



## **A WEIGHT ON THE BACK: THE WORK BACKPACK OF THE COMMERCIAL RELATIONSHIP AGENTS OF AN ENERGY GROUP FROM THE PERSPECTIVE OF ERGONOMICS**

Maria das Graças Sinésio da Silva<sup>1\*</sup>

### **Abstract**

The research describes the Ergonomic Analysis of Work (AET) carried out in a Brazilian energy distribution company. The construction of the work is a participatory process, with representation of the working class, the security and medicine sector and managers in the area. The help data for physicians were indicators to help develop the study. From the analysis of the activity, it was possible to verify that the backpack used by the commercial relationship agents needs transformation. This analysis is the basis of the designed backpacks, for a new model presented through prototyping.

**Keywords:** Ergonomic Work Analysis; Ergonomics; Backpack; Relationship Agents.

### **1. INTRODUCTION**

According to the International Energy Agency (IEA, 2021), Brazil is the largest individual energy consumer in South America, accounting for about 36% of total final energy consumption in the region. Work in the Electric Sector consists of the generation, transmission and distribution of electricity, and requires physical and mental efforts, associated with risks to the health and safety of workers (MARTINEZ & LATORRE, 2009). This study describes the Ergonomic Analysis of Work (AET) carried out in a Brazilian energy distribution company, focusing on the work activity of commercial relationship agents (readers).

The initial demand arose from information from a former employee of the company, who signaled the existence of possible demands to be studied in the sector. After contacting the coordination of health and safety at work, the readers' backpack was indicated as a point that needed improvement. Regulatory Standard No. 17 establishes that all equipment that makes up a workstation must be appropriate to the psychophysiological characteristics of the workers and the nature of the work to be performed. To this end, a participatory process, with representation from the working class, the Occupational Safety and Medicine sector and managers in the area was fundamental for the development of this research.

---

<sup>1</sup> PEP/COPPE/UFRJ. \* graca.sinesio@pep.ufrj.br.



According to Soares et al. (2012), ergonomics seeks, within its possibilities, to efficiently reduce the problems derived from the incompatibility between man, machine and the work context. According to the Manual for the Application of Regulatory Standard No. 17 (2002) the equipment, environmental conditions and work organization must be adapted to the psychophysiological characteristics of the workers and the nature of the work, in addition, the workers need to be consulted and approve the equipment, the environmental conditions and the organization of work, as only they can attest to their comfort or not.

The ergonomist's task is not only to prevent the risk of pathologies by transforming work, but to act on the causes, reducing the ergonomic risk arising from a method of developing working conditions (GONÇALVES, 2010). In all contexts that need an analysis of human labor, it is important to use appropriate mechanisms to arrive at the proposed project, taking into account all the factors that influence and affect labor activity.

### **1.1. Goal**

The main objective of this study is to improve the working conditions of the commercial relationship agents of a Brazilian company in the energy segment, focusing on the development of a backpack model more appropriate to the worker's activity.

## **2. METHODS AND TECHNIQUES**

This study was developed according to the Ergonomic Analysis of Work (AET).

In the exploratory phase, after knowing the demand, the first visit to the company was carried out, where the weighing and metric of the equipment that the commercial relationship agent carries during his journey and the verification of the uniform and types of shoes used were carried out. Unstructured interviews were conducted with the relationship agents and data related to the health of workers were requested from the Occupational Safety and Medicine sector.

In parallel with the analysis of the workers' health data, open observations were initiated, which totaled approximately 48 hours in the field. During the observations, semi-structured interviews were carried out in parallel with the performance of the activity, as well as the recording of the spontaneous verbalizations of the workers and the constraints. In addition, the time that the relationship agents remained with the backpack on their backs during the work period was verified.



## **2.1. The company and the characteristics of the working population**

The company studied is part of a group of companies in the energy distribution, generation and trading segments and is the fourth largest energy distributor in Brazil. Operating in 31 municipalities in the State of Rio de Janeiro and headquartered in the capital, where it has been operating for more than a hundred years, its services cover a region with more than 10 million people.

There are 603 agents between contractors and outsourced workers. The team is made up of 88% pedestrian relationship agents and 12% motorcyclist relationship agents. The relationship agents are mostly male, and represent 92.6% of the total number of readers. The team of pedestrian readers is made up of 487 men and 44 women. The team of motorcyclist readers is made up of 71 men and 01 woman.

