ANALYSIS OF ERGONOMIC DEMANDS IN THE BREAD MAKING SECTION OF A BAKERY IN NATAL/RN: A CASE STUDY

Fernanda Barreto de Almeida Rocha (GREPE/UFRN) 
fernanda_cei@hotmail.com
Luís Filipe Azevedo de Oliveira (GREPE/UFRN) 
luisfilipeao@hotmail.com
Marianna Cruz Campos* Bolsista PIBIC(IC)/GREPE (GREPE/UFRN) 
naninacampos@hotmail.com
Larissa Praça de Oliveira* Bolsista CAPES/GREPE (PEP/UFRN) 
larissaoliveiranutri@yahoo.com.br
Maria Christine Werba Saldanha* Coordenadora do Grupo de Estudos e Pesquisas em Ergonomia (GREPE) (PEP/UFRN) 
cwerba@terra.com.br

The current article describes the instruction methodology of demand based on Ergonomic Analysis of work applied to the Bread production section of a bakery in Natal/RN, with the particularity of being an artificial demand. From hypothetical demands, managerial demands, worker null and latent demands it was created an ergonomic demand related to the disuse of the practices of work hygiene and security and the Good Manufacturing Practices (GMP’s), thus risking physical and mental integrity of operators and also the quality of final product. The study of the theoretical and practical references in the Baker sector was fundamental to construct the hypothesis of demand in order to build the methodological instruments to be used in the understanding of the work. The analysis of the activity and the task as well as the perception of the variables and regulation mechanisms being used to keep production were very important to understand the activity and the risks to which most workers are exposed and the decrease in the quality of the product.

Palavras-chaves: Demands, ergonomics, bread making, health and worker security
1. Introduction

The bread-making industry accounts for 2,713 bakeries throughout the state of Rio Grande do Norte, which occupies the 7th position in the number of bakeries in Brazil. There are 600 bakers located in the municipality of Natal. This industry employs approximately 12 thousand direct employees who are responsible for producing three hundred thousand rolls every month (O Jornal de Hoje, 2008; SENAI, 2007, p. 11).

According to statistics from the Baking, Confectionery and Pastry Industry Union and the Baking and Confectionery Industry Association of São Paulo (SINDIPAN/AIPAN-SP, 2008) around 35% of the employees work in the production sector. It is known that this job requires intense labor force use, not only for operating the machinery but also for directly handling the product. For that reason, it is required that the working conditions are well suited to the workers’ needs in order to obtain a better outcome. However, ergonomic risks are commonly found in the premises conditions, in using the equipment, in the production process and work organization. Therefore bakers are frequently searching for alternatives to improve such conditions, which may generate situations that are unfavorable to their performance and repercussions related to their health and the industry itself, such as accidents and work-related diseases, production decrease and quality variations, among others.

Statistics of work accidents recorded in the Bakery, Pastry and Confectionery industry from 1998 to 2000 show that 82.7% out of the 663 records, correspond to typical accidents, while 9.7% refer to commuting accidents and 7.7% to work-related diseases. (CNAE 15.81-4; Ministério do Trabalho e Emprego apud SESI, 2005).

In this context, this study aims to investigate the ergonomic demands for the position of baker in a bread producing company in the city of Natal/RN. For this purpose, the chosen methodology was based on the Ergonomic Work Analysis (EWA) (WISNER, 1987; VIDAL, 2008; GUÉRIN, 2001) in order to provide a better understanding of workplace situations, the identification of the real ergonomic demand, and recommendations for a better execution of the activity, worker’s safety and wellbeing. In accordance with the facts previously mentioned, the research is justified due to the necessity of a better adjustment of this activity to the workers in the industry.

2. Theoretical Reference

The bread making activity is characterized by Minette (2006), Rodrigues (2005), Sarti (1997), SENAI (2006), SESI (2005) and Souza, A. (2002) as an activity that demands intense physical effort, under precarious working conditions, thus increasing the occurrence of health issues among the ones who operate in that sector.

