Diversitas Journal
ISSN 2525-5215
Volume 8, Número 3 (jul./set. 2023) p. 2538 – 2556
https://diversitasjournal.com.br/diversitas_journal

Analysis of work safety from the perspective of sizing and use of EPIs in a sawmill in the state of Mato Grosso

Análise da segurança do trabalho sob a ótica do dimensionamento e utilização dos EPIs em uma serraria do estado de Mato Grosso

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A B S T R A C T

The present study aimed to evaluate work safety from the perspective of the design and use of PPE (EPI´s) in a sawmill. The survey was conducted during the month of November 2021. The sawmill studied is located in the county of Apiacás, located in the extreme north of the state of Mato Grosso. It has a production capacity of 7,200 to 8,000 m³ of native wood and 3,960 m³ of sawn wood per year and formally employs thirteen workers. This is a descriptive qualitative study, which aims to clearly and accurately provide information on the importance of the use of personal protective equipment in the work of the sawmill. For its construction, a bibliographic study and data collection were carried out through the application of a questionnaire with questions related to work safety. The target audience included workers from the most varied sectors in relation to working conditions. Next, a qualitative analysis was carried out, the results of which showed that the majority of workers are men, with low education and where most of them hold the position of general assistant. The results showed that most accidents can be avoided with the correct use of safety equipment, especially with the use of Personal Protective Equipment (*Equipamentos de Proteção Individual* - EPI´s) and signs. Although the company in question has never been affected by serious accidents, it´s suggested to invest in new and modern training and equipment that bring safety to the worker and, consequently, an increase in final productivity.

R E S U M O

O presente trabalho teve como objetivo avaliar a segurança do trabalho sob a ótica do dimensionamento e utilização dos EPIs em uma serraria. A pesquisa foi realizada durante o mês de novembro de 2021. A serraria estudada localiza-se no município de Apiacás, situado no extremo norte do Estado de Mato Grosso. A mesma possui capacidade de produção de 7.200 a 8.000 m³ de madeira nativa e 3.960 m³ de madeira serrada por ano e emprega formalmente treze trabalhadores. Trata-se de um estudo qualitativo descritivo, que visa de forma clara e precisa oferecer informações sobre a importância da utilização dos equipamentos de proteção individual no trabalho da serraria. Para sua construção, realizou-se estudo bibliográfico e coleta de dados por meio de aplicação de questionário com perguntas relacionadas à segurança do trabalho. O público-alvo incluiu os trabalhadores dos mais variados setores frente às condições de trabalho. Em seguida realizou-se análise qualitativa, cujos resultados demonstraram que a maioria dos trabalhadores são homens, com baixa escolaridade e, onde, em sua maioria exercem o cargo de ajudante geral. Os resultados demonstraram que a maioria dos acidentes podem ser evitados com o uso correto dos equipamentos de segurança, principalmente com a utilização dos Equipamentos de Proteção Individual (EPI´s) e placas sinalizadoras. Apesar de a empresa em questão nunca ter sido acometida de acidentes graves, sugere-se investir em capacitações e equipamentos novos e modernos, que tragam segurança ao trabalhador e, consequentemente, um aumento da produtividade final.

INFORMAÇÕES DO ARTIGO

Histórico do Artigo:
Submetido: 06/02/2023
Aprovado: 01/05/2023
Publicação: 03/07/2023

Keywords:
Accidents at work, Work environments, Personal protective equipment.

***Palavras-Chave*:**
Acidentes de trabalho, Ambientes de trabalho, Equipamentos de proteção individual.

DOI: 10.48017/dj.v8i3.2592

Introduction

Sawmill can be defined as "industrial establishment where pieces of wood are sawn", these processes are usually mechanical, where the raw wood is transported from the field in the form of a log and undergoes the unfolding, being sliced into boards, slats, beams, rafters, saws and many others, depending on the accuracy of the buyer (Borba, 2011). For Vital (2008), the sawmills are characterized as isolated industries, small capital and inadequate management, and may have low operational and productive yield, however extensive waste production.

According to Rocha (2001; 2002), the sawmill is the type of industry that transforms the corrugated wood into sawn wood or in processed parts. This procedure happens through the technique of unfolding or mechanical processing, allowing to produce various solid products, with varied sizes and dimensions. Fao and Ponce (1993) report that in terms of volume of forest industries, sawn timber is the most important item. Sawmills process more than half of the timber sold in logs in the world. For Vital (2008), such products basically serve the civil construction and furniture industries.

Work accident can be understood as any bodily injury or functional disturbance that may cause death or physical disorder, permanent or temporary, by the exercise of work or when providing service to a company or a contractor (Cairo Júnior, 2015). In this sense, it can be said that one of the high-risk activities occurs in sawmills due to the constant use of machines and saws, the need for repetitive movements, such as excessive weight lifting, in addition to the risk of fire. They are considered improper or insufficient equipment, improper barriers, ineffective ventilation and hazardous environments with gases, dust, vapors, smoke, examples of inadequate environmental conditions conducive to explosion and fire hazards (FUNDACENTRO, 2011). Although these risks are inherent to the industry in general, because the sector makes use of equipment that offers higher danger, extra measures are necessary to increase the safety of these environments, especially in sawmills.