In the team of pedestrian agents, the predominant age group is between 30 and 40 years old, followed by the intervals of 19 to 29 years old and 41 to 51 years old. In the team of motorcyclist agents, the age group between 30 and 40 years old stands out over the others. Adding the two teams, workers in the prevalent age group represent 40.8% of the company's total agents.

With regard to the length of service, both in the team of pedestrian readers and in the team of motorcyclist readers, the period of time that stands out is up to 02 years of service, 61.7% of the workers leave the company in this period. This data portrays a high rate of worker turnover, and negatively affects the company's performance. The turnover rate may rise due to factors external to the company, however factors such as structure, processes and management of the company interfere directly.

## **2.2. Absenteeism of the working population**

Data were collected from the Occupational Safety and Medicine sector, referring to leaves in the last year. These data were separated according to the International Classification of Diseases (ICD), which assigns a category to each health status of the individuals, according to the pathologies cataloged by the World Health Organization.

The categories of the codes that stand out are classified with the initial letter 'M', related to diseases that affect the connective, bone and muscle tissue, with emphasis on the M545 category, which refers to the description of acute or chronic pain in the lumbar or sacral regions,



which may be associated with sprains and strains of the muscle ligaments, disc displacement and other conditions. This pathology generated a total of 58 leaves in 2020.

Another piece of data analyzed is the average number of leave days generated from each CID code category. The M545 category, in addition to presenting the highest number of leaves, also caused the highest average number of sick days. Workers affected by this pathology were away from work for an average of 155 days. Based on the information collected in the health area, the focus was defined as the lumbar problems of the relationship agents. Therefore, the objective of the analysis would be to generate specifications for the work backpack of these agents.

### 2.3. Equipment

During the monitoring of the activity, it was observed that the relationship agent does not start his route with all the work tools made available by the company, as represented in figure 1. Considering that according to the route of the day, he uses between 03 and 05 rolls of invoices, it was found that he would carry a minimum weight of 1,310kg during an 8-hour journey if he took all the equipment with him. To this weight must be added the weight of the personal belongings and food that each agent carries with him.

Figure 1 - Equipment of the Commercial Relationship Agents

IMAGE	ITEM	AMOUNT	DIMENSIONS	WEIGHT
	Invoice Roll (90 invoices)	03 - 05	10 x 5,5 cm	78g
	Label Reel	01	11 x 4 cm	38g
	Data Collector	01	14,7 x 7,5 x 2 cm	64g
	Collector battery	01	13 x 7 x 2 cm	82g
	Printer	01	19 x 16,5 x 7 cm	471g
	Protector against animal attack	01	11 x 5,2 x 3,5 cm	43g
	Sunscreen and insect repellent	01	-	51g
	Bottle for Liquids	01	33 x 8 cm	327g
	Food bag	01	20 x 15 x 12 cm	-
Minimum weight				<b>1,310kg</b>

Source: Own authorship (2021)



## 2.4. Task

The Commercial Relationship Agents work in an external environment and have the following duties:

- a. Reading of energy meters;
- b. Delivery of energy bills;
- c. Field indications such as: broken wire, fallen pole, rammed and damaged pole, leaking transformer;
- d. Update of customer registration;
- e. Reading supervision;
- f. Support in the company's commercial actions.

Regarding the organization of the activity, there is a division by work routes, made by the supervisor of the relationship agents, who uses as a criterion the previous knowledge of the route to be worked by the agent. It is the supervisor who also sets the production goal, which is between 200 and 700 daily readings, using as a criterion the difficulty of accessing the meters with readings expected on the day.

The shifts in the company are 08 hours a day, distributed as follows: Monday to Friday from 07 to 16h with a break of 01h for pedestrian agents; Monday to Friday from 8 am to 5 pm with a break of 1 am for motorcyclist agents; Saturday from 7 am to 11 am without a break for food for pedestrian agents; Saturday from 8 am to 12 pm without a break for food for motorcyclists.

According to the company's HR policy, the minimum education required to be hired as a business relationship agent is complete high school.

The hierarchical communication structure to which the agent has access is vertical: Manager – Supervisor – Tax – Commercial Relationship Agent, respectively from top to bottom.

## 2.5. Key Issues

In the initial contact, the workers were presented with how the ergonomic action would be conducted: what ergonomics is, their importance for the study, anonymity and the analysis methods that would be used.



