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PROPOSAL FOR THE STRENGTHENING OF THE MANAGEMENT OF THE RISK OF MUSCULOSKELETAL DISORDERS ASSOCIATED WITH THE MANUAL HANDLING OF LOADS IN THE PERSONNEL OF THE SANTAMARÍA HARDWARE STORE - MESA DE LOS SANTOS

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ABSTRACT

Musculoskeletal disorders (MSDs) represent one of the most frequent problems in the field of occupational safety and health, especially in activities that involve manual handling of loads. In sectors such as the hardware store, where operational tasks require constant lifting, transport, and storage of materials, workers are exposed to ergonomic risk factors that can affect their musculoskeletal health and work performance. In this context, the objective of this study was to analyze the factors associated with the risk of musculoskeletal disorders related to the manual handling of loads in the operating personnel of the Santamaría Hardware Store, located in Mesa de los Santos. The research was developed under a quantitative approach with a descriptive and non-experimental design. For the collection of information, the survey technique was used through the application of a structured questionnaire aimed at ten operational workers who perform activities related to manual handling of loads. The instrument allowed the collection of information on sociodemographic variables, musculoskeletal health conditions, exposure to ergonomic risk factors, and work practices associated with the lifting and transport of materials. The results showed a significant presence of musculoskeletal discomfort among the workers, mainly in the lumbar area and in the shoulders, associated with the frequency of load handling, the adoption of inappropriate postures and the repetition of movements during the working day. It was also identified that, although most workers have received training in safe load handling techniques, these trainings are not updated periodically, which can limit the correct application of ergonomic practices. The absence or limited availability of mechanical tools that facilitate the lifting and transport of materials was also evidenced. It is concluded that manual handling of loads is a determining factor in the exposure to risks of musculoskeletal disorders in the operational personnel analyzed. The findings

of the study allow us to identify working conditions that favor the appearance of these disorders and provide relevant information for the diagnosis of ergonomic risks in the hardware sector. In this sense, the results obtained contribute to the strengthening of the analysis of working conditions and provide a basis for decision-making aimed at improving occupational safety and promoting healthier work environments.

KEYWORDS: Musculoskeletal Disorders, Manual Handling of Loads, Ergonomics, Ergonomic Risks, Occupational Health and Safety.

1. INTRODUCTION

The management of the risk of musculoskeletal disorders in the workplace has become one of the most important elements in Occupational Health and Safety systems, especially in activities where manual handling of loads is common. This type of risk is strongly related to the appearance of musculoskeletal disorders, which affect the locomotor system, including muscles, tendons, ligaments, nerves and joints. These alterations usually occur when employees are continuously faced with high physical demands, repetitive movements, improper postures or handling excessive loads. Therefore, the connection between ergonomic conditions in the work environment and workers' health is clear, as prolonged physical exertion without appropriate preventive measures considerably increases the risk of injuries that affect both the quality of life of employees and the productivity of companies.

Globally, work-related musculoskeletal disorders are one of the most frequent causes of incapacity for work, creating very significant social, economic and organizational repercussions. Several studies on occupational accidents show that certain groups of workers are more exposed to these risks, especially those whose work is operational or manual. According to the International Standard Classification of Occupations, those engaged in "elementary occupations" have a greater susceptibility to occupational accidents and diseases, since their activities involve a high physical level and a lower degree of technical specialization. These jobs include construction helpers, loading attendants, cleaning personnel, and workers handling goods or heavy materials, who face constant physical demands that increase the risk of musculoskeletal injuries.

In this context, studies on occupational health have confirmed that manual handling of loads is one of the most significant factors in the appearance of musculoskeletal problems. According to data provided by Téllez Cobos, between 30% and 79% of workers who perform this type of activity experience musculoskeletal injuries due to physical overexertion. These statistics reflect the seriousness of the problem and show that disorders related to the musculoskeletal system have become one of the main concerns within occupational risk prevention programs. In Latin America, low back pain related to manual handling of loads is particularly common, underscoring the urgency of developing more effective strategies for the preventive management of these risks.

In Colombia, the issue of musculoskeletal disorders has gained great importance in occupational safety and health policies. Working conditions in various sectors show that manual handling of loads remains one of the main sources of ergonomic risk for employees. According to the Ministry of Labor, this type of risk causes a high number of disabilities in the industrial and commercial sectors, which has important repercussions on the productivity of companies and on expenses related to health care and labor compensation (MinTrabajo, 2017). Despite the fact that there are regulations to prevent these risks, their effective application in many organizations still faces significant challenges.

Faced with this situation, Colombian regulations have defined different guidelines to prevent injuries associated with the manual handling of loads. Regulations such as Resolution 2400 of 1979 establish guidelines for the safe handling of loads and the implementation of preventive measures in work environments. These regulations are intended to ensure that companies recognize, assess, and control the risks involved in work that requires considerable physical effort. However, despite these guidelines, many organizations, especially small and medium-sized enterprises, find it difficult to fully comply with these standards due to resource constraints, lack of training, or poor adoption of ergonomics programs.

In addition, technical tools such as the Evidence-Based Comprehensive Occupational Health Care Guide for Musculoskeletal Disorders related to Repetitive Movements of the Upper Limbs (GATISST) offer specific guidelines to prevent and manage these risks. This guide points out key factors that contribute to the onset of musculoskeletal disorders, such as repetitive movements, improper postures and manual handling of loads. It also suggests strategies to improve ergonomics in workspaces, encourage staff training and promote preventive practices such as taking active breaks and redesigning work tasks.

However, implementing these suggestions does not always happen in workplaces, especially in smaller companies where resources to manage risk are scarce. This reality creates a significant disparity between the regulations in force and the real situation of many companies, which increases the vulnerability of workers to occupational diseases. The lack of training in proper load handling techniques, the lack of mechanical tools and the weak application of ergonomic measures are factors that contribute to the persistence of this problem in various productive sectors.

The hardware industry is a clear example of these working conditions, since their work requires the frequent handling of heavy objects such as cement, pipes, tools and other materials used in construction. In this regard, the International Labour Organization has highlighted that manual handling of loads is among the main reasons for musculoskeletal injuries in sectors related to retail trade and construction (ILO, 2019). These injuries can come in the form of sprains, muscle strains, low back pain or herniated discs, impacting both the health of employees and the efficiency of companies.

The existence of these risks in the hardware sector demonstrates the need to reinforce prevention tactics in companies that carry out these tasks. Establishing safe methods for handling loads, employing mechanical support equipment, and providing ongoing training to personnel are essential factors in decreasing the frequency of musculoskeletal disorders in the workplace. In this context, applying a preventive approach to risk management not only safeguards the physical health of employees, but also improves organizational performance and optimizes the efficiency of production processes.

In the specific case of the Santamaría Hardware Store, located in the municipality of Mesa de los Santos, the operations include continuous tasks of lifting, moving and storing construction materials. These activities require employees to handle loads of varying weights and sizes, which entails considerable physical strain throughout the workday. Although the company has general safety protocols, the need to reinforce strategies focused on the management of risks of musculoskeletal disorders has been detected, to reduce the exposure of workers to ergonomic risks.