According to the Brazilian Constitution (*Constituição Brasileira*) (Law No. 8,213/91) defines work accident as, what occurs by the exercise of work at the service of the company, with the insured employee, single worker, as well as the special insured in the exercise of their activities, causing bodily injury or functional disturbance that causes death, loss or temporary or permanent reduction, of work ability. Article 21 of the aforementioned Law also equates work accidents as those linked to work, suffered at the place and time of work, those who develop diseases that arise from the exercise of their activity (Brasil, 1991).

Thus, the company is responsible for the adoption and use of measures to protect and safety the health of the worker, which constitutes a criminal offense, not complying with the standards of safety and hygiene at work (Brasil, 1991). The application of these safety measures must provide more favourable conditions for the worker (Romar, 2013).

The literature shows that Brazilian companies have been committed to qualifying work safety, so that in the exercise of the profession, their employees, whether permanent or temporary, do not suffer physical or psychological disorders or even death. The work accident also causes suffering on the victims, and possibly, the laments will echo well away from the employers who most often treat their worker with indifference (Melo, 2013).

Therefore, in any work environment it´s necessary that there is awareness about safety at work and the worker, due to diseases, accidents and the harm caused by work.

It´s important to highlight that the work environment is the place where much of the worker's life unfolds, whose quality of life is, therefore, in close dependence on the quality of that environment (Silva, 2009).

According to Abrantes (2014) it´s necessary to work on awareness through training and retraining of workers, about the risk and/or correct way to perform certain work and, consequently, avoid accidents, among others. However, avoiding occupational accidents is not an easy task, since they can happen by different accidents. Prevention is the best way to prevent accidents at work from happening (Kulkamp; Silva, 2014).

It´s known that motivating employees or collaborators in their daily tasks is one of the strategies adopted to create an environment of well-being and consequently, safer. According to Ciszet et al. (2015), the use of Personal Protective Equipment (*Equipamentos de Proteção Individual* - EPI´s) as all instruments for personal use provided by employers to their employees, which change safety and health to the worker, have the purpose of reducing and preventing injuries in cases of accidents or exposure of workers to risks.

Other strategies used by companies are incentives and growth opportunities within them. When the sharing of information and knowledge is explicitly related to career growth, it will be positively influenced. Fernandes (2013) defines these strategies as a “set of concepts and practices to consistently develop the competencies of people and the organization”.

The relevant differential of a company in relation to the other is perceived by the well-being and safety of its employees, because when they feel recognized and visualize opportunities for growth, they remain interested in the work and, consequently, greater focus and productivity. According to the World Health Organization (*Organização Mundial Da Saúde* - OMS, 2011), incentive programs for employees, which benefit their professional life, present an important improvement in the motivation, creativity and productivity of work teams.

It´s understood that the timber industries create an impact, not only environmental, but also on the quality of life of man, when their activities are not carried out correctly. According to Másculo (2011), poorly idealized jobs demand that the human being leans, stretches, bends, et cetera, leaving the impartial posture of the body, being the one that requires less effort from the individual and/or the posture that favors work with less effort.

Therefore, there are several accidents caused by such activities and include physical, chemical, biological and ergonomic risks. They are caused by agents who are in the workplace, to which the employee is exposed, putting his own life at risk (Saliba, 2013).

From the extraction of wood to its processing, logging presents various types of risks, with a history of relevant accidents, and the activity is considered to be of high degree of risk. Logging has a high rate of accidents, bought from other traditional activities, add the authors Medeiros and Jurado (2011).

Thus, it´s essential that the owners of the lumber companies guide their employees regarding the use of protective equipment, as well as the discrimination of which are necessary in the different activities performed by the employees, because the workers handle heavy and sharp machinery and equipment, with risks to the integrity of the worker when they are not well operated. In addition to these risks, there is the heat from furnaces, boilers and electric welding; the high level of noise and vibration; the management of chemical substances such as fungicides and pesticides; the dust originating from the wood and the poor lighting in the lumber mills (Bahia, 2013).

This study is justified, since the timber industry still has high numbers of accidents and many with mutilations and/or fatal, causing costs to the government, companies, society and even for the injured. The relevance of the work is the awareness and awareness of the need to adopt preventive measures in the field of occupational safety and health in a sawmill, through the identification of risks and actions to minimize them, in order to ensure the preservation of health, dignity and life of the worker.

From this perspective, it was sought to evaluate which work equipment is considered essential for each employee, so that their function is performed safely, in the company, according to what governs the laws and regulations in force, since according to the Regulatory Standards (NR) the possible existing risks and the necessary actions to prevent occupational accidents.

First, it´s necessary to identify the risks that machines offer to workers, as well as collective and individual protective equipment and from this knowledge propose improvements and preventive measures related to health and safety at work.

According to NR 6, any device or individual product used by the worker that aims to protect him from risks or threats to safety and health, as well as occupational diseases, making companies safer for their employees, since, inside or outside the workplace, accidents can happen to anyone.

This research is a descriptive qualitative study, which aims to clearly and accurately offer information on the importance of the use of personal protective equipment in the act of work of the sawmill. Thus, the present study aimed to evaluate work safety from the perspective of the design and use of PPE (EPI´s) in a sawmill.

