



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

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### **Summary**

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

**Keyword:** Ergonomic Work Analysis. Ergonomic Action. Repetitivity. Cost benefit.

### **1. INTRODUCTION**

A fundamental principle of Ergonomics consists of adapting the 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 ranks 4th in distribution and sales in its product sector in the state. Your level of ergonomic maturity is still low. The managerial demand was located in the packaging sector, a sector that concentrates the largest number of employees and where there was an indication of the presence of repetitiveness in the packaging activity.

packaging. After the Demand Instruction, the packaging activity was defined as the focus of the present study.

### **2. REFERENTIAL FRAMEWORK**

Repetitiveness, according to the International Organization for Standardization (ISO), is characteristic of a task when a person is continually 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 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 subjects 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 It seemed to us to be a prudent choice to carry out the aforementioned ergonomic action. This instrument is used in several Ergonomics studies (RICART; VIDAL; BONFATTI, 2012; MOREIRA, 2014; JATOBÁ et al., 2015).

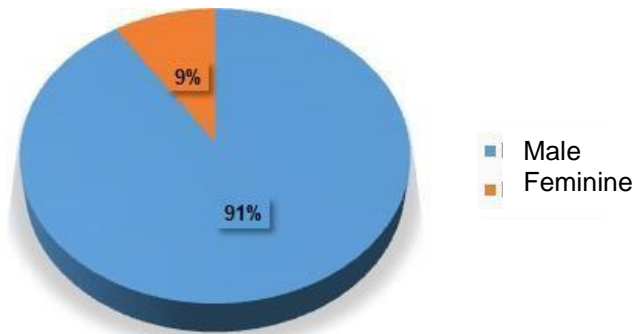
According to Mafra (2006), “the costing procedure is coupled to the methodological procedure of Ergonomic Analysis...” “from which the elements of the economic evaluation of the intervention in question will be derived”. Following this analysis, the 'cost foci' can be determined and the indicators of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

### **3. METHODOLOGY**

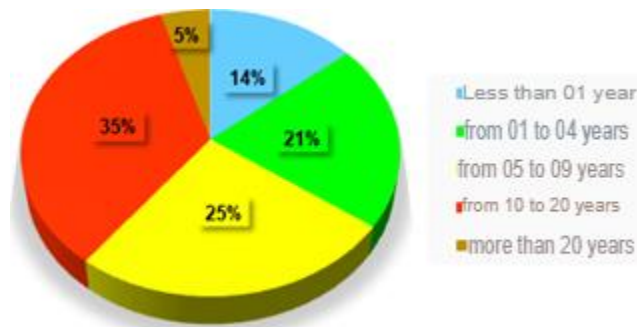
The methodology adopted in this work was the case study. Ergonomic Work Analysis (AET) was applied, using conversational action and the use of tools: EAMETA, Corlett, Moore & Garg diagram. In the focus situation, the Course of Action was observed, highlighting the time factor in the production line,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

#### **3.1. Global Analysis**

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



Graph 1. Division by gender



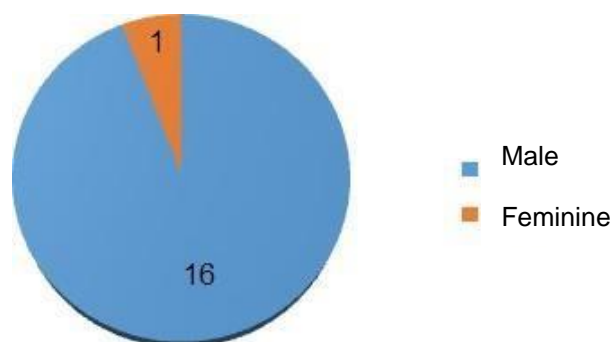
Graph 2. Division by length of service in the company

### 3.2. Focus Sector - Packaging

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

There is no absence due to work-related injuries or illnesses and there is also no discrepancy between prescribed activity and performed activity. 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 is finished.

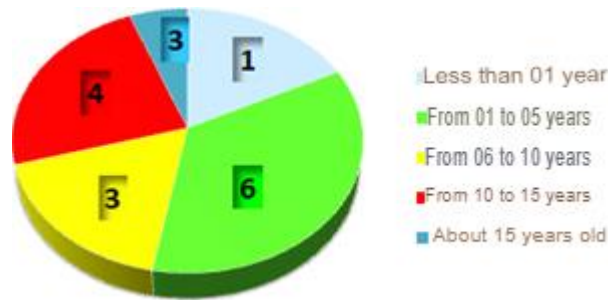
Production is carried out by 4 packaging machines with manufacturing dates of 1998, 2004 and 2008, which produce packages of 10g, 40g, 70g, 80g and 100g. The main production line is the 70g packaging produced on 2 or 3 machines depending on the demand requested by the sales sector.