Mental and physical overload are usually present, mostly at the end of the shift, directly influencing the work’s pace and organization. This fact also relates to inadequate breaks, in terms of duration and frequency, which may cause muscular fatigue. The fatigued worker then starts to simplify his/her duties, increasing the possibility of error and accidents. (SESI, 2005; SOUZA, A., 2002; DUL & WEERDMEESTER, 1995, apud SOUZA, A., 2002; IIDA, 1990 apud MINETTE, 2006).

The execution of the activity while standing up for a long time may also cause muscular fatigue and discomfort. Some authors relate those bakers only sit down to rest during their daily break for lunch or a snack. (DUL & WEERDMEESTER, 1995, apud SOUZA, A., 2002; GRANDJEAN, 1991 apud SOUZA, C., 2007).
Minette (2006) and Souza, A. (2002) finalize by stating that both bakers and assistants are forced to stand with bad postures, when handling the machinery or when working at the tables, once in many situations the work place is not adequate to operator’s anthropometric measurements.

When working with elevated surfaces, the neck and back of the workers become overloaded. On the other hand, when these tables are too low, the trunk bends over too much. The excess of such posture can cause malfunctions in the muscular-skeletal system, biomechanical disarrays as well as muscular pains. (GRANDJEAN, 1998, apud SOUZA, A., 2002; COUTO, 2002 apud AMORIM, 2006).

The repetitiveness of work movements during the handling of the dough is also frequently observed in the baker job. According to Dabdab (1997), the workers involved in the production of bread and cakes as well as the salesperson are susceptible to the occurrence of WMSDs (Work-Related Musculoskeletal Disorders).

It’s common to observe how the transport, lifting and handling of loads cause physical overload and may contribute to the appearance of mechanical tension in the muscles, ligaments and articulations and therefore, pains in the neck, back, shoulders, wrists and other parts of the muscular-skeletal system. (RIO & PERES, 1999, apud MINETTE, 2006).

To make the situation worse, Souza, A. (2002) calls the attention to the unbalanced diet of such operators. Workers in this area are subject to adopt an unbalanced diet with a high ingestion of carbohydrates, due to their work environment, and the fact that they do not have to pay for the sweets and snacks and so they consume a large quantity of these. In addition to that, we must take into account the bad hygienization of the mouth, leads to the disbalance of mouth pH and the occurrence of mouth diseases like tooth decay and other bacteria.

There are also health problems related to the constant contact and/or inhalation of flour, which, according to Sarti (1997), may cause bronchial asthma or “baker’s asthma” due to the immediate hypersensitivity reaction mediated by IgE (Immunoglobulin E) and caused by the inhalation of flour antigens.

The studies of Guérin (1991), apud Souza, A. (2002) demonstrate another issue in this activity and highlight the constant discrepancies in the meal times, sleep and common life with friends and family, which limits the possibilities of collective leisure and may lead the worker to isolation, which also influences its work performance.

In relation to the use of Individual Protection Equipment (IPE), the studies of Ayres and Corrêa, (2001) apud Minette(2006), demonstrate that in bakery as well as in any other activity, the use of such equipment reduces the risks of accidents and the occurrence of professional diseases.

Rodrigues (2005) has demonstrated in his research, the occurrence of accidents and the appearing of diseases in the bakers caused by the misuse of machines saying that “[…] accidents with machines represent about 70% of the cases of diseases and serious accidents.” There is a considerable likelihood of accidents such as crushing hands and fingers as well as falls caused by slippery floors.

Researches show that the physical work environment is influenced by high temperatures, inadequate lighting, excessive noise and biological risks, which interfere in the quality of work and the health of the worker. Both bakers and confectioners work near oven and cookers, which generate heat, and that emission can cause a sensation of thermal discomfort to the workers, and influence their production outcome, which considerably decreases when

Lightning factor also interferes notably in worker’s productivity, according to a study by Souza, A. (2002). The values of luminous intensity varied between 36 and 195 lux, when they should stay between 200 and 800 lux. From these findings it is possible to notice a significant insufficiency in the lighting level in work environment. (DUL & WEERDMEESTER, 1995; GRANDJEAN, 1998, *apud* SOUZA, A., 2002)

According to Dul and Weerdmeester (1995), Grandjean (1998), and Montmollin (1990), *apud* Souza, A. (2002) the presence of high noises in the baker’s work place may cause effects that range from sleep problems, uneasiness, problems to understand a conversation and even serious damage to hearing.

