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ERGONOMICS ECONOMICS: ERGONOMIC ACTION APPLIED IN THE PACKAGING SECTOR OF A FOOD COMPANY IN RIO DE JANEIRO

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Abstract

This article presents the development of Ergonomic Work Analysis (EWA) in a food industry company, which seeks to provide a picture of the work situation in a given sector, a fundamental object of transformation in Ergonomics (GUERIN et al. 2001). The initial demand pointed to the existence of repetitive movements during the work of workers in the packaging sector. The ergonomic action revealed the presence of other influencing factors, such as work organization, assistive devices and waste of packaging material. Based on a cost-benefit analysis, the improvements indicated in the physical and organizational aspects were evaluated.

Keywords: Ergonomic Work Analysis. Ergonomic Action. Repetitiveness. Cost-Benefit.

1. INTRODUCTION

A fundamental principle of Ergonomics consists of the adequacy of work to those who work and of Ergonomic Action the identification of problems of this nature followed by the elaboration of recommendations for the realignment of the organization.

The AET presented in this study was carried out in the central region of the state of Rio de Janeiro, in a company that occupies the 4th place in distribution and sales in the field of its product in the state. Its ergonomic maturity level is still low. The managerial demand was located in the packaging sector, which concentrates the largest number of employees and where there was an indication of the presence of repetitiveness in the packaging activity. After the Demand Instruction, the packaging activity was defined as the focus of the present study.

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2. FRAME OF REFERENCE

Repeatability, according to the *International Organization for Standardization* (ISO), is characteristic of a task when a person is continuously repeating the same work cycle, the same actions and movements. (ABNT NBR ISO 11228- 3:2014).

The OCRA method defines repetitiveness by measuring the frequency of actions performed during the task per minute, limiting it to up to 30 technical actions/min/Upper Limb or Cycles shorter than 30 seconds or the same technical actions occupying more than 50% of the cycle time. (COLOMBINI et al, 2008).

The EAMETA instrument (VIDAL et al., 2015) compares the issues contained in NR-17 (Space, Environment, Furniture and Equipment), combining them with an appreciation of the work process through the confrontation between Task and Activity, which seemed to us to be a prudent choice to conduct this ergonomic action. This instrument is used in several studies of Ergonomics (RICART; VIDAL; BONFATTI, 2012; MOREIRA, 2014; JATOBÁ et al., 2015).

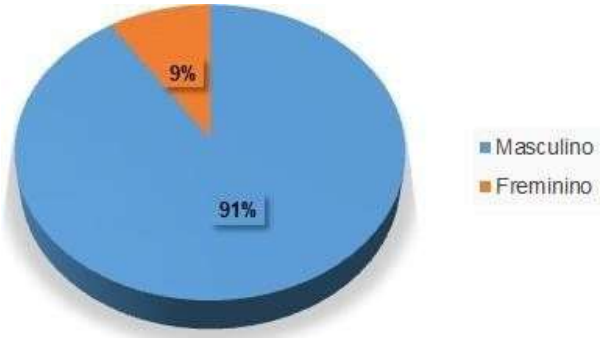
According to Mafra (2006), "the costing procedure is coupled to the methodological procedure of Ergonomics Analysis..." "from which the elements of the economic evaluation of the intervention in question will be derived". Following this analysis, the 'cost focuses' can be determined and the indicators of ergonomic losses in the company can be verified (Ergonomic Cost). With the indications of improvements, the calculations of the costs of the corrections, or the necessary investments, are made. With this, it is possible to predict the possible gains (benefits), or the expectations of returns from the proposed modifications and make a cost-benefit assessment. Following the analysis of the situation in focus, it is possible to identify the losses in the process, due to the absence of ergonomics, and evaluate what are the possible gains in the process, with the ergonomics project.