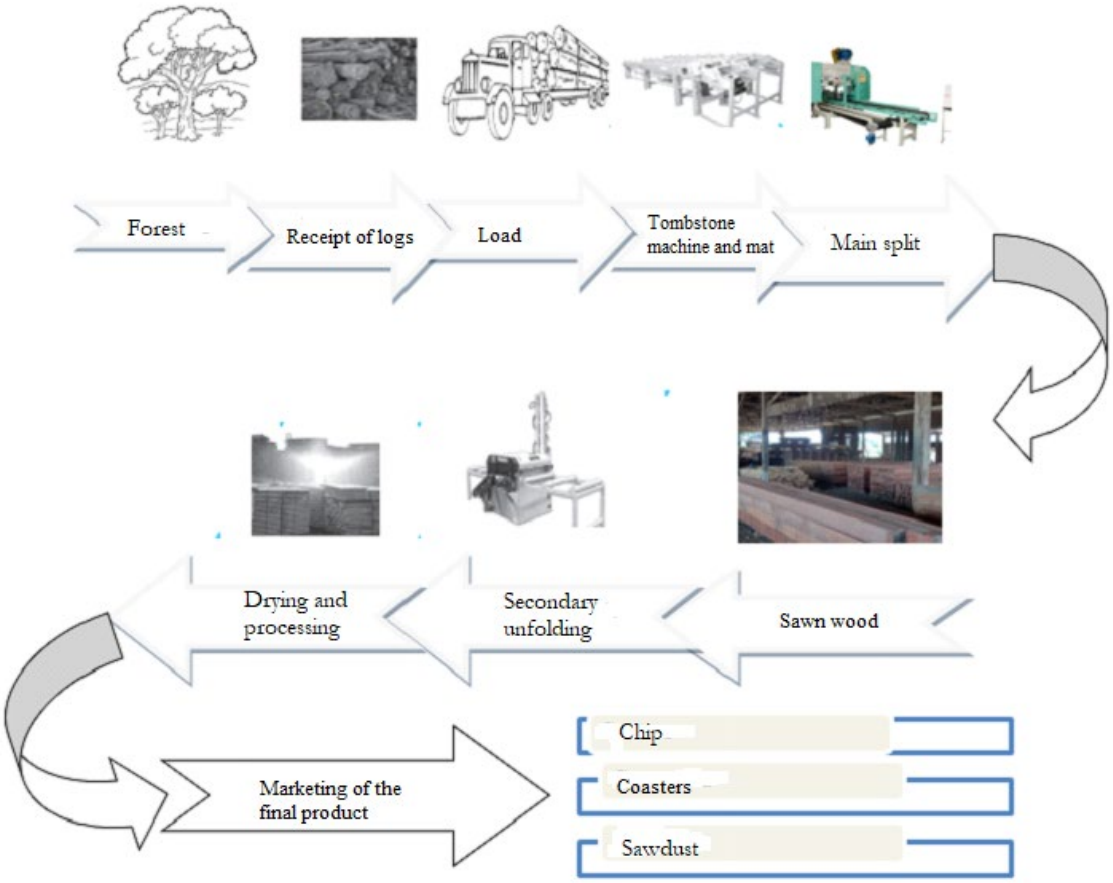
Materials and Methods

The present research was developed in a sawmill located in the county of Apiacás, located in the extreme north of the state of Mato Grosso, where it´s in full commercial activity, performing the folding of logs and commercializing the products generated. It has a production capacity of 7,200 to 8,000m³ of native wood and 3,960m³ of sawn wood per year and formally employs thirteen workers.

The main consumers of these environments are the timber depot companies and, to meet the demand, the sawmill has a loader, a skidder forestry tractor, a crawler tractor and three trucks. It´s a family business and pioneer in the field of extraction and processing of wood in the county of Apiacás.

The timber sector has always stood out, within the forestry activity, in number of companies and in wood consumption. This activity has always been a major provider of services, directly or indirectly, leveraging the economy of the county of Apiacás (Figure 1).

Figure 1. *Sequence of activities developed in the company.*



Source: Baumgart (2022).

The company has 13 employees on its staff. According to the Brazilian Micro and Small Business Support Service (Sebrae, 2013), considering only the number of employees, the sawmill analyzed is considered a small company.

Of these 13 employees, only eight participated in the interview, and only one is outsourced, who acts as general assistant. The number of employees in production is sufficient for the operation and performance of the company and all perform manual labor considered heavy and dangerous.

In a sawmill there are several environments used for the processing of wood, starting with the yard where the unloading of logs from the forest occurs. Pignati and Machado (2005), report, although the circular saw is the first mechanical process through which the log passes followed by the process that occurs with the destopadeira, planer, milling, sander and tupia. For Tillmann and Dultgen (2011), the geometry of the circular saw influences the power required during the sawing operation.

The circular saw and the band saw are highly dangerous equipment (Figure 2) and are considered the most dangerous of a sawmill, mentors of large and permanent mutilations, according to Pignati and Machado (2005). The risks of amputations of fingers, hands and others from the upper limbs is great by the workers who handle them. Such dangerousness constitutes the most common accident panorama of this work environment, generating absence and even disability (SOBIERAY et al., 2007).

Figure 2.

Saw tape used in the lumberyard, located in the county of Apiacás - MT.

Source: Baumgart (2022).

In order for a sawmill to have a higher yield in sawn wood and a greater operational efficiency, the prior planning of its activities must be done, as well as the maintenance of ergonomic and healthy conditions of all its employees. However, in them there are situations of health risks, such as accidents or diseases, as already recorded by Pignati and Machado (2005). The following sequence of activities developed by the studied company.