Analysis of absenteeism records revealed cases of medical disabilities linked to low back pain in some workers, suggesting a possible connection to manual load handling practices performed in daily activities. Several reasons that are increasing these risks were also identified, highlighting the lack of mechanical aids for lifting and handling materials, poor training in proper techniques for handling loads, and the adoption of inappropriate postures when performing tasks.

These circumstances bring negative effects for both employees and the organization, manifesting themselves in physical fatigue, recurrent muscle pain and potential chronic injuries that can affect the work capacity of workers. From the organizational level, the appearance of occupational diseases also leads to an increase in costs related to absenteeism, medical treatments and staff turnover. Additionally, reduced productivity and loss of work experience are factors that could impact the company's competitiveness in the market.

From a business and social perspective, strengthening the management of the risks of musculoskeletal disorders not only helps to safeguard the health of workers, but also generates significant benefits for organizations. The implementation of preventive strategies reduces the costs associated with work disabilities, improves the organizational environment, increases staff satisfaction and reinforces the safety culture within the company. Thus, the prevention of occupational risks becomes a strategic investment that favours both business sustainability and the well-being of workers.

In this context, the current study focuses on the creation of a plan to improve the management of the risk of musculoskeletal injuries related to the manual handling of loads by the operating staff of the Santamaría Hardware Store. Through an exhaustive analysis of working conditions, the identification of the main risk factors and the evaluation of current work practices, the aim is to develop intervention strategies based on ergonomic principles and the best occupational health and safety standards. Thus, the aim is to reduce musculoskeletal injuries, optimize the working conditions of employees and promote safer, healthier and more productive work environments.

2. OBJECTIVE

To analyze the factors associated with the risk of musculoskeletal disorders related to the manual handling of loads in the operating personnel of the Santamaría Hardware Store (Mesa de los Santos), based on the evaluation of working conditions, load handling practices and the presence of musculoskeletal discomfort reported by workers through the application of a structured questionnaire.

3. METHODOLOGY

To ensure an adequate and reliable development of the proposed objectives, an appropriate methodology was established, focused on a quantitative approach, using the survey technique as the main tool for data collection. The instrument used was a questionnaire specifically designed to evaluate working conditions, manual handling practices and possible risk factors for musculoskeletal disorders present in the daily activities of the personnel. Next, the key aspects that guided the methodological approach of this research were presented.

3.1 Type of Research

In order to meet the objectives set and meet the specific needs of the project, it has been determined that the research will be descriptive. According to (Sampieri, Hernández, Díaz Fernández, Baptista, 2022), this type of research is characterized by focusing on detailing and specifying the properties, characteristics, and profiles of a particular phenomenon, community, or situation. The main objective of this type of research is to answer questions about the "what is" or "how does it occur" a phenomenon, providing detailed information without seeking to explain the causes. Its usefulness lies in the fact that it allows obtaining a systematic and structured overview, which can be the basis for explanatory or experimental research.

3.2 Research Design

Taking into account the approach to the problem, it has been determined that the research design will be non-experimental. According to (Sampieri, Hernández, Díaz Fernández, Baptista, 2022), in this type of design, the researcher does not manipulate the variables, but limits himself to observing and describing them as they are presented in their natural context. This approach is appropriate when the objective is to study phenomena without directly intervening in them, allowing a clearer understanding of the conditions and relationships between the variables in their original state, as in the case of manual handling of loads in the hardware work environment.

The Research Approach

In order to meet the established objectives and address the specific needs for the development of the project, it has been determined that the research is quantitative. This approach, according to (Creswell, 2023), is characterized by the collection of numerical data and statistical analysis to examine patterns and relationships between variables. This type of research is especially suitable for identifying and evaluating risks of musculoskeletal disorders, since it allows to objectively measure the working conditions and the factors that affect the manual handling of loads. Through the application of structured questionnaires, accurate information is obtained that will be statistically analyzed to formulate effective strategies based on concrete evidence, thus ensuring the reliability and validity of the results.

The development of research under the quantitative approach generally follows a series of structured phases that allow numerical and statistically significant results to be obtained. The phases for this type of research, according to various authors such as (Sampieri, Hernández, Díaz Fernández, & Baptista, 2022) (Creswel, 2023) include the following steps:

Definition of the problem and objectives: This initial phase involves the clear identification of the research problem and the formulation of the specific objectives that will guide the study. It's critical to have a well-defined research question that can be measured numerically.

Literature review: Through a detailed review of previous studies, the theoretical framework that supports the research is established. This helps to understand the relevant variables and relationships to be explored.

Hypothesis formulation: In quantitative research, hypotheses are put forward that describe the possible relationships between variables. These hypotheses will be empirically tested throughout the study.

Research design: The type of research (descriptive, correlational, experimental, etc.) is decided and the most appropriate data collection technique is selected, such as surveys, questionnaires, structured interviews or secondary data analysis.

Data collection: In this phase, numerical data is obtained according to the design and the chosen tools. This could include applying surveys or collecting data from existing files.

Data analysis: Statistical tools are used to analyze the data collected, including descriptive techniques (such as frequencies and averages) and inferential techniques (such as hypothesis testing and regression analysis).

Interpretation of the results: Finally, the results of the statistical analysis are interpreted in relation to the hypotheses raised. This phase also includes discussion of the findings and their relevance to the research problem.

Conclusions and recommendations: Conclusions are generated based on the results obtained, and practical or theoretical recommendations are proposed to address the problem investigated.

Taking as a reference each of the existing steps for the realization of a research with a quantitative approach, it was possible to obtain numerical data that facilitate the identification of patterns and relationships between the variables involved. Through the phases, such as the clear definition of the problem, the review of the literature, the formulation of hypotheses and the design of the research, the phenomenon was addressed in a systematic and objective manner. Data collection through surveys or questionnaires, followed by rigorous statistical analysis, allowed to validate the hypotheses and

generate solid conclusions about the most effective strategies to manage the risk of musculoskeletal disorders in the hardware store work environment. In this way, the quantitative approach contributed to informed decision-making and the improvement of occupational safety in the sector.

3.3 Hypotheses or Assumptions

According to (Sampieri, Collado, & Baptista, 2022), a well-formulated hypothesis must be specific, measurable, and aligned with the objectives of the study, allowing its verification through the collection and analysis of data obtained during the research.

According to the inherent characteristics of the hypothesis addressed by Sampieri, the following hypothesis was proposed for the present research: the proposal of a strategy to optimize the task of manual handling of loads and prevention of the risk management of musculoskeletal disorders in the Santamaría - Mesa de los Santos hardware store will reduce the incidence of musculoskeletal disorders in the personnel, through the application of appropriate techniques for manual handling of loads, the use of biomechanical aids and continuous training in occupational risk prevention.

This strategy included an inspection of tasks involving load handling, identification of workstations with repetitive movements or high physical exertion, and analysis of work postures and their duration. In addition, a continuous training plan, practical training adapted to the work environment, addressing appropriate techniques for manual handling of loads, postural hygiene, use of assistance equipment, relaxation and stretching exercises.

3.4 Population and Population Sample

In the context of research, the population refers to the total set of elements that share defined characteristics relevant to the study, while the sample is a subset of the population that is selected to be studied, in order to obtain conclusions applicable to the total. According to (Sampieri, Collado, & Baptista, 2022), the selection of an appropriate sample is essential to optimize resources and guarantee the validity of the results, as long as it is representative of the population. This involves using systematic sampling techniques that reduce bias and ensure that key characteristics of the population are reflected in the sample. A well-defined sample allows inferences to be made that contribute to the development of scientific knowledge.