3. METHODOLOGY

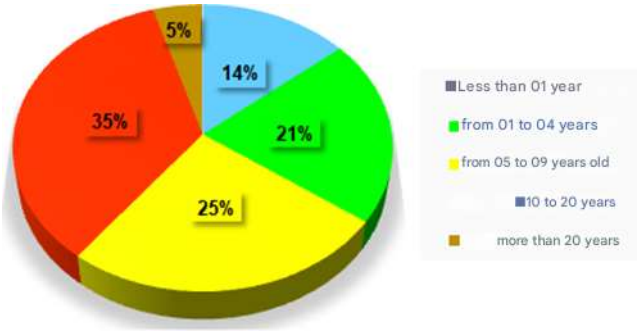
The methodology adopted in this work was the case study. Ergonomic Work Analysis (EWS) was applied, using conversational action and the use of the following tools: EAMETA, Corlett diagram, Moore & Garg. In the focus situation, the Course of Action was observed, highlighting the time factor on the production line, associated with a cost-benefit study of the absence of ergonomics in the sector.

3.1. Global analysis

The company has 43 employees distributed in 6 sectors. It works in 2 shifts from Monday to Friday and every 15 days on Saturdays, except for the administrative sector that works only in 1 shift from Monday to Friday. There is no absenteeism or absence from work.



Graph 1. Breakdown by gender



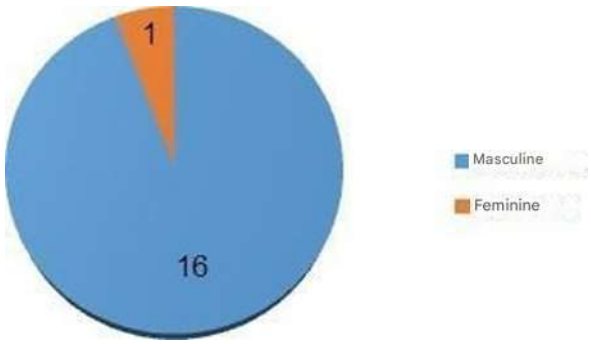
Graph 2. Division by length of service in the company

3.2. Sector of focus - packaging

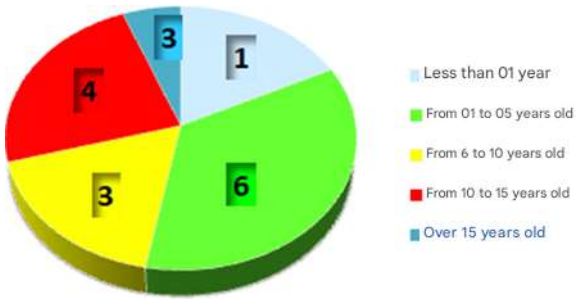
The sector is composed almost entirely of male employees, with 8 employees aged between 20 and 30 years and 6 employees aged between 40 and 50 years, as we can see in graphs 3, 4 and 5.

There is no leave due to work-related injuries or illnesses and there is also no discrepancy between prescribed activity and activity performed. This activity essentially consists of assembling bales with the packages packed by the machine, adjusting its parameters when necessary and changing the plastic coil for packaging the product, when it reaches the end.

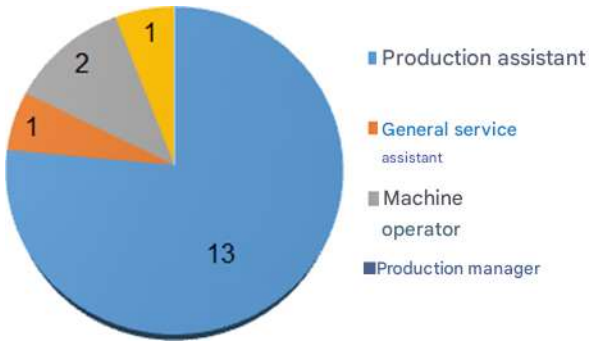
The production is carried out by 4 packaging machines with a manufacturing date of 1998, 2004 and 2008, which produce packages of 10g, 40g, 70g, 80g and 100g. The main production line is the 70g package produced in 2 or 3 machines depending on the demand requested by the sales sector.



Graph 3. Gender division



Graph 4. Division by length of service



Graph 5. Division by professionals

4. FINDINGS

The table below illustrates the main findings after using the EAMETA tool.