The workers verbalized about the day-to-day activity, and pointed out some complaints:

a) The backpack does not close properly

"It's not a zipper backpack, so its mouth is wide and it stays open, depending on the posture I take, if I go down to put a bill, a bill under the door, for example, it is at risk of the products that are inside, such as safety equipment, sunscreen, alcohol gel, fall out of the backpack and even the invoice itself. The water bottle has already fallen." (Agent 02)

Figure 2 - Opening on the sides of the backpack



Source: Own authorship (2021)

The backpack has a closure with through straps, which does not completely seal the top opening. When performing some body movements during the activity, the backpack is in positions that cause the objects inside it to fall.

b) The backpack causes physical discomfort

"The backpack by itself, if it doesn't have anything there, you lift it up and it's light, but you stay on your back all day is heavy, you know?" (Agent 03)

Figure 3 - Backpack with few objects inside



Source: Own authorship (2021)



Readers report that although the weight carried in the backpack is not high, the time they remain with the backpack on their backs causes a greater perception of weight, in addition to causing physical discomfort at the end of the working day.

CP-Rede meters, whose equipment is installed on poles or other structures owned by the distributor, located on roads, public places or underground compartments, require greater attention from the reader, as visibility is reduced due to the weather, luminosity and/or cleanliness of the equipment. The readers use an LED flashlight with a closed focus to assist in the measurement, but this equipment is not provided by the company, so only a few workers have it.

## 2.6. Activity analysis

The supervisor informs the route and the number of readings/goal that the agents will work with 01 (one) day in advance, so that they organize the materials that will be used according to the route, such as the number of invoice reels, for example.

To carry out the activity, the relationship agent uses the data collector, a device where he records the numbers of the readings of the energy consumption meters and sends them to print the invoices, enters the codes preventing reading<sup>1</sup> and registers new customers.

Figure 4 - Data Collector



Source: Own authorship (2021)

The collector works with a data chip, which allows the collected information to be sent to the company's system in real time. This device also indicates the direction that the worker should follow on the route, according to the geographical position of the energy meters, and allows the inspector to know the progress of the work.

<sup>1</sup> When the reader is unable to access the energy meter, he registers in the data collector a numerical code that identifies the type of impediment. In these cases, the customer's bill is calculated by the average consumption of the last 03 months.





The printer used to print invoices is interconnected with the data collector and can print one invoice at a time (a function usually used after reading house meters) or a batch of invoices (a function usually used after reading building meters), in addition to the invoice reprinting function. The invoice rolls are coupled to the printer, which results in the printing of 90 invoices each.

Figure 5 - Printer



Source: Own authorship (2021)

After printing, the worker folds the invoice and seals it with the company's label, thus ensuring the confidentiality of customer information. The invoice is then delivered directly to the customer/doorman or placed in the mailbox.

Throughout the work, it was observed that the agents show discomfort with the backpack. They commonly support the backpack with one hand when bending down to read the meter.

Some regulations were also recorded, such as the use of the backpack interspersed with the shoulders, the backpack left at the entrance of the buildings and the printer placed on the floor. These regulations are shown in the following figure.

Figure 6 - Adjustments



Source: Own authorship (2021)





During the semi-structured interview, carried out in parallel with the observations, the relationship agent verbalized about the most frequent regulation.

"I leave it at the entrance because it avoids, you know, holding the backpack a lot so as not to harm my spine anymore, right, because it is already a little heavy [...] So anything you take off your backpack is very good." (Agent 02)

The reader explains why he leaves his backpack at the entrance of the buildings he enters to read the meters.

Agents also perform the activity of picking and delivering invoices that have already been printed. These invoices refer to electronic meters with a chip, which send consumption data directly to the utility.

Figure 7 - Invoice screening



Source: Own authorship (2021)

The invoices are separated by streets and ordered by the number of the properties. This separation is made at the Base Center and the delivery is carried out daily by one of the agents.