According to Sampieri's guidelines, the sample selected for this research is made up of 10 workers who perform operational activities of manual lifting of loads, this includes operational personnel, storage and distribution of hardware material, who are exposed to risk factors for musculoskeletal disorders in their daily tasks. These were extracted from a total population of 12 workers. This sample was determined considering its representativeness and relevance for the objective of the study, which allows valid and generalizable conclusions to be drawn within the context analyzed.

3.5 Information Collection Techniques and Instruments

The survey and questionnaire are key tools for data collection in quantitative research. According to (Sampieri, Collado, & Baptista, 2022), the survey is a method that involves the collection of information from a group of individuals, using a structured questionnaire as the main instrument. The questionnaire is a set of questions designed in a systematic way to obtain relevant data on the study variables. This instrument can be administered in person, online, or by print media, and its effectiveness depends on the clarity and relevance of the questions. Both concepts complement each other, since the survey uses the questionnaire as a means to standardize the information collected and facilitate its subsequent analysis.

In the present research, the survey technique was used as the main method of data collection, using a questionnaire as an instrument, which is composed of five (5) sections. This approach allows precise and detailed information to be obtained on the aspects relevant to the study. The first section of the questionnaire is intended for the sociodemographic characterization of the operational staff of the Santamaría Hardware Store. This section collects key data on key variables such as workers' age, gender, education level, and type of contract. The collection of this data allows for a more detailed analysis of the demographic profile of employees, making it easier to understand the diversity of the workforce and its possible relationship with occupational risk factors. For ease of reference, this section is available in Appendix B.

The second section focused on knowing musculoskeletal health conditions through the Positiva questionnaire. This included four areas: personal information (data of the worker and his position), habits (tobacco consumption and physical activity), occupational exposure to DME risks and health status, where the areas of pain, their duration, intensity and the impact on work activities were visually identified. The corresponding information is

found in Appendix C.

The third section was designed to identify the dangers of musculoskeletal disorders present in the work environment. Various variables are analyzed, such as the position held by the worker, the time he has remained in that position, the frequency with which he handles loads, the average weight of the loads he handles, and the frequency with which he lifts loads from the ground. In addition, handling loads in awkward or forced positions, repetitive motions involving the same joints when handling loads, as well as whether you have received training in safe handling techniques (such as proper gripping, lifting, simultaneous twisting, and task duration and intensity) are considered. It is also evaluated if you experience discomfort or fatigue in any part of your body after handling loads and if you have had a history of lifting-related injuries in the past 12 months. Details of this section can be found in Appendix D.

The fourth section focused on the characterization of the activities that are sources of danger. In this section, data were collected using variables that include questions about activities involving loadlifting. The questions posed were: Which of the following activities do you carry out that involve lifting loads? The options included activities such as unloading goods from trucks or suppliers, organizing and storing products in the warehouse, replenishing goods on shelves, serving and dispatching heavy products to customers, preparing orders for delivery or shipping, and internal transportation of goods, as well as an open option for other activities. In addition, it was asked about the types of products that are most frequently lifted, such as bags of cement, sand or gravel, metal or wood sheets, tools and machinery, boxes with various products, and pipes and plumbing fixtures, also with an option to specify other products. This section is available in Appendix E.

The fifth section aims to determine the control measures implemented by the hardware store to prevent fatigue and injuries caused by manual handling of loads. To do this, variables were used, such as the availability of tools or mechanical equipment to facilitate the lifting of loads, such as forklifts, forklifts or hoists, and whether these are always available or not. It was also asked if employees use any help tools to lift or move loads, either constantly or occasionally, or if they consider that they are not necessary. In addition, a consultation was included on the training received in safe cargo handling techniques and whether it has been recent or not. It was also asked if the use of the appropriate technique to lift loads, such as knee bending, keeping the back straight and avoiding torsion of the trunk, is encouraged in their workplace, and if this is done regularly or only on some occasions. The questionnaire also addressed the frequency of active breaks or stretching exercises during the workday, and whether the work area has signage on the maximum recommended weights for manual lifting. It was also evaluated if the workspace is adequate to carry out safe lifts.

Regarding the perception of safety, it was asked if employees consider that the safety measures implemented are sufficient to prevent injuries due to lifting loads or if, on the contrary, they consider them insufficient. In addition, the experience of discomfort or injuries related to lifting loads was inquired about, as well as the suggestions that employees have to reduce the risks of musculoskeletal disorders in their workplace, such as improving tools and equipment, adjusting shelves to facilitate access to loads, the implementation of more frequent breaks and more in-depth training in proper lifting techniques.

4. RESULTS

Sociodemographic Characterization and Musculoskeletal Health Conditions of the Operational Personnel of the Santamaría Hardware Store.

To carry out the Sociodemographic Characterization and Analysis of the Musculoskeletal Health Conditions of the operating personnel of the Santamaría Hardware Store - Mesa de los Santos, a structured questionnaire designed to collect relevant information about the workers was applied. This instrument included sociodemographic variables such as age, gender, educational level, length of work experience, and type of contract, as well as aspects related to their musculoskeletal health conditions.

Through closed questions and statistical analysis, the frequency and intensity of musculoskeletal discomfort in different regions of the body was investigated. The collection and analysis of these data allowed the identification of risk of musculoskeletal disorders associated with the manual handling of loads, providing an objective basis for the design of the Proposal for the Strengthening of the Risk Management of Musculoskeletal Disorders Associated with the Manual Handling of Loads in the Personnel of the Santamaría - Mesa de los Santos Hardware Store.

Section 1. Sociodemographic characteristics of the working population

A. Age of workers

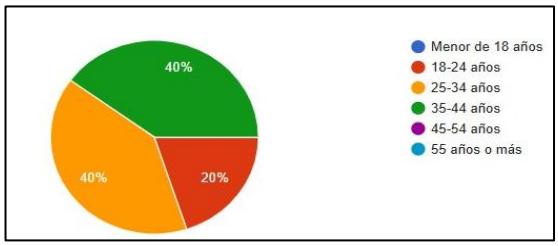

Figure 1. Age of workers

Note. Distribution by age range of workers. In original language, Spanish

The analysis of the age distribution of the operating staff of the Santamaría - Mesa de los Santos Hardware Store shows that 40% of the workers are in the range of 35 to 44 years old, another 40% are between 25 and 34 years old, and the remaining 20% are in the 18 to 24 years old group. This age profile indicates that most employees are at productive ages, where the physical demands of work can have a progressive impact on musculoskeletal health.

According to (Bernard, 1997), age is a determining factor in exposure to risks of musculoskeletal disorders, since over time the recovery capacity of musculoskeletal tissue decreases, increasing vulnerability to injuries and disorders such as low back pain, tendonitis and carpal tunnel syndrome. In young workers (18 to 24 years old), muscular endurance and flexibility are usually higher, but lack of experience in handling loads can lead to a higher incidence of accidents. In contrast, in the 35 to 44 age group, the accumulation of repetitive efforts and the possible presence of chronic conditions can increase the probability of developing occupational pathologies.