Table 1. Outcome of the implementation of EAMETA

EAMETA			VERBALIZATIONS
Environment	Temperature	Bad	*"Now with a fan, it has improved".*
Space	Circulation	Bad	
	Station area	Bad	
Furniture	Chair	Bad	*"It hurts my buttocks to stay*

Equipment	Machinery / Wrapping Machine	Good	*"Easy adjustment".*
		Bad	*"Very old, it always stops".*
Organizational			

The application of the Moore & Garg tool and the chronoanalysis of the technical acts per minute showed the existence of repetitiveness and the need for attention to this factor, which is predisposing to wrist and hand injuries, although there are no complaints or sick leave in the sector for this reason. Table 2

Table 2. Result of the application of the Moore & Garg tool

MOORE & GARG			
Result (Strain Index Score - IS		0,00	6,00
<3	Safe working		
3 to 7	Work can present risk to upper limbs		
>7	Dangerous work. Present risk		
RESULT			
Repeatability	Upper limb dominant side: 65 technical actions/min.		
	Contralateral upper limb: 08 technical actions/min.		

The machines are programmed to manufacture 37 to 38 70g packages of the product per minute. During the chronoanalysis, interruptions in the activity of the machines caused by mechanical defects were observed, resulting in significant loss of packaging material and working hours.

The workplace environment is marked by disorganization caused mainly by the use of improvised support accessories during activity, absence of adequate furniture and preventive maintenance. Photos 1 and 2

Photo 1. Inadequate furniture

Photo 2. Inadequate furniture

5. TABLE OF PROBLEMS FOUND AND REFERRALS

Table 3. Issues found and referrals

Problems encountered	Cause	Effects	Suggestion
Repeatability	Programmed cycle of the machine	Predisposing to wrist and hand injury. Risk of leave and labor demand	Insert packing aid equipment
Machine shutdown	Absence of preventive maintenance program. Old equipment	Loss of packaging material . Increased maintenance cost . Rework.	Acquire new machinery . Carry out a preventive maintenance program.
Forced posture	It talks about orientation regarding postural variation.	Pain, especially lower back and lower limbs. Venous stasis.	Instruction for postural modification during the workday.
Improvisation of furniture and equipment	Absence of furniture and accessories suitable for activities	It induces forced postures and disorganization in the environment.	Acquisition of furniture and accessories with adjustments.

Decreased productivity. Increased cost of production	**Improved productivity. Increased profit. Increase in capacity for new investments.**

6. COST-BENEFIT ANALYSIS

It was found that the lost time (machine inoperative by default), generates a loss of profit of approximately R$ 20,000.00 per month and that, in addition, the loss of packaging material costs around R$ 4,000.00 per month.

Investments totaling R$ 192,000.00 were suggested. This is divided into new machinery, at a cost of R$190,000.00 (financed by the manufacturer in 18 interest-free installments) and the preparation of a preventive maintenance program, both for the new machinery and for the machinery that is currently in operation.

Also among the suggestions is the acquisition of baling support (Figure 1), which allows, in addition to a better organization of the space at the station, a reduction in the number of technical actions per minute (reducing repetitiveness) and a better postural adaptation during the activity (mitigating WMSD). This with an investment of R$ 800.00.