There is a possible existence of a biological risk factor in the work environment of bakers for some characteristics of the space, such a as air relative humidity, temperature over 25ºC and the presence of organic matter contribute to proliferation of biological agents such as microorganisms (fungus, virus and bacteria) and parasites like mites and others. (SESÍ, 2005).

Through an accurate analysis of those studies, it is possible to state that ergonomics can give a positive contribution transforming this work reality. That is possible once the Ergonomic Analysis of Work methodology focuses on the operator and his several operational modes, trying to understand the aims in situations pre-defined by factors internal and external to the task, as well as the variabilities and regulations to the development of the activity (VIDAL, 2001). The current research was based on that methodology.

### 3. Methodology

The methodology used in this paper is based in the Ergonomic Analysis of Work (EAW) (WISNER, 1987; VIDAL, 2003; GUÉRIN, 2001), applied to a case study in a bakery. The EAW comprises a set of analysis of determining factors for a positive change in work, which relates to technical, human, environmental and social factors. Such considerations are made from the analysis of a demand, which in the current study, corresponds to an induced demand (VIDAL, 2001; 2008).

For the data collection, 5 systematic visits were made to the place of study. Information were got based on surveys and previous analysis of bibliographical references on the subject, as well as situated analysis from observational methods (preliminary studies and organizational analysis) and interactional methods in the company (amplified listening, conversational action and verbalizations), while notes, photos and films were taken. Preliminary studies allowed the view on all the context of the company, the global analysis, which helped us perceive some characteristics which are peculiar to brad-making and also the real work.

Such observations guided the elaboration of dynamic scripts, so the themes covered were discussed and not only referenced with affirmative or negative answers. During the observation stage some analysis were carried out based on the dialogue between the operators and the manager. In order to accomplish an analysis of demands and to construct them, it was used the matrix of demand analysis matrix. Such methodology helped the assessment of ergonomic demand and its recommendations.

### 4. Instruction of demand

Instruction of demand is the first step in EAW. The current case study is based on an induced demand, since the team of specialists approached the company in order to perform the study.
Through theoretical references, with scientific papers and manuals about the bread making activity, the hypothesis of induced demand were elaborated, and furthermore, their existence was proved after the global analysis of the aforementioned case study and their confrontation with latent and managerial demands identified.

4.1 Hypothesis of induced demand

a. Inadequate postures due to machinery or tables.
b. Exposition to temperature changes.
c. High mental and physical tiredness (physical and cognitive load) at the end of the working day.
d. Unconventional work timetable.
e. High repetitiveness
g. Unbalanced diet with high ingestion of carbohydrates due to work environment;
h. High incidence of tooth decay (Inadequate diet and hygiene)
i. High incidence of noise;
j. Health problems related to Constant contact and/or inhalation of flour (bronchial asthma or baker’s asthma)
k. Work standing up for long periods;
  l. Accident related to crushing hands and fingers
m. Biological risks caused by the presence of mites, bacteria and fungus in the material vectors;
n. Accidents caused by the contact with materials or equipment in high temperatures;
o. Simplification of the activity, increasing the chance of mistakes and accidents;
p. No awareness on the use of IPE’s;
q. Excessive force applied in the activities;
r. Workspace inadequate as to the anthropometrical measures;
s. Inadequate time and quantity of pauses;
t. Irregular luminosity degree;
u. Occurrence of RS1/CTD/WMSDs;
v. Injuries caused by slippery floors
4.2 Case study of a Bread making and snack bar company in the municipality of Natal/RN

4.2.1 Company Features

The bakery and snack bar of the research has been in the market for almost 50 years, and is located in one neighborhood of Natal-RN. It is a family-run company and it is part of the food sector, more precisely in the baking and confectionery business.