The bibliographic study comprised the following steps: the formulation of the problem and the choice of the theme to be researched; elaboration of the work plan, formulation of the objectives, identification, localization and acquisition of sources that are capable of providing the appropriate data for the desired research, reading of the material obtained, analysis and logical interpretation of the data and final writing of the text (Gil, 2002).

The target audience was workers from the most varied sectors who perform their functions in a small sawmill, in view of the working conditions. It was sought to know the guidelines regarding the correct use of the protective and safety equipment offered by the company and whether they are in accordance with the current regulations. The central idea of this research was to know and evaluate what are the essential equipment for each employee, so that their function is safely exercised in the company, according to what governs the laws and regulations in force.

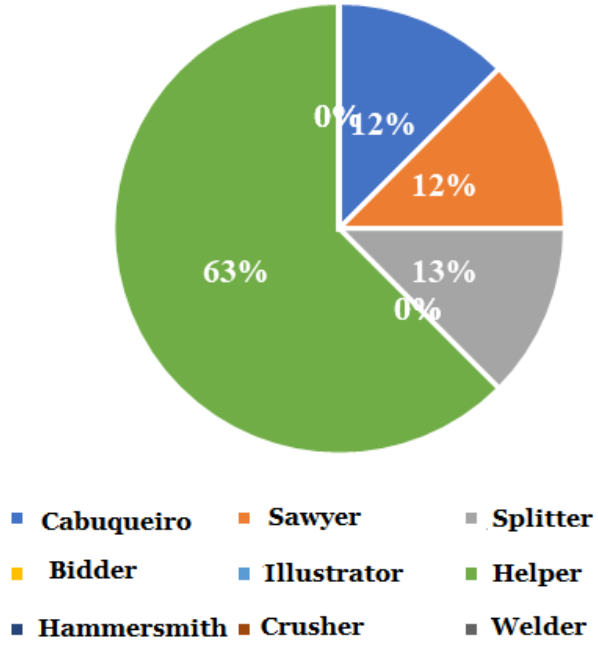
To answer the objective, a questionnaire was applied with data collection composed of alternative questions and free answer with the professionals who make up the staff of the sawmill mentioned above. The same is basically focused on the use and application of Personal Protective Equipment - PPE (EPI´s), so that with the answers obtained, it´s possible to make an analysis of the safety at work in force in the company in question and, in line with the critical look of scholars in relation to the theme. For the treatment, interpretation and analysis of the data, descriptive analysis was used. Then the data were organized for the purpose of systematic analysis, through graphs constructed in the Excel, 2016.

Results and Discussions

The employees work in different functions, allocated in the area of mechanical processing of wood, and the position of general assistant is the one that predominates (Figure 3), with 38% and 46% of the interviewees.

Figure 3.

Distribution of employee functions.



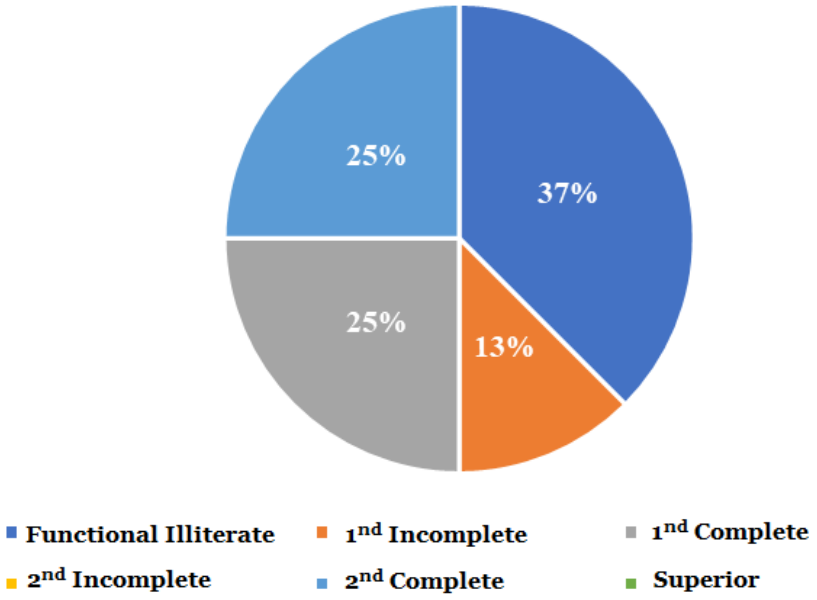
Within a sawmill manual work does not require specific professional qualification, however, it demands the development of varied activities, such as yard cleaning, stacking assistant, among others.

For Silva et al. (2002), the knowledge of the profile of the workers is of paramount importance for the development of works alluding to training, orientations and interventions in the work environment, among others.

According to the profile of the interviewees, the sawmill workers are all men, and the predominant level of education is semi-illiterate (Figure 4). Coming from low-income families, and to help support the household, they began to work at a very young age, leaving school education aside. And, because they have little education, there are few job opportunities.

Figure 4.

Education level of employees.



According to Sobieray et al. (2007), also worrying is the age at which many workers enter the dangerous heavy jobs of a sawmill often in violation of the legislation. Brasil (2014) reported in its article 403, that Law No. 10,097/2000 determines that: it´s forbidden any work under sixteen years of age, except in the condition of apprentice, from the age of fourteen. Also, according to the signed Law, the work of the minor may not be carried out in places harmful to his formation, to his physical, psychic, moral and social development and at times and places that do not allow the attendance at school.