According to the consumer units, the routes can be classified as follows:

- Route houses – work path with a predominance of meters in houses, on flat ground, slopes or slopes;
- Building route - work path with a predominance of meters in buildings, on flat ground, uphill or downhill;
- Diversified route - work path with meters in houses, buildings and businesses, on flat ground, slopes or slopes;

The follow-up of the activity began with simple observations, concomitant with the unstructured interviews. In the following follow-ups, the observations were more detailed, measuring the time that the worker remains with the backpack, the number of times he accessed



it and the adjustments made. The systematic observations, carried out in a cursive and participatory way, contributed to the collection of information in the effective exercise of the work that were useful to the understanding of the activity. At the end of each follow-up of the execution of the activities, the records obtained were validated by the participants of the process.

## 2.7. The backpack

The way the worker transports the equipment can be determined by factors such as the weight carried, the size and shape of the equipment, the transport time, the terrain, the climate, and the individual characteristics of each one.

The backpack used by the relationship agents, represented in the following figure, has dimensions 40 x 31 x 20 cm, and a strap of 07 cm wide. It is made of 100% cotton fabric, with a waterproof rain cover and padding on the back and straps, which also have adjustment.

Figure 8 - Commercial Relationship Agents' Backpack



Source: Own authorship (2021)

A spontaneous verbalization, in the form of a suggestion, was made by one of the agents accompanied during the observations. He verbalizes what could be improved in the backpack for the comfort and safety of his work.

"It should be a more closed backpack so that the products we carry are more retained, with a zipper. The pockets are not closed so everything that is inside the pocket, depending on the movement can fall, someone with bad intentions can also put their hand inside the backpack because it does not close completely."

The motorcyclist relationship agent also verbalized, in an unstructured interview, about the functionality of the backpack during the activity.

"The fact that it is not waterproof gets in the way a little, because when it rains the raincoat does not hold much."



He explains that the raincoat does not perfectly protect the entire backpack, and because the fabric of the backpack is not waterproof, the objects and/or printed invoices end up getting wet on rainy days.

The reference situations allow, based on current experiences, to develop the equipment with the greatest possibility of being adapted for use in the future. The bag used by the postmen and the backpack used by the photographers were references for this research.

### 3. DIAGNOSIS

From the analysis of the workers' activity, focusing on the backpack used by the commercial relationship agents, the possibility of damage to the worker's health and the need for frequent adjustments were evidenced.

The size of the backpack is larger than what is necessary to accommodate the equipment that the reader needs to develop his work, this can provide an increase in the load generated by objects unrelated to the activity. The backpack also does not have a structure that prevents its displacement during some body positions adopted by the agents when taking the meter readings, generating physical discomfort and embarrassment that increase the time needed to carry out the readings.

In addition, the backpack does not have compartments that ensure a distribution of the weight carried, concentrating all the weight at the bottom of the backpack and overloading the lumbar spine. Due to this overload, frequent regulations were observed, such as the use of the backpack interspersed on the shoulders or in the hand and the backpack left at the entrance of the buildings.

Another no less important point is the precarious closure of the backpack, which does not completely seal its openings, causing the loss of objects. This situation requires the agent to pay greater attention along the entire route and ends up taking the focus away from the activity carried out.

In addition, the backpack is made of permeable fabric and has a raincoat, which for motorcyclists does not work properly. The movements of the motorcyclist, added to the climatic factors, make the cover not remain attached to the backpack for the necessary time.



#### 4. RECOMMENDATIONS

As a result of the analysis of the activity, the documentary analysis and the verbalizations of the actors involved in the course of this study, based on the theoretical framework, I present in the following table recommendations for a new backpack model.

Table 1 - Study recommendations

ITEM	SUGGESTION
01	<p><b>What?</b> Reduction of the size of the backpack.</p> <p><b>What for?</b> Induce the worker to take only what is necessary for the development of the activity.</p> <p><b>Why?</b> The size of the current backpack is larger than what is necessary to accommodate the equipment that the agent needs to develop his work.</p> <p><b>Ergonomic principles?</b> NR-17.4.1 - All equipment that makes up a workstation must be appropriate to the psychophysiological characteristics of the workers and to the nature of the work to be performed.</p> <p><b>Recommendation?</b> Dimensions 46x30x15 with empty side pockets and 46x44x15 with filled side pockets.</p>
02	<p><b>What?</b> Structuring the backpack.</p> <p><b>What for?</b> Ensure the stability of the backpack.</p> <p><b>Why?</b> The backpack does not have a structure that prevents its displacement during the numerous body positions adopted by the agents when taking the meter readings.</p>
	<p><b>Ergonomic principles?</b> NR-17.4.1 1 - All equipment that makes up a workstation must be appropriate to the psychophysiological characteristics of the workers and to the nature of the work to be performed.</p> <p><b>Recommendation?</b> Ventilation and dorsal padding panel, Straps with 05 cm width, padded, curved and with adjustment, Chest belt with adjustment.</p>