These results highlight the need to implement differentiated prevention strategies in the company, considering the age of the workers. For younger employees, intensive training in safe load handling techniques is recommended, while for older employees, the adaptation of active breaks, muscle strengthening, and the use of biomechanical aids is suggested to mitigate the impact of physical exertion on their work performance.

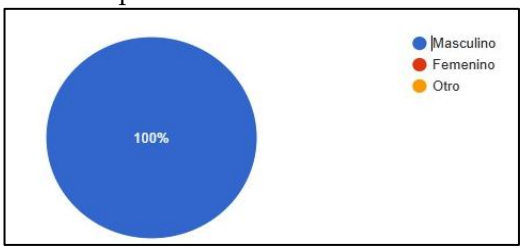

Figure 2. Gender of workers

Note. Gender distribution of workers. In original language, Spanish

The analysis of the "gender" variable of the operating staff of the Santamaría - Mesa de los Santos hardware store reveals that 100% of the workers are men, while there are no women or people of another gender. This distribution suggests that the hardware store does not have a representation of female workers, which could be related to cultural, historical or structural factors within the industry.

According to (González, 2015), gender can influence exposure to occupational risks, since physiological and social differences between men and women affect the way in which risks are perceived and faced in the work environment. Although there are no women on the staff of this particular company, it is important to note that, in general, women tend to have lower average physical strength than men, which could influence their vulnerability to injury in tasks that require physical strength or lifting loads (Zhao, 2016). However, it has also been shown that women tend to have greater flexibility and a lower incidence of musculoskeletal disorders in certain activities (Lorusso, 2013), which could influence the way occupational safety and health and gender-based ergonomics interventions are designed.

Despite the lack of women in this sample, it is essential that the hardware store considers future inclusive policies that promote gender diversity, since a diverse workforce could enrich work dynamics and contribute to the implementation of more complete prevention and health strategies. In addition, future research that includes a more gender-balanced sample would allow for more representative results and generate specific recommendations for each group.

C. Educational level of the working population

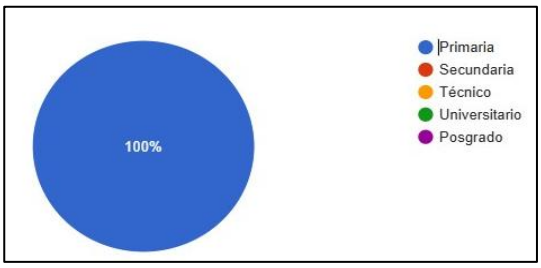

Figure 3. Educational level of workers

Note. The figure presents the level of academic training of the hardware store staff. In original language, Spanish

The analysis of the variable "Educational level achieved" in the operating personnel of the hardware store reveals that 100% of the workers have a higher level of education than primary school, while there are no employees with secondary, technical,

university or postgraduate studies. This distribution suggests that the company's operational personnel lack access to higher educational levels, which could have implications both in job performance and in the implementation of prevention and occupational safety measures.

According to previous research (Serrano, 2021), educational level can significantly influence workers' ability to understand and apply safety practices at work. Those with a lower level of education, as is the case with most of the staff at this hardware store, may have difficulty understanding the risks and preventive measures related to job tasks. This could lead to greater vulnerability to injury, since, as suggested (López M., 2020), adequate training in safety and ergonomics is crucial to reduce occupational risks, and the ability to acquire and apply that training may be influenced by educational level.

In addition, a low level of education may also be linked to greater exposure to risks of musculoskeletal disorders, as workers with less education may be less likely to use safe load handling techniques or to use appropriate ergonomic equipment (García R., Occupational Risks and Education, 2022). In this context, it is essential that the hardware store implements accessible training programs that do not depend only on academic level, but that adapt to the educational profile of its staff. These programmes should include practical training modules in ergonomics and safe handling techniques to prevent injuries and improve worker well-being.

Therefore, it is recommended that the Santamaría hardware store consider training strategies that include visual and practical methods, and that integrate simple technology so that workers can access information regardless of their educational level. In addition, continuing education opportunities for employees could be considered, which would not only benefit occupational safety and health, but could also improve the overall performance of the company.

D. Type of contract of the working population

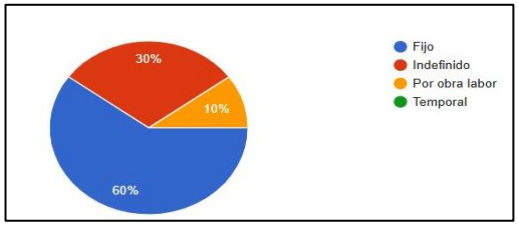

Figure 4. Type of hiring of workers

Note. The figure shows the modality of hiring the employees of the hardware store. In original language, Spanish

The analysis of the variable "Type of contract" in the operating staff of the hardware store shows that 60% of the workers are hired on a permanent basis, 30% have an indefinite contract, and the remaining 10% are under a contract for work. No personnel with temporary contracts are registered. This distribution suggests that a large portion of employees have a stable employment relationship, which can contribute to greater stability in the workplace and a longer commitment to the company's health and safety policies.

According to studies by (Smith, 2021), the type of contract can influence workers' behavior in relation to occupational safety and risk perception. Employees with permanent or permanent contracts are usually more committed to complying with health and safety regulations, as they have a longer-lasting employment relationship and therefore a stronger interest in protecting their well-being and avoiding injuries. On the other hand, workers with contracts for work, although less frequent in this case, tend to have less commitment to preventive measures, given that their permanence in the company is temporary and they may not receive the same training or attention in terms of occupational risks (Fernández P., 2019).

The type of contract can also affect the motivation to report incidents or physical discomfort. According to (García R., 2020), workers with more stable contracts are more likely to report health problems, such as musculoskeletal injuries, due to their perception that the company has a responsibility to protect their long-term well-being. On the other hand, employees with less stable contracts may feel that health problems will not be taken into account or that they do not have the same guarantee of medical assistance.

In this context, the results of this variable highlight the importance of adapting prevention and training strategies according to the type of contract. Although most workers have stable contracts, it is essential that the company implements continuous training programs in safe load handling techniques and properly manages occupational risks, both for permanent workers and for those with contracts for work. It is also recommended that accessible safety measures and a support system be provided for all employees, regardless of their type of contract.

Section 2. Health Conditions

For a second part, the POSITIVE ARL questionnaire of SIN-DME Symptomatology was used as a reference, a screening tool designed to collect information on the presence of symptoms associated with Musculoskeletal Disorders (BMD) in the workers of a company or productive organization. The questionnaire is

structured in four domains:

a) Personal Information. In which information was collected on the worker and the position held.
b) Habits: Individual habits were investigated: tobacco consumption and physical activity.
c) Work: Its purpose was to identify occupational exposure to possible events that generate AMD.
d) Health status. A graph was used that allows through visual coding, to identify the areas of the body where different symptoms associated with AMD occur. The worker is asked to IDENTIFY the part of the body where he or she has had pain or discomfort. Then the duration of the pain and the intensity of the type of pain identified are asked, finally the interference of the symptoms in the activities carried out by the worker is inquired.

For the validation of the questionnaire, the identification of the different parts of the body affected by symptoms associated with Musculoskeletal Disorders (BMD) was taken into account. The workers selected, from a reference graph, the body areas where they have experienced discomfort, specifying regions such as the nape of the neck, neck, shoulders, arms, elbows, forearms, wrists, hands, fingers, back, knees, legs, thighs and feet. This process allowed detailed and accurate information to be obtained on the location of symptoms, thus facilitating a more complete analysis of possible risk factors and the implementation of appropriate control measures for injury prevention.