During the interview, the owner said that his main competition comes from supermarkets and off-license bakeries who have a disloyal price competition. The company has been in the market thanks to its loyal customers, generally people from the upper classes who search for quality in products and services, which are reached through the practice of “Good Manufacturing Practice” (GMP) by the company. The owner adds: “The client has several doors to choose from but we have only one to serve” commenting on the quality service that must be given to the customer.

The bakery offers to its clients several kinds of services and products, such as cakes, pies, sweets, biscuits, cookies, sweet rolls, semi-sweet rolls and salty bread, besides self-service meals, breakfast and dinner. It also has several retail products and people can pay their bills there. Compared to other kinds of bread, bread rolls are the most produced, representing between 48% and 51% of total production, approximately.

The Baker has 25 employees, who are divided into 3 groups: 3 confectioners, 8 clerks/salesperson, 2 cooks, 3 cleaners, 3 bakers, 1 baker/oven operator, 1 oven operator and four people in administrative area. None of the employees belongs to a union. 16 employees are male and only 9 are female. It is valued workforce from areas nearby the bakery for it takes less time for them to get to work besides keeping the working capital in the area for they are both employees and potential consumers of the bakery. The ages vary from 22 to 54 years old. The scholarship varies from unfinished primary education to finished high school. The employees follow the Labor Laws Consolidation (CLT) and earn salaries from R$540,00 to R$ 1,000.00 gross.

Turnover rate is low for they value employees who have been in the company longer. One operator says: “I’ve been here for 14 years. We become friends with the boss because of our own competence”. The absence amount is four absences/month, mostly in the production area. The company does not inform the reasons, but they say that the absences are not related to the job itself. Vacation period has 30 days and the manager chooses the date.

Customer service time is from 5:30 a.m. to 8:00 p.m. Employees in charge of production work from 4:00 a.m. to 11.30 a.m. Sales and kitchen staff arrive at the moment the bakery opens. Employee’s lunch is on the premises and lunch break is from 11.30 a.m. to 2.00 p.m., though some employees do not spend all the time for they prefer to speed production. There no programmed pauses in the job. The owner says: “There is no Sunday or holiday” explicating the intense pace of production in the bakery, which opens seven days a week.

4.2.2 Population related to Baker job

In the production sector there are four employees. The operator 1 is 46 years old. He is the master, the only one who has the knowledge on the bread recipe and is the most experienced, having been in the bakery business for 30 years. He has been in this bakery for 5 years. He lives 15 km far from the job and is the only employee who attends to the course of Good Manufacturing Practices. None of the other bakers have attended to any course on...
qualification or training. Operator 2 is the baker/oven operator who is 49 years old and has been in the baking industry for 12 years, having begun as a packager. For one month he had been readapting to his tasks due to the crisis in the company, so he spent ten years away. He lives about 5 km from the bakery and arrives there at 4 o’clock in the morning in order to bake the first batch.

Operator 3 is the baker/mixer, he is 25 years old and has been in the business for 9 years. It has been his first and only job and employer. He also has experience as confectionery assistant but as the demand for bakers is bigger, he ended up learning from the routine his current job. Operator 4 is also a baker/mixer. He is 20 years old, has been in the business for 3 years and in two different bakers, the current one and another from the same family. Operators 3 and 4 live near the company. When a replacement is needed they do it, as we could observe during the research period.

There is no kind of training for new bakers, they learn from everyday practice. They all must wear a gown, white pants and boots. An apron is also used in order to keep the uniform cleaner and to protect employees. Although to wear the apron is compulsory, bakers said that they do not use it because of the increase in the heat caused by the use of the uniform, which makes the job more tiring and exhaustive.