03	<p><b>What?</b> Compartmentalization of the backpack.</p> <p><b>What for?</b> Ensure a distribution of the loaded weight and avoid adjustments.</p> <p><b>Why?</b> The backpack has no compartments, concentrating all the weight at the bottom of the backpack and generating regulations.</p> <p><b>Ergonomic principles?</b> NR-17.4.1 1 - All equipment that makes up a workstation must be appropriate to the psychophysiological characteristics of the workers and to the nature of the work to be performed.</p> <p><b>Recommendation?</b> External left/right side compartments for water bottle and coils; external upper pocket for rain cover; internal upper pocket for personal documents; internal partitioned pocket for printer, collector, collector battery and sunscreen/insect repellent; pocket on the handle.</p>
4	<p><b>What?</b> Backpack closure.</p> <p><b>What for?</b> Ensure the complete closure of the compartments.</p> <p><b>Why?</b> The closure of the backpack does not completely seal its openings, causing the loss of objects.</p> <p><b>Ergonomic principles?</b> NR-17.4.1 1 - All equipment that makes up a workstation must be appropriate to the psychophysiological characteristics of the workers and to the nature of the work to be performed.</p> <p><b>Recommendation?</b> Zipper closure.</p>
05	<p><b>What?</b> Waterproofing of the backpack fabric.</p> <p><b>What for?</b> Prevent equipment and invoices from getting wet.</p> <p><b>Why?</b> The backpack is made of permeable fabric and has a rain cover at the bottom. The movements of the motorcyclist, added to the climatic factors, make the cover not remain attached to the backpack for the necessary time.</p> <p><b>Ergonomic principles?</b> NR-17.4.1 1 - All equipment that makes up a workstation must be appropriate to the psychophysiological characteristics of the workers and to the nature of the work to be performed.</p>
	<p><b>Recommendation?</b> Nylon fabric, waterproof stitching and rain cover on the top.</p>

Source: Own authorship (2022)

#### 4.1. Materials and Specifications

Based on the recommendations presented, the research for the materials that best meet the project began.



External Body: Coating in nylon 600 pvc waterproof 350gr; Reinforced bottom in reinforced polyester fabric 1200, weight 370g/M<sup>2</sup>.

Inner Body: 70 nylon coating.

Raincoat: Coating in resinated nylon 70; 12mm piping elastic.

Shoulder strap: Outer lining in sandblasted fabric fabric; Internal lining in 8mm pack foam; Polyamide lace strap, 3cm wide and 0.9mm thick; Castelo regulator injected in nylon 6.6 with locking teeth, internal base 3cm and external height 5cm. Strap pocket: 70 nylon lining; Zipper opening slider nº5, polyester lace and nickel-plated cursor nº5.

Inner pocket: 70 nylon lining; Zipper opening slider nº5, polyester lace and nickel-plated cursor nº5.

Partitioned inner pocket: Lining in 300D PU Oxford fabric.

Chest belt: Polyamide lace strap, width 2.5cm and thickness 0.9mm; Quick release closure in nylon 6.6, width 3.5cm, internal base 2.5cm and length 6cm; Rectangular regulator in polypropylene plastic, internal base 2.5cm and external width 3.5cm.

Opening and Closing: Main opening in zipper slider No. 10, nylon shoelace and Cursor toothpick No. 10; Side pocket opening with zipper slider no. 8, nylon lace-up and metal slider no. 8.

Back padding: Outer lining in air sandblasted fabric fabric; Internal lining in 8mm foam pack.

Hand strap: Pressure reduction cushion with external coating in sandblasted fabric and internal foam lining pack 6mm; Strap laces in polyamide, width 3cm and thickness 0.9mm.

Finish: Boneon/piping bias 25mm. Sewing: 40 thread in polyamide 80gr.

Logo: Silkscreen engraving stamping the upper front.

## 4.2. Prototyping

The first version of the backpack is a low-fidelity commercial prototype with a focus on functionality, developed to be an initial outline of recommendations and provide a visualized: ➡ idea-product product.