Feith (2008) points out that culturally, men of low purchasing power are part of the profile of the workers of the sawmills, where one of the predominant factors of great value is the experience. Leite et al. (2012) observed that low schooling is a very important indicator, as it can influence and/or compromise training and retraining programs, especially in activities that involve the use of high-tech machinery and equipment. This factor hinders the process of qualification and awareness within a company, especially with regard to the use of PPE (EPI´s). To remedy the educational deficit, different public policies offer school training, easy access as well as professional qualification in the most varied areas.

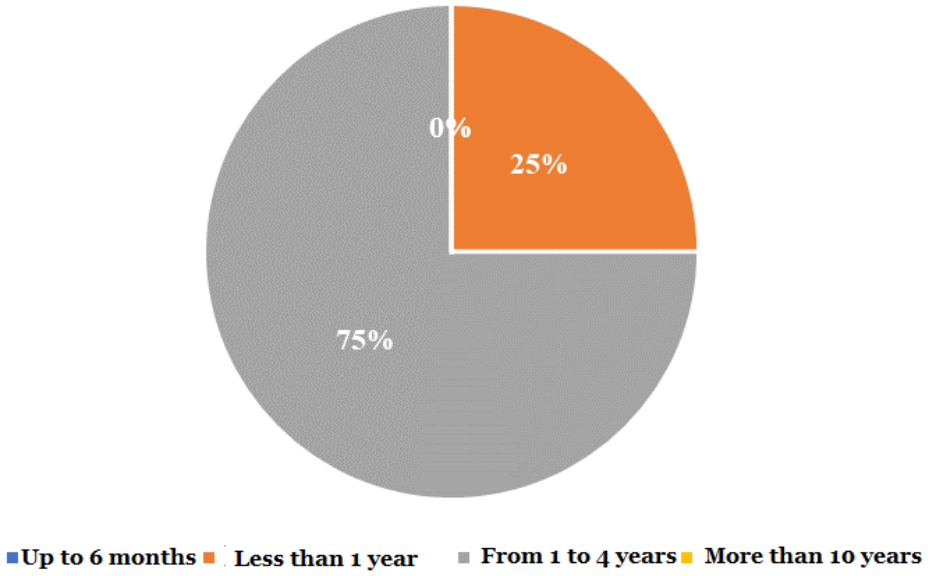
Sobieray et al. (2007) added that the increase in the education of workers contributes to a better understanding of the guidelines on the use and handling of equipment, whether of protection, as well as of the machines that they must operate, having more education and knowledge of the rights there is also a greater concern such as physical health and the work environment.

It was observed in view of the answers obtained, that three of them have worked in the company for almost 10 years and the others are between one and five years in the company and perform a work day of eight hours a day (Figure 5). It´s highlighted here that because it´s a small company and that values its employees, it brings security to its employees, making them remain for long years in the company.

Chiavenato (2014) states that companies are investing more in people and their activities, in those who know how to develop, produce and improve. And so, companies earn more, because the investment in people that become a basic component of business success.

Figure 5.

Time in the company.



Regarding the working day, it was found that only one employee performs his function in a workload of up to 10 hours (Figure 6). This condition of working hours contradicts Decree-Law No. 5.452 of May 1st, 1943, which provides in article 58 that the normal duration of work for employees in any private activity shall not exceed eight hours per day, provided that no other limit is expressly fixed.

In article 59 of the Consolidation of Labor Laws (*Consolidação das Leis do Trabalho* - CLT) and related rules in paragraph 1, it governs that the remuneration of overtime will be at least 50% (fifty percent) higher than that of normal hours (Federal Senate) (*Senado Federal*, 2017).

In addition, it challenges item XVI of article 6 of the Constitution of the Federative Republic of Brazil of 1988 (*Constituição da República Federativa do Brasil de 1988*), which states that the remuneration for the higher extraordinary service must be at least fifty percent of the normal (Brasil, 1988).

As stated in the Law, the remuneration for overtime must be made to the employee

from the fulfillment of an eight-hour day. According to the interviewees, there is almost no incidence of overtime referring to only one affirmative answer and, when it happens, the company complies with the legal regulations (Figure 7).

Figure 6. *Working hours.*

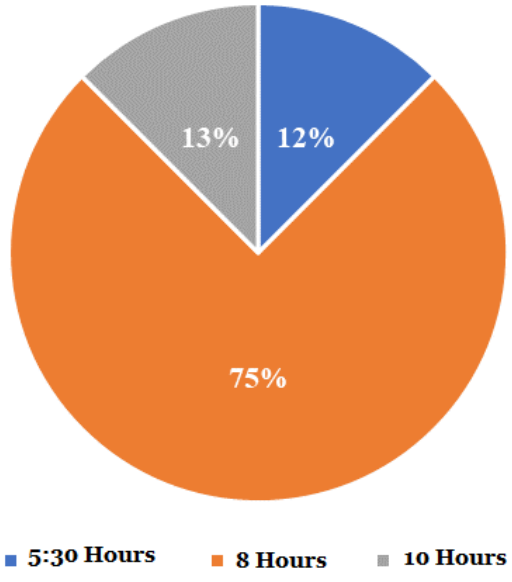
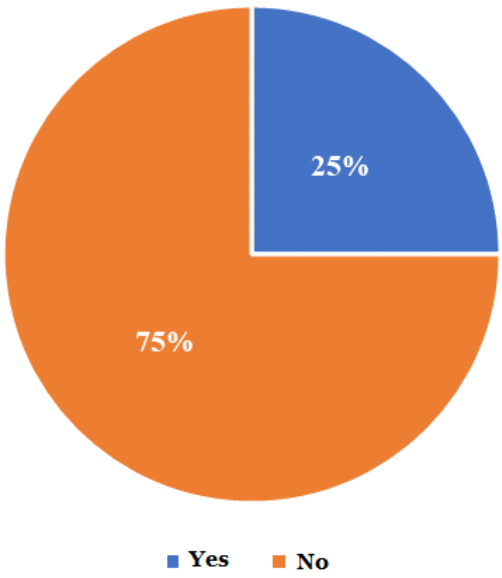


