      | 4 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 3 | 4 |   |

Figure 2: Framework for the definition of the postures by the combination of variables. Source: IIDA (2005)

Based on the analysis of the posture, it may be classified as belonging to one of the four possible types of classes represented below according to Iida (2005):

- a) Class 1 - normal posture, dispensing care, except in exceptional cases;
- b) Class 2 - posture that should be checked during the next review;
- c) Class 3 - posture that deserves attention in the short term;
- d) Class 4 - posture that deserves immediate attention.

This study aimed to perform a postural analysis of workers while performing their duties in special sections of a meat processing line in the studied industry. We selected this industry because it presents high complaints and absents, besides being monotonous and present repetition of activities.

## 2. Methodology

This is a case study, where the postural analysis of the main activities of the special cut sector (sausages) of a meat processing company of a swine industry took place. The case study is defined as an empirical inquiry, in which we analyze the actual events, especially those evident in the situation proposed (Yin, 2005).

This study was developed in a company in the food sector located in the state of Minas Gerais, that specializes in breeding, slaughter and pork processing. The food processing plant has an area of 40,000 m<sup>2</sup> and 10,226 m<sup>2</sup> of construction with an annual production capacity of 53.100 tons of meat. The activities analyzed belong to the special cuts sector and the data collection involved two processes: a survey and observation.

Initially a survey was applied to the employees, in which it was possible to identify their profile, their general working conditions, food, health and safety performance of their daily chores. The questionnaire contained 48 questions and was administered to a sample of 67 employees, both men and women, from a total of 470 employees, representing more than 10 % of employees. Each sector had at least 10 % of the employees interviewed.

Observation was performed two ways: directly by the analyst and later with the help of photographs and footage that was recorded by digital camera. To analyze the positions during the execution of the activities, the technique of OWAS method was applied.

### 3. Results and Discussion

The production process of the meat processing plant includes the moment in which the animal arrives at the slaughter house, until the meat is ready to be sold, which is the output.

Through the questionnaires, it was found that 56.7 % of employees, the majority, considers the job monotonous and repetitive or heavy, and it would be interesting that the company intensified its policy of rotations within the sector, mainly in the special cut sector.

According to the data obtained by the survey and by observation of the positions executed by the workers, it was concluded that the sector of special cuts had greater need of an ergonomic study. This need was identified due to the fact that the sector has a great number of females, the tasks are monotonous, repetitive and there were high complaint rates.

The description of the postures identified during the execution of the activities in this sector, their combination and pose category, according to the OWAS method, are presented in Figure 3.

| Phase of the activity                          | Postures   | Categories |
|--|--|------------|
| Push the loaded meat cart to fill the sausages | Leaning torso with both arms at shoulder level, moving with load over 20 kg<br>2373                    | 4          |
| Sausage filling                                | Leaning torso with arms below shoulder level, straight legs and load under 10Kg<br>2121                | 2          |
| Cut and weigh the sausage                      | Leaning torso with arms below shoulder level,<br>Sitting position and load under 10kg<br>2111          | 2          |
| Seal package                                   | Leaning torso with both arms under shoulder level, both legs straight and with load under 10Kg<br>2121 | 2          |

Figure 3 – Description of the postures of the OWAS system considering the phases analysed in the process of the special cut sector of the meat processing plant.

Source: research data.

The position of the employee during manual transport of the cart with the raw material used in producing sausage was classified as category 4 and, according to this classification, this attitude evokes immediate attention. The factors that most influenced this classification are the worker's movement and the excessive weight of the loaded cart.

The other postures, from the activities of this sector were classified as category 2, which requires long-term attention. The inclination of the employees' bodies is the main factor that led to this ranking.

#### **4. Conclusion**

According to the results obtained by classification of postures based on OWAS, it was noted that the activity of pushing the loaded cart (raw material) sausage filling in the special cut sector was classified as category 4, which indicates need of immediate corrective action. The remaining positions were classified in category 2, indicating the need of attention in the long term.

It is important to emphasize that the responsibility for the sector should implement a process of postural reeducation, encouraging workers to adopt a correct posture while developing their activities, to avoid muscle fatigue and risk of injury.

It is suggested that workers who sit during cut and weighing of the sausage, should have a base in the chair to put their feet and hold the whole foot, being adjustable in height to be used by any worker. Furthermore in this sector, it is recommended the implementation of regular maintenance of the carts to avoid unnecessary movements during the process of pushing them.

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