Below are the percentages obtained from the information collected, which reflect the distribution of symptoms reported by workers in the different areas of the body evaluated.

Figure 7. Symptoms associated with Musculoskeletal Disorders (BMD)

Note. Symptoms reported in the body areas evaluated to hardware store workers.

The analysis of the data obtained from the questionnaire applied to 10 workers reveals a high prevalence of musculoskeletal symptoms in various regions of the body. 40% of the workers reported pain in the lumbar spine or lower back, followed by 30% who reported neck pain. In addition, 20% had discomfort in their shoulders and 10% reported pain in their knees. No discomfort was reported in the abdominal area or in the feet. These findings suggest significant exposure to risk factors for musculoskeletal disorders, mainly related to manual handling of loads, one of the main causes of musculoskeletal disorders in work settings.

The lifting, transporting and handling of loads generates physical overexertion that affects different structures of the body. Neck pain, reported by 30% of workers, can be the result of improper posture when lifting loads, especially when excessive extension or flexion movements of the neck are performed to stabilize or visualize the object being carried. Research such as that of (Marras, 1993) shows that prolonged static loading and the use of inadequate lifting techniques can generate muscle tensions in the cervical area, increasing the risk of injury.

Shoulder discomfort, present in 20% of workers, is associated with repetitive lifting of loads above shoulder level, which generates compression in the rotator cuff joint and increases the risk of tendon injury (Armstrong, 1987).). In addition, repetitive movements or the use of excessive force in the grip of objects can generate fatigue and affect joint mobility.

Pain in the lumbar spine or lower back, the most prevalent symptom with 40% of cases, is highly indicative of excessive effort during loadlifting. Inadequate flexion of the trunk, torsion when carrying objects and lack of postural stability increase pressure on the intervertebral discs, generating muscle fatigue and possible long-term injuries (Bernard, 1997). The International Labor Organization (ILO) points out that low back disorders are one of the main causes of absenteeism from work in jobs with load handling, which highlights the importance of implementing preventive strategies.

Knee pain, reported by 10% of workers, may be associated with deep flexion postures, where the joint receives a greater weight load. The incorrect use of body mechanics, such as bending the back instead of the knees, increases pressure on the lower back and the femorotibial joint, favoring injuries (NIOSH, 1991). In view of this situation, it is essential to promote training in safe load handling techniques and reinforce ergonomic measures to reduce the incidence of musculoskeletal disorders in workers.

In conclusion, the results obtained reflect a considerable exposure to risks of musculoskeletal disorders derived from manual handling of loads, evidenced by the prevalence of musculoskeletal pain in different regions of the body. The high incidence of discomfort in the lower back, neck and shoulders highlights the need to strengthen prevention strategies, as these conditions can lead to chronic musculoskeletal disorders if not corrected in time.

Scientific evidence supports that factors such as improper flexion of the trunk, twisting when lifting objects and repetitive lifting of loads above shoulder level significantly increase the risk of injury. In this context, it is essential that the company implements effective ergonomic measures, such as continuous training in safe lifting techniques, active breaks and the improvement of working conditions. The adoption of these strategies will not only contribute to reducing the incidence of muscle ailments, but will also improve the productivity and well-being of workers, promoting a safer and more efficient work environment.

Identification of the dangers of musculoskeletal disorders, characterization of the activities that are the source of the hazard and the control measures implemented by the hardware store for the prevention of fatigue and injuries due to manual handling of loads.

Identifying the dangers of musculoskeletal disorders in the hardware store required a detailed analysis of activities involving manual handling of loads, as these can lead to fatigue and musculoskeletal injuries if not properly managed. According to the International Labour Organization (OTI, Guidelines on Ergonomics and Manual Handling of Loads at Work, 2021), handling loads without proper technique or appropriate ergonomic measures can lead to musculoskeletal disorders such as low back pain and strains. To mitigate these risks, it is essential to characterize the activities that are the source of the hazard, considering factors such as the weight of the materials, the frequency of handling, and the postures adopted by the workers. Likewise, the implementation of control measures, such as ergonomics training, use of mechanical aids, and active breaks, contributes significantly to the reduction of the incidence of injuries and improves working conditions in the hardware store (OTI, Guidelines on Ergonomics and Manual Handling of Loads at Work, 2021).

Section 3: Hazard and Risk Identification

The identification of hazards and risks is a fundamental process in the management of occupational health and safety, as it allows the detection of potential threats that may affect the physical and mental integrity of workers. This process involves recognizing both obvious hazards, such as improper handling of loads or exposure to toxic substances, and risks associated with less visible conditions, such as fatigue or work stress. The correct identification of these factors allows the implementation of effective control measures to mitigate their impact, preventing accidents and occupational diseases. According to (Rodríguez J., 2020), an accurate and systematic identification of hazards is the basis for the planning of preventive interventions, contributing to creating safer and healthier work environments. In addition, this process must be continuous and participatory, involving both employers and employees to ensure its effectiveness and adaptability in the face of possible changes in the work environment.

A. Occupation of the worker in the hardware store

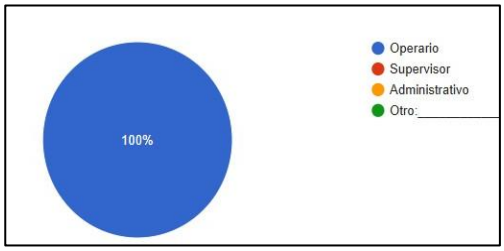

Figure 8. Position in the Company

Note. The figure shows the types of positions of workers in the company. In original language, Spanish

The analysis of the variable shows that 100% of the exposure corresponds to operators, while supervisor, administrative and other positions are not represented (0%). This indicates that the management of the risk of musculoskeletal disorders falls mainly on the operational personnel, who are directly involved in the handling of loads. However, the absence of participation from other hierarchical levels suggests the need to strengthen awareness and training in all positions, promoting a culture of comprehensive prevention in the company.

According to the Descriptive Manual of Positions developed for the Rojas y Rodríguez Hardware Store, this tool constitutes a fundamental support in the management of human resources, providing a detailed documentary base on the characteristics and requirements of each position within the company. Its elaboration followed various methodological stages, including the collection of information about the company, its organizational structure and

existing positions. Through observations and communication with management, the structure of the manual was designed and adjusted, obtaining a final version after feedback from management.

The process included the collection, documentation, analysis and approval of the information of each position, with the active participation of the collaborators. The implementation of this manual will allow the hardware store to improve internal organization, define hierarchical levels, establish lines of authority and optimize the contracting and distribution of functions.

It is recommended that it be disseminated in the company and used as a basis in hiring, induction, training and performance evaluation processes, contributing to better management of human talent (Jimenez & Estela, 2008). In this sense, the creation of a similar document for Ferretería Santamaría S.A. aims to provide a key tool for human resources management, serving as a documentary basis to describe the characteristics and requirements of each position within the organization.