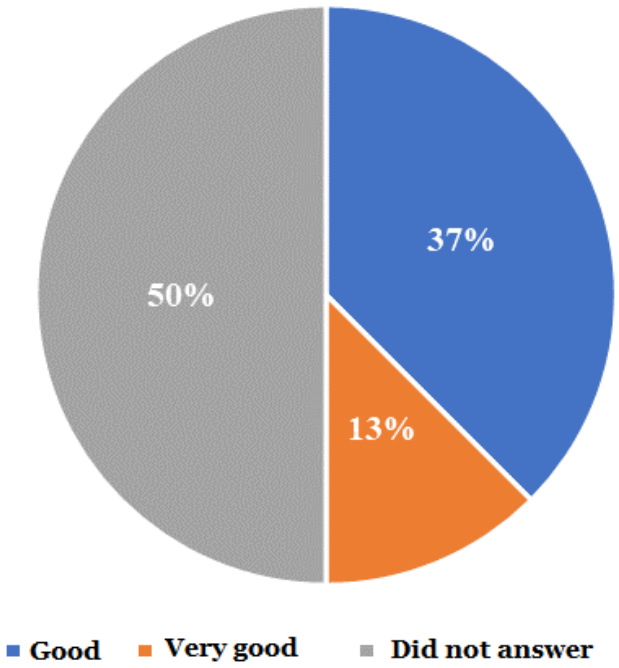
Figure 7. *Overtime.*



When asked about work activities, most workers stated that the ergonomic conditions of the work environment are adequate, as well as accessible cafeterias and bathrooms and in good hygiene conditions such as bathroom hygiene (Figure 8).

Figure 8.

How is the hygiene of the bathrooms?



The ergonomic conditions verified according to the answers obtained refer to compliance with the Regulatory Standards, highlighting NR 17, which addresses the need to adapt working conditions to workers, providing maximum comfort, safety and efficiency in performance (Brasil, 1978).

This, however, does not cancel out the noise of the machines and the dust coming from the sawdust. To this end, following the rules that govern the work of sawmills, the company invests in PPE (EPI´s) so that its employee does not suffer work accidents. The use of PPE (EPI´s) is essential to reduce the risk of absorption of the toxic product by the body, protecting the health of the worker (Andef, 2002).

Of extreme importance for the physical integrity of the worker, PPE (EPI´s), help prevent the most frequent and common accidents, such as cuts, falls, burns, electric shocks and also, serious accidents, such as amputation (Mastela, 2013). There are several precautions, it depends a lot on the type of activity that the employee develops. But the main care is with the upper and lower limbs, head, trunks and airways.

It was found that in the work environment in which the interviewees were exposed, there are noises coming from the machinery and also dust derived from sawdust (Figure 9). However, it was observed that the company invested in personal protective equipment, preventing accidents, from the simplest to those of great inconvenience, whether physical or not, to the employee (Figure 10).

When asked what actions are performed to avoid the dispersion of dust in the work environment, only one of the interviewees answered that cleaning is part of this procedure. The others did not respond nor did they justify the absence of the answer.

Figure 9. *Is there a level of dust and noise coming from work?*

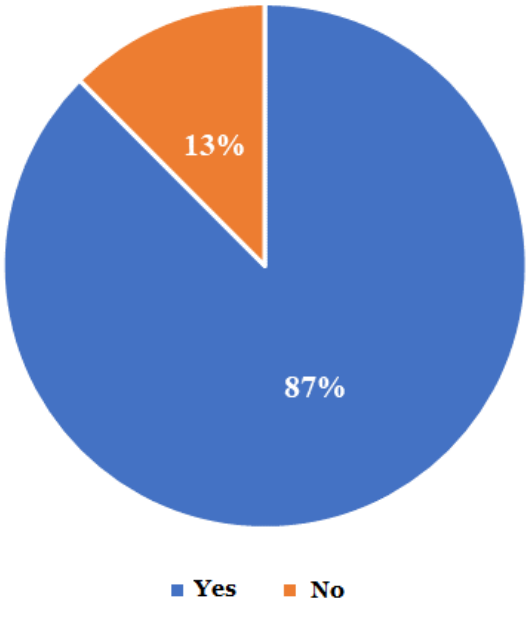
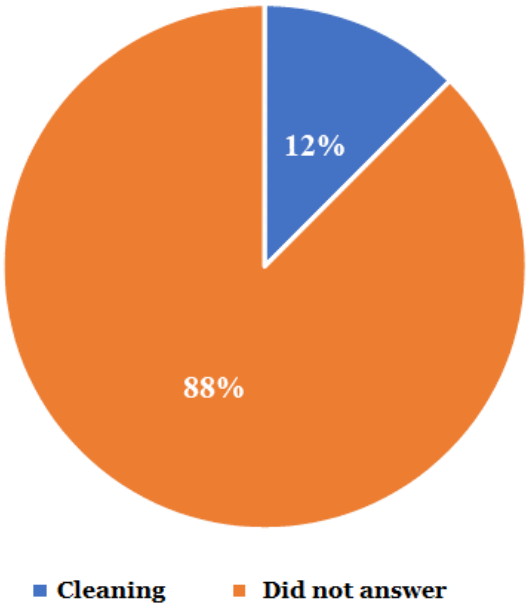