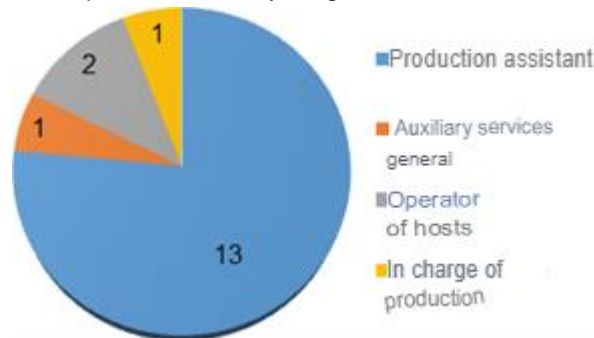
Graph 3. Division by gender

**A ECONOMIA DA ERGONOMIA: O CASO DA AÇÃO ERGONÔMICA APLICADA NO SETOR DE EMBALAGEM DE EMPRESA ALIMENTÍCIA NO RIO DE JANEIRO**

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Graph 4. Division by length of service



Graph 5. Division by professionals

**4. RESULTS**

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

Table 1. Result of applying EAMETA

EAMETA			VERBALIZAÇÕES
Environment	Temperature	Bad	“Now with a ventilator it’s better.”
Space	Circulation	Bad	
	Station area	Bad	
Furniture	Chair	Bad	“My buttocks hurt from being
Equipment	Machinery / Packaging Machine	Good	“Easy adjustment”.
		Bad	“Very old, always stops.”
	Temperature		
Organizational			

The application of the Moore & Garg tool and the chronoanalysis of technical acts per minute the existence of repetitiveness and the need for attention to this factor that is predisposing to wrist and hand injuries were noted, despite there being no complaints or absences in the sector for this reason. Table 2

Table 2. Result of applying the Moore & Garg tool

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

The machines are programmed to manufacture 37 to 38 packages of 70g of product per minute. During the chronoanalysis, interruptions in the activity of the machines were observed caused by mechanical defects, 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, lack of adequate furniture and preventive maintenance. Photos 1 and 2

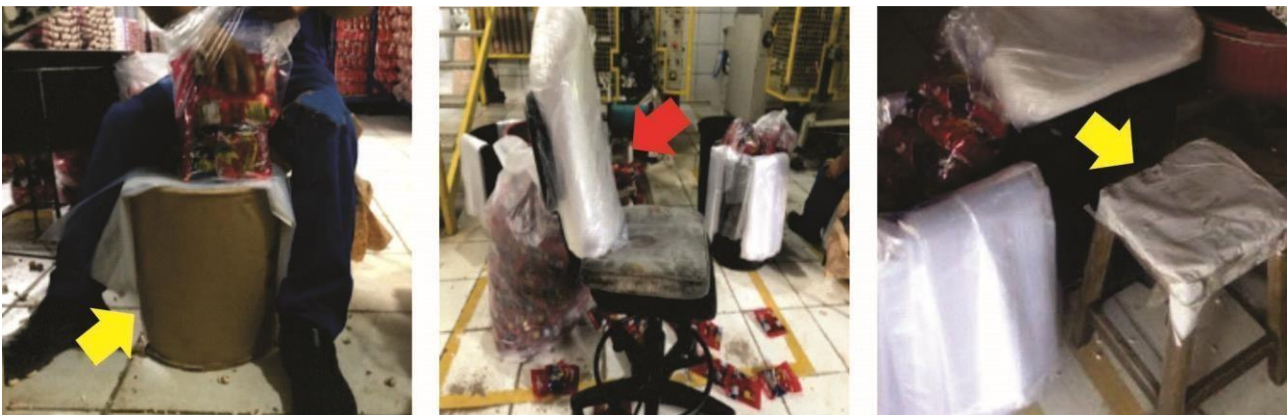


Photo 1. Inappropriate furniture



Photo 2. Inappropriate furniture

## 5. CHART OF PROBLEMS FOUND AND REFERRALS

Table 3. Problems found and escalations

Problems found	Cause	Effects	Suggestion
Repetitiveness	Machine programmed cycle	Predisposing to wrist and hand injuries. Risk of removal and	Insert packaging aid equipment
Machine stop	Lack of preventive maintenance program.	labor demand	Purchase new machinery.
Forced posture	Old equipment	Loss of packaging material.	Carry out preventive maintenance program.
Improvisation of furniture and equipment	It talks about guidance regarding postural variation.	Increased maintenance cost.	Instruction for postural modification during the journey.
Decreased productivity. Increase in production cost			<b>Improved productivity. Increased profit. Increase of capacity for new investments.</b>

## 6. COST-BENEFIT ANALYSIS

It was found that lost time (machine inoperative due to defect) 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 being divided into new machinery, at a cost of R\$190,000.00 (financed by the manufacturer in 18 interest-free installments) and the development of a preventive maintenance program, both for the new machinery and for the machinery currently in operation. .