4.2.3 Bread production task analysis

The task of producing traditional roll Bread with thin dough is indicated by the Manual of Good Manufacturing Practices and comprises 11 steps. First of all, ingredients are received by the bakers in the production area and then put them in the storage room of bakery-confectionery sector. The ingredients to be used in each type of bread are then weighed in order to reach the right quantity for each product. Flour and other ingredients are mixed accordingly to the recipe in a mixer (dough kneading machine) until it reaches the right consistency of the dough.

After being processed in the dough kneading machine, the dough goes to the rolling machine. It is weighed on a digital scale and then divided into pieces in the divider. In the bread shaper, pieces are shaped, being sometimes shaped manually. After all these steps, it is placed either on baking sheets (for traditional bread rolls) or baking trays (thin dough bread). When the pieces of bread need any topping or stuffing they are added at this moment.

Then they are taken to a fermentation cabinet until ready. The oven is preheated between 180° and 195°C. Heating time varies according to the size and weight of each piece. Oven temperature is controlled through an adequate worksheet for each product. Once baked, bread goes to distribution, which is made either directly at the counter or in plastic boxes to convenience stores, bakeries and corner shops.

There are also cleaning instructions which are displayed next to bread making equipment. Besides that, handlers have a table showing work instructions related to cautions to be observed when dealing with food (Table 02).

<table>
<thead>
<tr>
<th>Work Instructions(WI’s)</th>
<th>WI – 01</th>
<th>Washing hands and forearms</th>
<th>WI – 17</th>
<th>Hygienizing sinks, tables and boards</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WI – 02</td>
<td>Cleaning and keeping uniforms</td>
<td>WI – 22</td>
<td>Hygienizing dough rolling machine</td>
</tr>
<tr>
<td></td>
<td>WI – 03</td>
<td>Personal hygiene and behaviour rules</td>
<td>WI – 23</td>
<td>Hygienizing bread shaper</td>
</tr>
<tr>
<td></td>
<td>WI – 07</td>
<td>Caution to be taken with food or raw material</td>
<td>WI – 25</td>
<td>Hygienizing Bread divider</td>
</tr>
<tr>
<td></td>
<td>WI – 08</td>
<td>Cautions to be taken when choosing food or raw material</td>
<td>WI – 26</td>
<td>Hygienizing dough kneading machine</td>
</tr>
</tbody>
</table>
4.2.4 Goals in the Bread-making sector

Bread-making sector has daily goals received everyday in two different times during morning and afternoon shift. They are elaborated by the manager and placed in the production areas. Therefore, the turn ends when the amount of bread required is produced. This amount is normally constant but it might vary on some days of the week and in certain months of the year. Comparing goals from the morning shift for two consecutive months, the greatest change in the units produced was observed for the soft roll, which had an increase of 75% on its production, from 120 to 210 units. There was a total increase of 16.95% in the weight of bread produced: from 59kg to 69 kg due to the coming of the weekend, when sales are bigger.

4.2.5 Analysis of activity in the Bread-making sector

The Bread-making sector produces about 22 different kinds of Bread, such as: “raspa” (stuffed with coconut), made with coconut in the dough, round roll, soft roll, long soft roll, hamburger buns, big hamburger buns, “carrapicho” (a sweet roll that takes coconut on the top), “carteira” (which has a wallet shape), sliced, sandwich, made with soy, “special”, whole wheat, traditional bread roll and “caranguejo” (which has a crab shape). They also produce three kinds of crackers: “praiêira”, “regalia” and “copia”. For each kind there are specific ingredients, recipe and activities. The basic raw material for bread is flour, salt, sugar, yeast, additives and water. Some types may take milk, sweet potato, butter, lard, fresh yeast and eggs.

As it was established in the task, the individual hyginization of operators is necessary, as well as the equipment to be used. In the studied bakery, the personal hygien sink is shared when certain ingredients are manipulates, even though it is necessary to have an exclusive sink for personal hygiene, which does not occur. The taps should not have manual contact (1.210/06/SMS.G item 13.1.1).