Figure 10. *Actions for dust dispersion.*



The most used PPE (EPI´s) by employees are gloves, masks, boots and specific clothes that serve as prevention and care. Mastella (2013) contributes by stating that prevention is one of the ways to avoid accidents and investing in the training of workers results in improvement of the organizational environment.

The Committee on Good Agricultural Practices (*Comitê de Boas Práticas Agrícolas* - COGAP) and the National Association of Plant Defense (*Associação Nacional de Defesa Vegetal* - ANDEF) have prepared a manual for the correct use of PPE (EPI´s) to guide workers in the agricultural area. However, with minor adaptations, the same manual can and should be used by sawmill workers. Among them are gloves, masks, transparent face shields, clear glasses, earplugs, apron and boots.

Figure 11 shows which PPE (EPI´s) is most used by the employees of the company studied and, after receiving the equipment, the new employees receive training on how to use them correctly. It´s worth mentioning that all PPE (EPI´s) must be washed separately, sanitized and stored properly, thus ensuring a longer service life. According to the ANDEF Manual, the Procedures for washing protective clothing (PPE) (EPI´s) are: a) PPE (EPI´s) must be washed separately from ordinary clothing; b) protective clothing should be rinsed with plenty of running water to dilute and remove residues from the spray mixture; c) washing should be done carefully with neutral soap (coconut soap), d) the garments should not be soaked and then and should be thoroughly rinsed to remove all soap; e) Important: never use bleach, as it may damage the resistance of the garments; f) boots, gloves and

visor should be rinsed with plenty of water after each use; g) keep PPE (EPI´s) separate from ordinary clothing to avoid contamination and; h) periodically review and replace damaged PPE (EPI´s) (ANDEF, 2002).

It´s noted that 75% of the interviewees did not answer the question when asked about the conservation and care with the protective equipment. However, the company provides lockers for them to be stored, but the company is not responsible for their individual care (Figure 12).

Figure 1. *What equipment is needed in your role?*

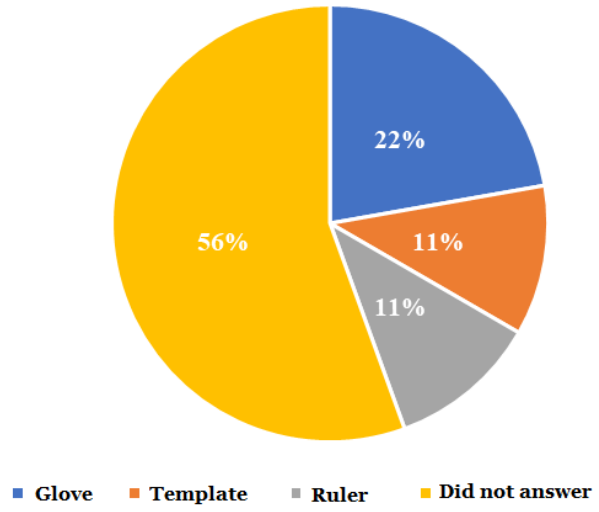
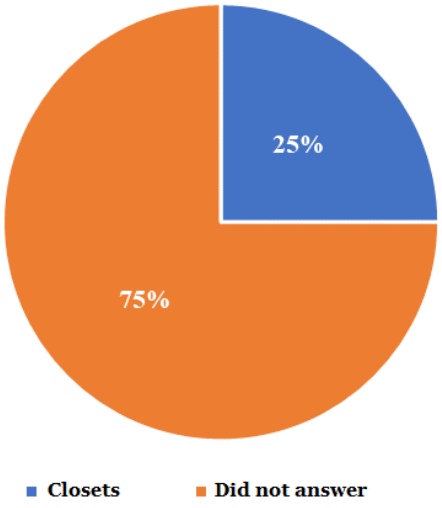


Figure 12. *Conservation of protective equipment.*

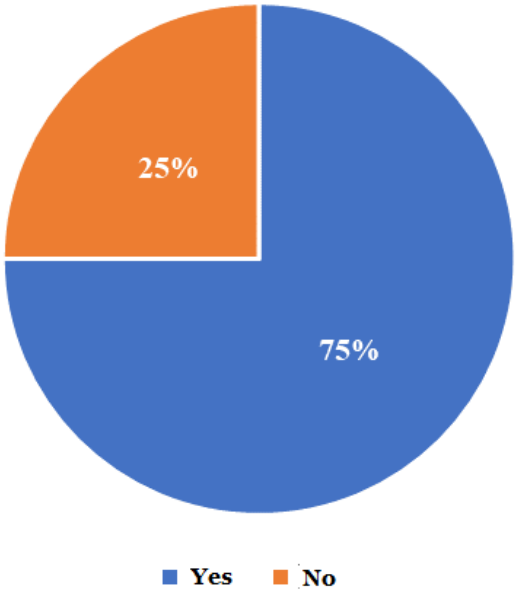


Another precautionary measure used by the company, to avoid risks of accidents, are the plates with figures that represent a risk to which the workers are exposed (Figure 13).