B. Time of service in the workplace

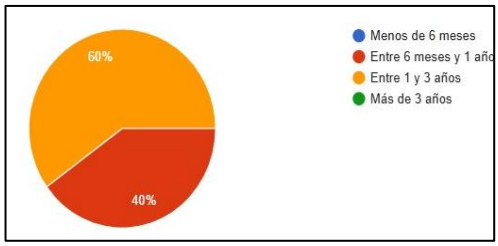

Figure 7. Time in Office

Note. The figure shows the times in the positions of the workers in the company. In original language, Spanish

The analysis of the variable indicates that 60% of the staff have remained in their position for between 1 and 3 years, which reflects stability and consolidation in their functions. On the other hand, 40% of employees have been employed for between 6 months and 1 year, which suggests a process of constant renewal and adaptation underway. There are no workers with less than 6 months or more than 3 years in the position (0% in both cases), which shows a low turnover in the short term, but also poses possible challenges in the retention of talent in the long term.

A study entitled Endomarketing and organizational commitment in MSEs in the hardware sector in the province of Huamanga - Ayacucho in 2023 found a positive and significant correlation between endomarketing strategies and employee organizational commitment (Serda, 2023). This suggests that the implementation of internal marketing strategies, such as strengthening the sense of belonging and the recognition of performance, can contribute to increasing the retention of workers in the company. In the context of the Santamaría Hardware Store, the application of these strategies could be key to improving talent retention and strengthening work commitment.

In this sense, the job stability observed in the company can translate into benefits for both workers and the organization. Tenure allows for the accumulation of experience and the development of industry-specific knowledge, which improves operational efficiency and service quality. However, to ensure the sustainability of this stability over time, it is essential to implement strategies that promote employee satisfaction and commitment, thus avoiding talent drain and guaranteeing more efficient management within the Santamaría Hardware Store.

C. Frequency of handling loads at work

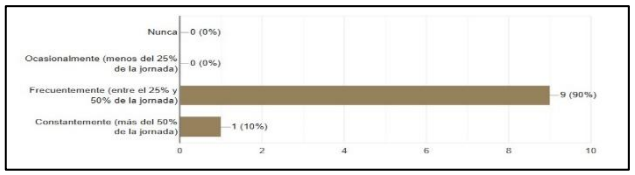

Figure 8. Frequency of load handling at work

Note. The figure shows how often workers handle loads in the company.
In original language, Spanish

The analysis of the variable reveals that this activity is a central function in the company, since 90% of the staff performs it frequently (between 25% and 50% of the day), while 10% do it constantly (more than 50%). There were no cases in which the handling of loads was null or occasional (0% in both categories), which highlights the need to implement ergonomic strategies and prevention measures to mitigate the risks of musculoskeletal disorders and improve working conditions.

A study entitled "Design of an intervention proposal to reduce the risks of musculoskeletal disorders of the staff of the Bolívar Plaza hardware store located in the city of Popayán, Cauca" addresses this issue in depth. The research reveals that workers are exposed to risks of musculoskeletal disorders due to forced postures, repetitive movements and manual handling of loads, highlighting the need for interventions to mitigate these factors. In addition, it highlights the importance of evaluating and controlling the frequency of load handling in the hardware environment (Fernadez & Tania, 2021).

In this sense, analysing the frequency of load handling at the Santamaría Hardware Store is essential to identify risks of musculoskeletal

disorders and establish preventive measures that protect the health of workers, thus guaranteeing a safer and more efficient work environment.

D. Weight of the loads it handles

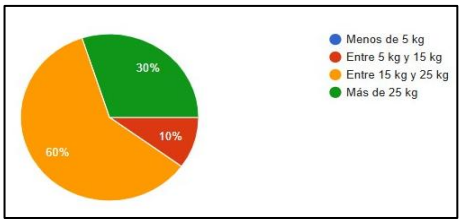

Figure 9. Average loads handled

Note. The figure shows the average weight of the loads handled by the workers. In original language, Spanish

The analysis of the variable "Average weight of handling loads" in the operating personnel of the hardware store shows that 60% of the workers handle loads between 15 kg and 25 kg, 30% of the workers handle loads of more than 25 kg and 10% of the workers handle loads between 5 kg and 15 kg. while no worker handles weights less than 5 kg (0%). This distribution indicates that a large portion of personnel are exposed to handling heavy loads, which can increase the risk of musculoskeletal injuries.

According to the "Standard on Manual Handling of Loads" of the University of Cantabria, the maximum recommended weight for a worker should not exceed 25 kg, while, for women, young or older workers, this limit is reduced to 15 kg. In special circumstances, able-bodied and physically trained workers can handle loads of up to 40 kg, provided it is sporadically and in safe conditions (Manual Load Handling Standards, 2007).

In relation to the study carried out at the Santamaría Hardware Store, these guidelines are especially applicable to the hardware sector, where the handling of heavy materials is a frequent activity. Therefore, it is essential that companies implement preventive measures and provide adequate training to guarantee the safety and health of workers in the handling of loads.

E. Frequency of lifting loads from the ground

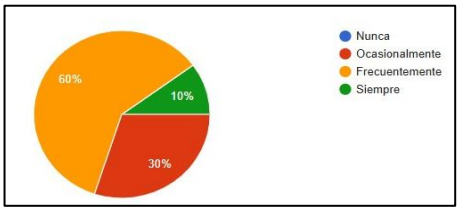

Figure 12. Frequency of lifting loads from the ground

Note. The figure shows the frequency of lifting loads from the ground. In original language, Spanish

The analysis of the variable in the operating personnel of the hardware store shows that 60% of the workers perform this action frequently, 30% do it occasionally and 10% always lift loads from the ground, while no worker (0%) avoids this practice. This distribution shows that a large part of the staff repeatedly performs this biomechanical gesture, which can increase the risk of injuries and ailments in the lower back and knees.

The "NIOSH Method," a widely used tool for assessing risk in manual lifting, considers a variety of factors, including the frequency of lifting, to determine a risk index and establish whether a task is safe or potentially harmful to the worker. According to this method, the frequency is classified into ranges ranging from less than 0.2 lifts per minute to more than 9 lifts per minute, which allows the level of risk to be assessed and appropriate intervention strategies to be designed (Ergonautas, 2024).

Since the handling of loads is a recurring activity in the hardware sector, it is essential that the Santamaría Hardware Store implements periodic ergonomic evaluations that consider the frequency and conditions in which these lifts are carried out. An adequate evaluation will allow the identification of risk factors for musculoskeletal disorders or prevent musculoskeletal injuries and optimize work processes, reducing fatigue and improving the well-being of workers. In addition, the implementation of preventive measures, such as training in safe lifting techniques and the reorganization of tasks, will not only contribute to the protection of the health of personnel, but will also favor a more efficient and productive work environment.

F. Handling of loads in awkward or forced positions

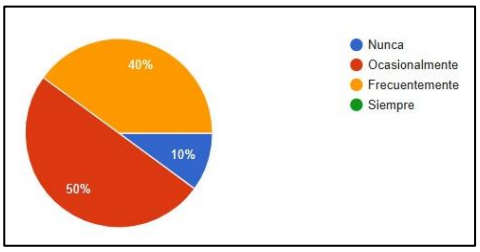

Figure 11. Handling loads in awkward or forced positions

Note. The figure shows the handling of loads in forced postures by workers. In original language, Spanish

The analysis of the variable "Should you handle loads in uncomfortable or forced positions?" in the hardware store's operating personnel reveals that 50% of the workers perform this action frequently, 30% occasionally, 10% always and 0% never. These results

show that a significant proportion of employees adopt improper postures when lifting loads from the ground, which can increase the risk of musculoskeletal injuries, especially in the lower back and knees.