The basic mixture is made by operator 1 because he is the only one who knows the recipe. The production steps are received being followed during the shift. The procedures start with the weighting of the ingredients which are then placed on a conventional bread kneading machine. At this point all ingredients are mixed in order to become uniform. Water is added according to Operator 1 instruction. Then ingredients are scraped from the sides of the machine while it is still on in order not to waste any ingredient. The texture of the dough is constantly checked (figure 01).

In the next step, the dough may follow the production flow or it may rest until it is worked. In the bread rolling machine, after several turns and regulations, the pieces which are not totally dispersed are smashed, so that fermentation gas is kept and also gluten (dough elasticity) develops itself. As the dough runs through the cylinder, its texture is observed in order to achieve the right elasticity (figure 02).

Once out of bread rolling machine, the dough may take two different ways according to the kind of Bread to be produced. In the first one, dough is simpler, because it does not go to the divider. The dough is stretched, then folded and have its excess removed. Then the baker measures the dough with his fingers and cuts it with a knife running between his thumb and index finger, according to the set dimensions. This is one of the riskiest operations in the bread-making process for the knife runs very close to the fingers and the movement is repeated very quickly.
Finally, the dough receives extra shaping or manual finishing in order having the right bread shape.

In the second way, the dough goes to the divider. It is cut and weighed according to the kind of bread to be produced. The weight of raw dough is slightly superior to the standard, after baked. It is important to mention that bakers have an “eye sensitivity” to look at the dough and to know which size to cut manually so that the weight is precise (figure 03).

After the dough has been weighed it goes to the divider. This step aims to individualize bread before it is produced: from the pressing of the dough it is fractioned in standardized units with the same thickness/weight. The machine is switched by a manual lever (figure 04):

Once the standard size is set in the divider, the dough may or may not go to the shaper, where its final shape is produced for most bread. The dough is inserted one by one and it leaves the machine in its final shape (figure 05). After the shaper, the pieces are finished manually. The pieces that did not go through the shaper will be shaped by balling i.e.: bakers manually shape them as balls rolling the dough on the board.

Regardless of the shaping process, every piece is placed on the baking sheets. In case it takes any kind of topping, that might be added before the dough is put on the sheets. At this point, the sheets are placed in the fermentation/growth cabinets. Each dough has its own fermentation time. The cabinet will help it ferment quicker and safer, thus producing a uniform piece with better volume and softness, durability and yeast saving (figure 06).

After this growth process, in case traditional bread rolls are being produced, some “scratches” are made on the upper surface of Bread. Then the sheets go to the oven when the process finishes (figure 07). For sliced bread, for instance, there is a slicer which is used after the cooling of bread, for it would damage the blades if it was cut still warm.

The cleaning of sheets and trays is made by the cleaning team. Cleaning the shaper, rolling machine and divider is done by the bakers; the kneading machine is only cleaned by the master. When asked about these procedures, the staff answered that they do a general
hygienization every 15 days and that they follow the guidelines they already know for external cleaning due to their experience in daily cleaning. They use edible oil and 70% alcohol, which means they partially follow the GMP manual, which only a few of them know.

Based on real work accomplishment, we can identify bread-making as a predominantly semi-autonomous work group, although it has characteristics of other work organizations. Employees are organized in order to perform a task, helping each other and doing operations according to their abilities and knowledge and having only the recipe, equipment and raw materials provided in order to reach their daily goals. There is no hierarchical relationship between them. Seldom do one of them asks for another one to perform his own task, or even help in some activity. When some operation is needed or something is missing, it is soon noticed by someone who will promptly perform the necessary action.

4.2.6 Operator’s variabilities and regulations in Bread-making

Intra-individual variability shows that someone don’t have the same performance during the day. Such variability has been found in bread-making in terms of workers’ productivity when balling the dough. During the work journey the pace varies, being faster in the beginning of the shift and slower at the end because of fatigue. However, depending on the increase of demand, the pace may have fewer variations.