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

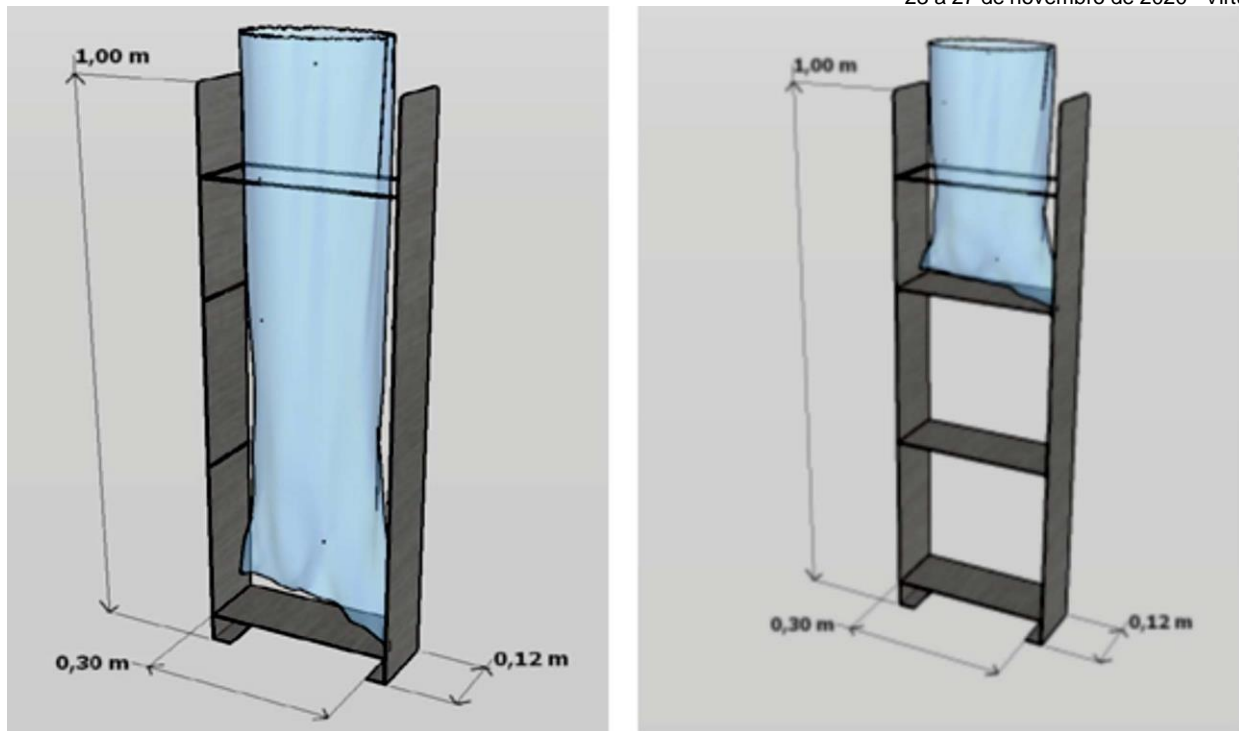


Figure 1. Baling support

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 sustained posture for long periods and the possibility of working in an adequate posture during the journey.

It is worth remembering that the Ergonomic Cost is related to the financial losses arising from the lack of Ergonomics, which, here, was around R\$ 24,000.00 (twenty-four thousand reais). And, in a Cost-Benefit analysis, the cost corresponds to the necessary investment and the benefit to the results obtained between 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 period of eighteen months, in the nineteenth month, the investment will be paid off and the real profit will be realized (profit margin in the order of 125%).

Table 4. Ergonomic cost

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

## 7. CONCLUION

The objective of this work was to present the results of an AET in a food company. It was evident in the ergonomic action that, in addition to the repetitiveness indicated 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 and, due to an investment in machines, equipment and training, the problems could be eliminated. And, based on a cost-benefit analysis, the improvements highlighted in the physical and organizational aspects were evaluated, verifying the recovery of this investment in 18 months.

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