The study "Manual load handling as the main ergonomic risk factor triggering lumbar disorders in the construction industry" points out that poor posture and overexertion when lifting and transporting heavy objects are determining factors in the appearance of lumbar disorders (Rodriguez, 2021).

Applying these findings to the context of the Santamaría Hardware Store, it can be concluded that certain conditions of the work environment, such as lack of adequate space, uneven or slippery floors, and adverse environmental conditions, may force workers to adopt forced postures, increasing the risk of back injuries. Therefore, it is essential to implement ergonomic prevention strategies that minimize exposure to these risks and improve working conditions.

Section 4. Characterization of the Activities Source of the Hazard

The characterization of the activities that are the source of the hazard is an essential step in the management of occupational health and safety, since it allows the identification and description of the tasks or processes that represent a risk to workers. This analysis consists of a detailed examination of the activities carried out in the workplace, with the aim of recognizing the conditions, tools, equipment and methods that could generate specific hazards, such as falls, overexertion and exposure to toxic substances. (Gómez A., 2021), understanding how and why certain activities generate these hazards is crucial to designing effective control measures that minimize their impact. In addition, this process must consider both ergonomic factors and organizational and operational conditions, to ensure a comprehensive risk assessment. The proper characterization of these activities allows prioritizing interventions and resources, thus contributing to the creation of a safer and healthier work environment.

A. Activities involving lifting

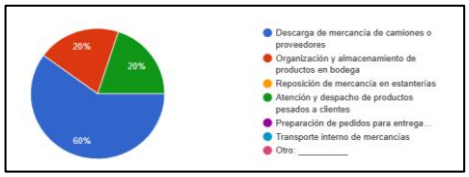

Figure 12. Activities carried out with lifting loads

Note. The figure illustrates the activities that involve lifting loads. In original language, Spanish

The analysis of the activities related to lifting loads at the Santamaría Hardware Store shows that 60% of the employees unload merchandise from trucks or suppliers, while 20% are involved in the organization and storage of products in the warehouse and the attention and dispatch of heavy products to customers. However, the activities of replenishment of goods on shelves, preparation of orders for delivery or shipment, and internal transport of goods are not represented in the indicators, with 0% in each. This distribution suggests that the most demanding tasks in terms of cargo handling are concentrated in the reception and delivery of goods, which can have implications for exposure to ergonomic risks and musculoskeletal disorders, especially if the necessary precautions are not taken (Gaviria, 2020).

The absence of workers in tasks such as replenishing goods on shelves and picking orders could reflect automation or a division of labor where these activities do not involve significant physical effort. However, the tasks related to unloading and organizing products are critical from an occupational safety point of view. Lifting loads in forced and repetitive positions can lead to musculoskeletal disorders, such as herniated discs or tendonitis (Burdor, 2019). It is important to recognize that 60% of the workload in intense physical activities such as unloading goods must be accompanied by preventive measures to reduce the risks associated with handling loads, such as training in safe lifting techniques and the use of assistive equipment (Del Río, 2022).

The implementation of ergonomic prevention strategies should be a priority in areas with the highest load, such as the unloading and dispatch of heavy products. In activities with 0% participation, although in principle they do not present an immediate risk, they could be areas where training can be reinforced and the need for ergonomic interventions in the future can be evaluated. Studies have shown that a continuous assessment of workloads, even in seemingly minor tasks, helps to identify potential hidden risks and improve working conditions in a comprehensive manner (Vega, 2021). Therefore, the planning of ergonomic interventions and training programs must be adapted to the specific characteristics of each activity to mitigate the negative impact on the worker's health.

B. Most frequently lifted products

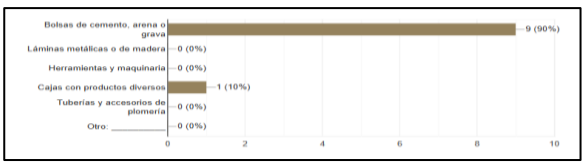

Figure 13 Type of products you usually lift most frequently

Note. The figure presents the results on the most frequently raised products In original language, Spanish

Frequent handling of bags of cement, sand or gravel, which account for 90% of the products lifted in the hardware store, involves significant ergonomic risks. Manual lifting of heavy loads can lead to musculoskeletal disorders, especially in the lower back, due to repetitive efforts and improper posture. According to the National Institute for Occupational Safety and Health (INSST), any task that involves manually lifting loads over 3 kg should be assessed to identify potential risks (INSST, 2023). The handling of these loads can have a progressive impact on the health of workers if the necessary precautions are not taken, such as the use of appropriate techniques to reduce physical effort and the implementation of periodic breaks.

On the other hand, the handling of boxes with various products, which constitutes 10% of the products lifted, also presents ergonomic risks. Although the weight of these boxes may be less, the variety of sizes and shapes can make safe handling difficult, increasing the likelihood of injury. The use of improper lifting techniques and lack of ergonomics training can contribute to these risks. The INSST highlights that the manual handling of loads, regardless of their weight, can be dangerous if they are not carried out correctly (INSST, 2023). Training in the proper way to lift, move and store these products is crucial to prevent injuries to the workers who handle these boxes.

It is relevant to note that the company does not report the handling of other products such as metal or wood sheets, tools and machinery, pipes and plumbing accessories, which could indicate a specialization in the sale of lighter construction materials. However, the lack of exposure to these products does not diminish the need to implement preventive measures for products that are handled. Training in safe lifting techniques, the use of appropriate personal protective equipment, and the promotion of active breaks are essential to reduce the risks associated with handling loads in the work environment (INSST, 2023). The absence of other heavier products does not mean that workers are exempt from injury if proper precautions are not taken.

Section 5. Control measures

Control measures are actions designed to reduce or eliminate occupational hazards associated with physical tasks or manual handling of loads. These strategies focus on preventing musculoskeletal injuries, which are common in jobs that require repetitive strain, heavy lifting, or improper posture. To be effective, control measures must be implemented in a comprehensive manner, ranging from the modification of working conditions to the continuous training of personnel. According to (Martínez F., 2021), control measures include both technological interventions, such as the use of ergonomic tools, as well as organizational actions, such as the implementation of active breaks and the periodic review of work procedures. In addition, recent research has highlighted the importance of occupational safety awareness and education, ensuring that workers understand the relevance of adopting safe practices (Pérez J., 2023). The combination of these measures is essential to minimise risks and protect the worker's health in the long term.

A. Availability of mechanical tools to facilitate lifting of loads

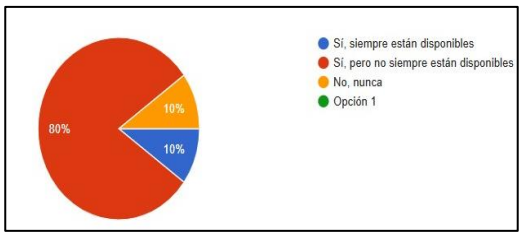

Figure 14. Tools or mechanical equipment to facilitate lifting loads (forklifts, forklifts, hoists, etc.)