A higher number of inter-individual variabilities have been found, which show differences between the executions of tasks by bakers. The small portions resulting from the division of dough may be well or badly defined depending on the strength applied to it, so youngest bakers tend to get better shaped portions. The sensitivity demonstrated in the cutting moment before weighing also varies. Some of them need more attempts than others in order to reach the right weight. Some kind of breads increases the sensitivity required, such as the types which only need cutting. So usually only one baker does it, due to the higher precision and quickness that he can gives with his with his practice, otherwise there is the risk of cutting fingers and delaying the process, which is always hurried.

At the rolling machine stage, once again the baker’s perception is needed for he has to know how many times it is necessary to pass the dough through the machine in order to get the right final thickness, as well as the right space between the rolls, which is defined by the baker and his own perception and expertise. The dough might not be perfectly uniform in the cylinder. In that case, a more experienced baker repeats the process in the machine. One operator adds: “If you are not strong enough to use this machine, at night your back will be aching”, referring to physical stress caused by the equipment.

In the shaper, an operator may separate two already divided pieces of dough before taking them to the machine, while another may not divide them and use the machine suction to do so, which increases the number of mistakes. If any problem in the standard of bread is noticed in the quality control stage, before placing in the baking sheets, the dough will have to be worked again. Manual shaping, employees round the dough in ways that vary from baker to baker.

Technical variabilities are related to productive process. Even when the shaping machine is being used, there are technical variabilities in the equipment. It may occur some dysfunction causing the dough to be thrown from over the canvas with shaping problems, so the dough has to be worked again. There is also the variety of ingredients and brands which directly affect the dough composition, thus characterizing a technical variability related to raw material.
Organizational variabilities are inherent to the work organization adopted by the company. Among them, we can mention the hiring of a new baker to replace another one who is on holiday. Such fact will considerably influence all production process, for the substitute may not have the same practice and agility in performing the tasks (inter-individual variability). In some cases, could be necessary to have some guidance from other bakers during the process in order to be told which machine the substitute will operate as well as to redistribute the tasks among the most experience, mostly for the machines which need more precision or strength to be operated.

Other organizational variabilities include the several different processes, which due to the great product mix of the company demand different procedures. Seasonality causes distinct production level scales throughout the year and during weekdays, which makes workers behave differently in order to reach their goals. At the moment of making the dough, in which raw materials are added there might be the addition of more or less ingredients, and that makes the baker to regulate the system by balancing the quantities again from his own experience.

We observe in this study the existence of normal variabilities, characterized by being predicted and controlled up to some limits, such as demand variation caused by production and the different kinds of products made (product mix), raw material variations caused by different suppliers or supplies and which occur because of the very kind of work and product. Even if one of the variabilities might be predicted by operators, their occurrence and consequences may not always be solved or avoided, which generates health and security problems for workers as well as quality and productivity problems for the product. However, according to Guérin (2001), “their occurrence along with the operators might be more or less expected, more or less brutal and its consequences to the production operations more or less predictable”.

According to Guérin (2001), another part of production variabilities are random, and even if the moment and the precise form of these normal and/or incidental variations are unpredictable, some elements of this variability are known by the operator, who expects a higher frequency of certain incidents at certain times, such as: instant demand variations in product type and volume; failures, maladjustments, bad working of equipment or tools, electricity, unpredictable variations in material because of changes in air humidity.

By facing these variabilities, either normal or incidental, predictable or random, operators modify operational ways and work pace thus deconstructing collective and individual protection mechanisms in order to fulfill such demands and many times without evaluating the consequences which such attitudes may bring to their own security or health.

4.3 Ergonomic Demands

Situated analysis has enabled the understanding of the activity of bakers. From that analysis it was possible to prove the existence of some of the demand hypothesis in this work situation, as well as to indentify latent and managerial demands as shown in table 03. The ergonomic demand chosen was based on the composition of these demands:

<table>
<thead>
<tr>
<th>Bread Production</th>
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</thead>
<tbody>
<tr>
<td>Proved Demand Hypothesis</td>
</tr>
<tr>
<td>* items corresponding to Table 1 – Induced demands hypothesis</td>
</tr>
<tr>
<td>Managerial Demands</td>
</tr>
</tbody>
</table>
Latent Demands