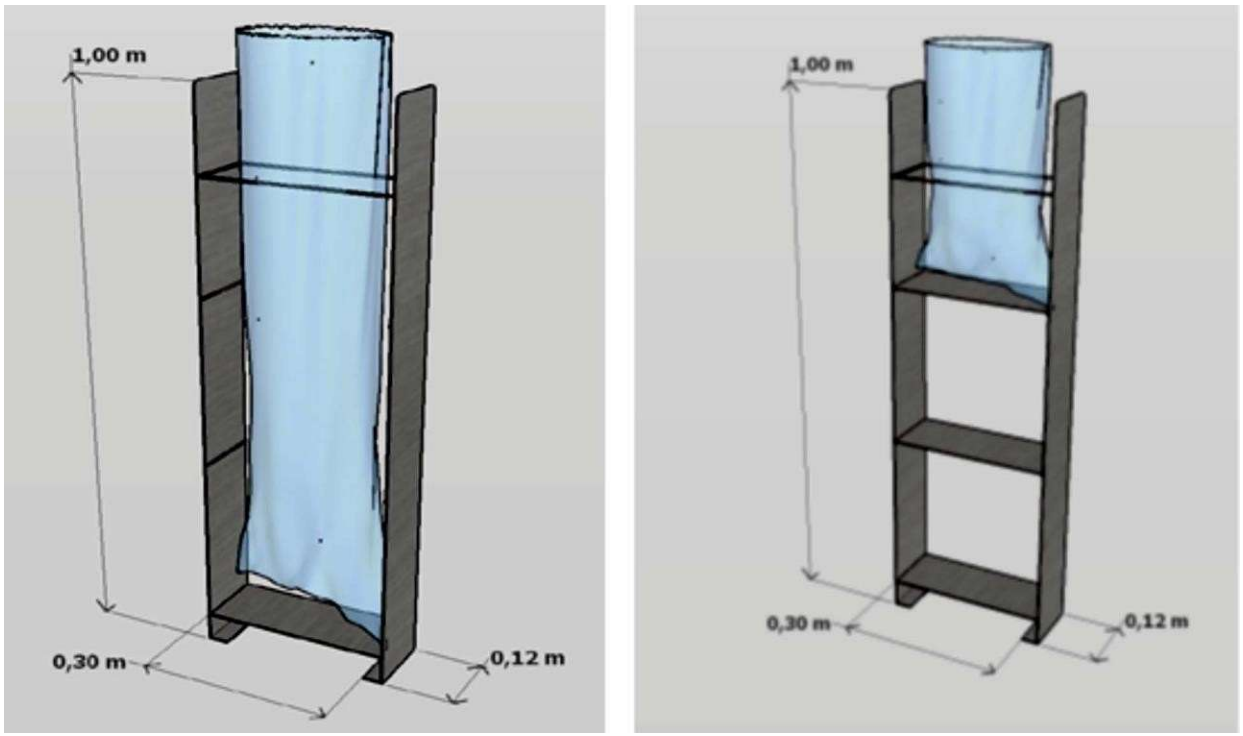


Figure 1. Baling support

The training, covering postural variation, together with the acquisition of a chair with adjustments, represented an investment of R$ 1,600.00. The resulting benefits are the reduction of discomfort, caused by the posture sustained for long periods and the possibility of working in adequate posture during the workday.

It is worth remembering that the Ergonomic Cost is related to the financial losses arising from the absence of Ergonomics, which here was around R$ 24,000.00 (twenty-four thousand reais). And, that, in a Cost-Benefit analysis, the cost corresponds to the necessary investment and the benefit to the results obtained between the gains and losses, with the changes implemented. In this case, the elimination of losses appears as benefits, compared to monthly investments, for 18 months. After this eighteen-month period, in the nineteenth month, the investment will be paid off and the actual profit is realized (profit margin in the order of 125%).

Table 4. Ergonomic cost

Investment = Cost (R$)		**Loss (R$)**	**Benefit (R$)**
1st month	12.956,00	24.000,00	11.044,00
2nd to 18th month	10.556,00	24.000,00	13.444,00
Total =	**192.408,00**	**432.000,00**	**239.592,00**

7. Conclusion

The objective of this study was to present the results of an ETS in a food company. It was evidenced in the ergonomic action that, in addition to the repetitiveness pointed out in the initial demand, there was the presence of other influencing factors, such as work organization, assistive devices and waste of packaging material.

In the analysis of the station, significant losses were verified that, in the face of an investment in machinery, equipment and training, the problems could be eliminated. And, based on a cost-benefit analysis, the improvements pointed out in the physical and organizational aspects were evaluated, verifying the recovery of this investment in 18 months.

8. Disclaimer

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