Note. Distribution of mechanical tools for lifting loads.
In original language, Spanish

The evaluation of the availability of mechanical tools or equipment at the hardware store reveals that 80% of workers report that these equipment, such as forklifts, forklifts and hoists, are not always available, which could increase the risk of musculoskeletal injuries. 10% have constant access to these tools, while the other 10% have no access at all. This lack of availability suggests that there is no policy in place to ensure continuous access to this equipment, which could negatively impact employee health and safety, especially in tasks that require heavy lifting.

The use of mechanical tools is essential to reduce the load on workers, as highlighted by the (OTI, 2009), since they help to avoid repetitive movements and inappropriate postures. However, the lack of availability of this equipment underscores the need to implement adequate and regular maintenance, as suggested by the (OTI, 2015) to ensure its effectiveness. In addition, training in the proper use of these tools is crucial, as it educates workers on the correct handling and postures to adopt, which also contributes to the reduction of injury risks, according to (Rosenstock, 1998).

Another important strategy is the implementation of additional technologies, such as exoskeletons, which have been shown to be effective in reducing the burden and likelihood of injury, especially in vulnerable areas of the body such as the spine, as noted (Siegmund, 2019). Although their cost is high, their incorporation can significantly improve occupational health in the long term, resulting in higher productivity and less absenteeism.

Finally, since the availability of mechanical tools is not guaranteed, it is recommended to implement task rotation policies. This measure could reduce continuous exposure to repetitive efforts, decreasing the likelihood of musculoskeletal injuries, as suggested by several studies in ergonomics.

B. Use of assistive tools to lift or move loads

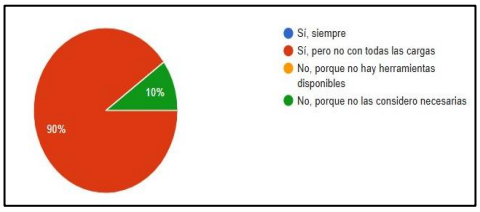

Figure 15. Use of an assistive tool to lift or move loads

Note. Availability of mechanical tools for lifting loads. In original language, Spanish

The analysis of the use of tools to help lift or move loads at the Santamaría Hardware Store reveals that 90% of the workers use some tool to facilitate the lifting or transfer of loads, although they do not do so with all loads. The remaining 10% do not use these tools, as they do not consider them necessary. This pattern suggests that while most employees use tools when possible, there is a perception that they are not always necessary for all loads, which could be related to a lack of training or limited availability of suitable tools for each type of load. (Gómez F., 2022), the use of assistive tools, such as forklifts, lifts, or manual cranes, is essential to reduce physical exertion and minimize the risk of musculoskeletal injuries, especially when handling heavy or bulky loads.

Proper use of assistive tools can significantly decrease the load on the worker's body, reducing the risk of injuries related to manual lifting. According to a study by (Rodríguez J., 2021), the implementation of ergonomic assistance equipment improves operational efficiency and contributes to the prevention of musculoskeletal disorders, as it allows workers to handle loads more safely and with reduced effort. However, failure to use these tools in all cases may be an indication that the tools are not available or are not considered mandatory for certain types of loading.

To improve safety at work and reduce the risks of musculoskeletal disorders, Santamaria Hardware may consider increasing the availability and use of ergonomic tools, ensuring that all loads are handled safely and efficiently. According to research by (Martínez S., 2023), companies that provide assistive tools and train their employees in their proper use manage to significantly reduce injuries related to manual lifting of loads. In addition, it is crucial to foster a culture of safety in which the use of tools is seen as an essential preventive measure, regardless of the weight or size of the loads.

5. CONCLUSIONS

The examination of the results from the survey of employees of the Santamaría Hardware Store facilitated the identification of several factors linked to the risk of musculoskeletal disorders related to the manual handling of products. The tasks carried out in this type of business include continuous activities of lifting, transporting, storing and organizing construction materials, which causes frequent exposure to intense physical exertion. This situation indicates that the work environment in the hardware sector has characteristics that favor the appearance of ergonomic risks, especially when activities are carried out without the help of mechanical tools or without the proper implementation of safe techniques for handling loads.

The study's findings indicate that a significant portion of employees report musculoskeletal discomfort in different areas of the body, particularly in the lower back and shoulders. This distribution of symptoms evidences the biomechanical overload that is generated during manual material handling activities, where lifting and carrying loads causes tension in the spine and upper joints. The existence of these discomforts acts as an early warning of possible musculoskeletal conditions, which can progress to more severe injuries if interventions are not made in working conditions in a timely manner. In this context, the identification of these nuisances implies recognizing the need to strengthen preventive measures within the company's operational activities.

On the other hand, the analysis of labor practices revealed that manual handling of loads is very frequently carried out in the daily routines of operational personnel. This situation indicates that employees are repeatedly exposed to ergonomic risk factors, such as lifting objects off the ground, performing torso turns, carrying heavy materials, and adopting improper postures while performing their tasks. The combination of these elements

increases the chances of developing musculoskeletal disorders, especially when activities are carried out for long periods or without adequate breaks that allow muscle recovery.

Another important aspect found in the study was the scarcity of mechanical aids or ergonomic tools that facilitate the lifting and transport of materials. The lack or insufficiency of these types of resources forces employees to make direct physical efforts to move loads of various weights and sizes, which increases the biomechanical load on the musculoskeletal system. This circumstance highlights the need to consider the ergonomic redesign of work processes, integrating equipment and tools that reduce the physical effort necessary in operational activities.

When it comes to staff training, the study's findings show that most employees have received some form of instruction in safe methods of handling loads. However, it became clear that these trainings are not carried out with the necessary regularity to ensure the constant updating of the knowledge and skills of the staff. The lack of renewal in training programs can limit the adequate implementation of ergonomic techniques in the work, increasing the probability of adopting inappropriate practices that facilitate the appearance of injuries in the musculoskeletal system.

The study also showed that workers' sociodemographic characteristics, such as age and work experience, can affect their exposure to risks related to the musculoskeletal system. Employees who spend more time performing demanding physical tasks may accumulate repetitive efforts over time, which elevates the susceptibility of the musculoskeletal system to chronic injury or discomfort. In this context, the study of these variables is crucial to understand how individual factors are related to working conditions and how they contribute to the generation of ergonomic risks.

Likewise, the results obtained suggest that manual handling of loads not only poses a risk to the health of employees, but can also negatively impact the productivity and performance of the organization. Musculoskeletal discomfort can lead to physical fatigue, reduced work capacity, increased absenteeism and reduced efficiency of operational tasks. Therefore, early detection of these risks is essential to make decisions that improve working conditions within the company.

Similarly, the study highlights the need to strengthen ergonomic evaluation processes in the agency's occupational health and safety management system. The identification of the activities with the highest risk due to manual handling of loads makes it possible to establish priorities in risk management and direct preventive actions that help to reduce the incidence of musculoskeletal disorders in operating personnel.

Finally, the results of the research provide significant information to understand the dynamics of ergonomic risks in the hardware sector, especially in small and medium-sized companies where a large part of operational tasks depend on the physical effort of workers. The analysis of the survey data provides a diagnostic basis that helps identify the factors that affect the occurrence of musculoskeletal disorders and underscores the need to further develop preventive strategies to improve working conditions, strengthen the culture of occupational safety and promote healthier and more sustainable work environments.

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