- High accident risk in the process of cutting the dough, specially the “carteira” and “raspa” kinds / Imminent risk of accident in the kneading machine in the moment of scraping the inside for dough saving / Not using the security door / Inadequate sleeve size of uniform (short sleeved) / Disuse of hygiene and work security practices;

<table>
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<tr>
<th>Table 03 – Matrix of Demand Analysis in the Bread production sector</th>
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</table>

When the activity was analyzed, it was observed that in general, practices of hygiene and work security and also the Good Manufacturing Practices (GMP) were not being used (latent demand), which risks mental and physical integrity of operators as well as product quality. Therefore the ergonomic demand to be worked comprises the reasons which are taking workers not to consider such practices. Such reasons might be related to employees not knowing the rules of production; lack of training on production and prevention procedures; activity’s own nature; production pace imposed to workers or the lack of awareness in how to use IPE’s and CPE’s (Individual and collective protection equipment, respectively)

4.4 Repercussions of Ergonomic Demand

The execution of the activity, not considering work hygiene and security practices as well as Good Manufacturing Practice (GMP) does affect directly the health and security of workers and the quality of product.

Aiming to promote worker’s security, it is extremely important to constantly regulate the machinery. Baker’s health and security are directly affected, once the protection device of the kneading machine is not being used and so it cannot be locked. Besides, the model is old and does not have the protection device.

Another situation is related to the security grill of the elevator door. It should remain shut during production and also during the elevator moving. However, it is never closed which increases the risk of accident, mainly when the fermentation cabinet is taken to the ground floor. That might happen due to its height being higher than the operator’s, who will not have peripheral vision.

For the dough rolling machine it is recommended to stop the motor break when the emergency button is on, in order to turn it the opposite way, as it was observed. One out of the two available buttons did not work.

About the product, it might have its quality damaged once the dough is in contact with places with a high contamination rate at some points of its production. Areas such as the walls, when the dough is being takes to the rolling machine for it is placed next to the equipment; also tools when they are on the floor, even if unexpectedly. At the moment of transporting the dough from the rolling machine to the board, there is direct contact with operator’s arms which have hair and are not properly hygienized.

On the GMP of baking it is mentioned: “Periodicity whenever it’s necessary”. And on the RDC number 216 by ANVISA (Sanitary Authority): “ Handlers must wash hands carefully when arriving to work, before and after handling food and after any interruption at work, after touching contaminated material, after going to the toilet and whenever it’s necessary”. In the handling of food, workers are in constant contact with other tools and also with devices from the machines themselves, such as levers and switches, and they do not follow the right procedures.

The Practice of GMP (Good Manufacturing Practices) and the SOP (Standard Operating Procedure) are extreme importance to baking, in terms of qualifying and training employees...
for the activities to be developed. However, the bakers themselves have demonstrated that there are no training in the company. The baker-master is the only one who has taken part of GMP courses, so the other employees do not even get to know about essential elements to product quality and their own health. The absence of GMP practice makes it difficult to characterize the business and the activities performed. Because SOP has not been developed yet many problems are found in organizing and executing tasks which should always be performed. To implement these programs to all employees is vital to the company.

5. Final Considerations

Understanding the diversity of demands, as well as their origins, is fundamental in the specificity of each ergonomic action. In the specific case of an induced demand, ergonomists look for a company to demonstrate the existence of problems which can be solved and understood in a positive transformation process. The current paper has clarified the instruction/construction process of an ergonomic demand, its repercussions to both worker and product in the production of bread in a baker, with the feature of being a demand induced by students to follow the procedures of a curricular subject. In this kind of action, in which the demand does not come from the company, elaborating pertinent demand hypothesis is fundamental to the social construction and to continue with the instruction/construction process of demand.

Theoretical reference and intervention studies in the bread-making sector were fundamental to the construction of demand hypothesis and to the methodological instruments to be used in both global and activity analysis, thus allowing the understanding of the work situation, its variabilities, regulation mechanisms used to keep production and deriving repercussions to workers and product quality.

References


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