According to NR 26, the standardization of symbols and colors allows the transmission of clear and easy-to-understand information, minimizing risks and accidents. According to the current legislation of the Ministry of Labor (*Ministério do Trabalho*), companies that adopt these rules create a work environment where everyone knows how to act in a preventive way to safety.

The interviewees were asked about pain and/or injuries resulting from their working hours provided by the task they perform. Most of them said that they do not have pain caused by the exercise of their profession. However, those who answered that they have pain/injuries provided by the task performed daily, did not specify what they would be.

Figure 13. *Are there representative security figures?*



One of the fundamental rights guaranteed to workers in the constitution is a safe and healthy work, because it emphasizes that the "reduction of the risks inherent to work, through health, hygiene and safety standards" (Sesi-Sebrae, 2005).

In view of the above, the interviewees refer to the company in which they work as an environment with a good level of social integration, without hierarchical distinction. This factor favors the quality of life at work. For Gonçalves et al. (2011), this factor can be considered by the absence of any type of prejudice (religion, race, sex, color), by the probability of growth in the hierarchy in rank of capacity and potential, by the experience of mutual support (practice of reciprocal help and socio-emotional support and by the discernment of integration of the employee with the organization.

It´s observed that most of them do not feel pain after the activities performed in the company (Figure 14) and know the relevance of their work, however, they do not feel safe in affirming how important they are for the development of the company (Figure 15).

In this dimension, Gonçalves (2011) emphasizes the relevance of professional and educational activities, aimed at highlighting and emphasizing the importance of each one within the organization of a company in order to maintain and expand the capacity of the worker.

In the face of those exposed, the studied sawmill performs its functions within what determines the current laws, here in question, the safety of its employees. This factor is determinant for the prevention of accidents, whether from minor injuries to others of larger proportions.

Figure 14. *Level of pain and/or injury provided by the task performed.*

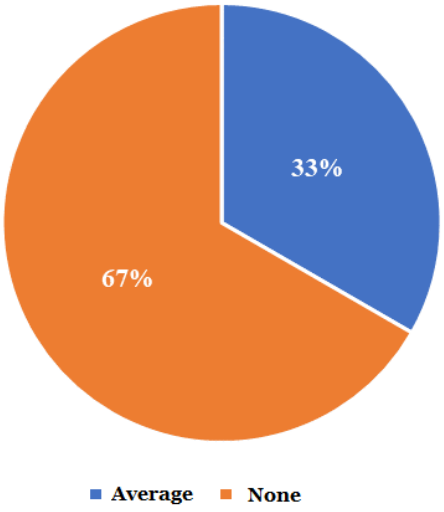
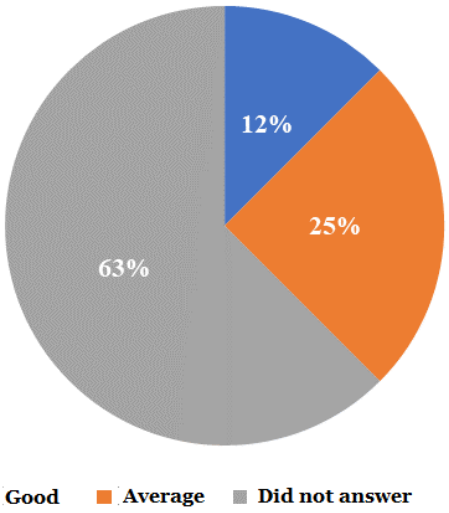


Figure 15. *Relevance of your work.*



One of the great challenges of small and medium-sized companies is the implementation of actions that will improve working conditions and, together, the safety of workers. The work environment should be at least safe, bringing a greater well-being and quality of work to yours.

It´s of great value to emphasize that any expense aimed at safety represents an investment in the quality of work and, consequently, of life for the worker. Such actions provide an increase in its productive capacity and avoid possible future inconvenience to the company, with indemnity expenses.

In the case of the company under study, it was observed that it has a concern to maintain the safety of its employees, investing in equipment that brings greater security in the face of the daily and current risks provided by the different equipment they handle.

Conclusion

It´s expected that the company always invests in safety, either with PPE (EPI´s) and/or with necessary interventions, so that there is no absence at work, expenses with employees on leave and even demotivation for work due to lack of security.

Although the company studied has never been affected by serious accidents or any other negative consequences, it should be noted that the lack of care and investments in safety and well-being can generate operational and financial disorders, with relevant negative impacts.

Several times, quantifying gains generated through the implementation of safety activities and resources, highlighted here that of a small sawmill, can be very difficult. However, when an employee is exposed to dangerous situations, aggressive conditions can result in a compromise of the expected results.

Finally, it´s suggested that the company may be constantly investing in training and equipment that bring personal security, thus improving the gain with employee satisfaction and, consequently, an increase in final productivity.

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