Figure 9 - Backpack of Commercial Relationship Agents



Source: Own authorship (2022)

**Inside:** pocket in the upper central part for documents, partitioned pocket in the center to accommodate printer or printed invoices, data collector, data collector battery and





sunscreen/insect repellent, ensuring weight distribution. The lower inner part is reserved for the accommodation of personal belongings.

**Dorsal part:** it is padded and with ducts that reduce the contact surface with the back and facilitate ventilation, preventing excessive sweating.

**Shoulder straps:** padded and in fabric that facilitates perspiration, with pocket for easy access. The 'S' shape ensures even weight distribution of the backpack along the chest, reducing shoulder discomfort.

**Opening and Closing:** on the front, in a 'U' shape, providing a full view from inside the backpack. Zippered, ensuring complete opening and closing.

**Hand strap:** reinforced and padded stitching.

**Side pockets:** for accommodating bottles and printer coils. Zippered, ensuring complete opening and closing.

**Chest belt:** with size adjustment, height adjustment and front closure, it presses the backpack closest to the body and distributes part of the weight with the chest. Reduces unwanted movements that can cause fatigue due to weight variation on the sides of the body.

**Rain cover:** located in the upper central part.

## 5. CONCLUSION

It was verified through this study that the characteristics of the activity that the agents perform can contribute to the development of musculoskeletal diseases. Thus, it is vital to act on working conditions for the adequate prevention of their negative effects on the worker's body, because from the beginning of their working life, the process that will determine their health status in the future begins.

All work equipment must be analyzed at the design stage of the projects, so that ergonomics can be applied preventively, thus avoiding the application in a corrective or post-traumatic way. In general, it can be said that the size and structure of the backpack are inadequate for the work of business relationship agents. All work equipment and personal belongings are concentrated at the bottom of the backpack, generating physical discomfort and embarrassment during the journey. In addition, the concern with the precarious closure of the backpack requires greater attention from the worker, taking the focus away from the activity performed.



Furthermore, ergonomic analysis cannot be understood as a mechanism with a ready-made recipe, the transformations require a long time of study and monitoring of the activity, in addition, involving the worker in decisions about his own work provides the professional with greater autonomy, power of control and creativity in his work life.

## REFERENCES

- ABRAHAO, J.I.; SNELWAR, L.I.; SILVINO, A.; SARMET, M.; PINHO, D.L.M. Introdução à Ergonomia: da prática à teoria. São Paulo: Blucher, 2009.
- BRASIL. Ministério do Trabalho e Previdência. Normas Regulamentadoras. Disponível em: <<https://www.gov.br/trabalho-e-previdencia/pt-br/composicao/orgaos-especificos/secretaria-de-trabalho/inspecao/seguranca-e-saude-no-trabalho/ctpp-nrs/normas-regulamentadoras-nrs>> Acesso em 03 de abr. de 2022.
- DEJOURS, Christophe. Epistemologia concreta e ergonomia. In: DANIELLOU, François. A Ergonomia segundo seus princípios: debates epistemológicos. São Paulo: Edgard Blücher, 2004. p. 199-216.
- GONÇALVES, J.M.; Estratégias operatórias frente ao trabalho repetitivo: o caso das soldadoras nas indústrias de jóias folheadas e bijuterias. 2010. 135p. São Carlos: Dissertação (Mestrado em Engenharia de Produção) – Departamento de Engenharia de Produção, Universidade Federal de São Carlos, São Carlos, 2010.
- INTERNATIONAL ENERGY AGENCY (2021), E4 Country Profile: Eficiência Energética no Brasil, IEA, Paris Disponível em: <<https://www.iea.org/articles/e4-country-profile-energy-efficiency-in-brazil>> . Acesso em 23 de fev. de 2021.
- MARTINEZ, Maria Carmen; LATORRE, Maria do Rosário Dias de Oliveira. Factors associated with labor capacity in electric industry workers. Caderno de Saúde Pública, vol.25, no4, Rio de Janeiro, 2009.
- SOARES, A. V., CARVALHO JUNIOR, J.M.DE, FACHINI, J., DOMENECH, S.C., BORGES JÚNIOR, N.G. Correlação entre os testes de dinamometria de preensão manual, escapular e lombar. Revista Acta Brasileira do Movimento Humano, Ji-Paraná, v. 2, n. 1, p. 65- 72, 2012.