# ANALYSIS OF THE PERCEPTION OF ERGONOMICS IN THE HONDURAN COFFEE SECTOR.

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*Abstract*— **Musculoskeletal symptoms experienced by coffee growers result from having to maintain awkward postures, perform repetitive efforts, endure long workdays on sloped terrain, and lack ergonomic training. This study examines the perception of ergonomics in Honduras's coffee sector, aiming to assess whether preventive practices exist for these symptoms and to determine how workers perceive ergonomic risks and characterize their working conditions. To achieve this, a literature review of scientific and academic research on musculoskeletal risks in the coffee sector was conducted. A structured survey was administered to 41 individuals belonging to small and medium‐scale farm and cooperative harvesters. Information was gathered on their sociodemographic data—such as age, experience, and educational level—as well as the frequency of symptoms they experienced, including low back pain, wrist pain, and shoulder pain. For example, 26.8% of respondents reported periodic low back pain. Data were also collected on risk perception, adoption of general ergonomic practices, and terrain slopes, with 66% of workers reporting that they labor on moderately or very steep terrain. The results show that few people take regular stretching breaks: 14.6% never pause, and only 17.1% do so frequently. Workers under 25 years old adjust their posture far less often than those over 55 years old. The combination of physical loads, working angles, and lack of ergonomic technique adoption explains the high prevalence of musculoskeletal symptoms. Ergonomics in Honduras's coffee sector is underdeveloped; although there is awareness of the risks, the implementation of preventive ergonomic practices and training to educate workers is lacking, as 97% of them have not completed secondary education. It is recommended to design training programs tailored by age group, implement mandatory breaks during coffee‐related activities, develop best‐practice protocols based on international standards, and conduct monthly training sessions. These actions will reduce injury risk and ensure improved well‐being for coffee growers.**

*Keywords*— *Ergonomics, Coffee sector, Perception, Working conditions, Occupational health, Individual factors, Ergonomic practices, Musculoskeletal risks, training, Honduras, Labor productivity.*

## I. Introduction

Coffee activities are essential to the economy of Honduras. This activity provides for thousands of families and contributes significantly to the country's agricultural GDP. However, the activities that are developed in the coffee sector, such as coffee harvesting, roasting, and coffee planting, imply having to maintain forced and uncomfortable postures. As well as having to make repetitive efforts and working long hours on an inclined terrain. These implications favor the appearance of musculoskeletal symptoms such as pain in the lower back, shoulder and wrists. In addition, there is the lack of training which educates the worker to have better ergonomics and the lack of higher education. This allows workers to be aware of the damage they may be doing to themselves and take corrective actions to reduce possible risks. The objective of the study is to analyze and investigate if preventive practices exist to reduce musculoskeletal symptoms and to determine how workers perceive the ergonomic risks they face. For this purpose, a bibliographic review of scientific and academic studies on the coffee sector was carried out and a survey was applied to 41 farm and cooperative workers. The results confirm that there is a lack of training and implementation of ergonomic practices, especially among the younger age groups and those with less education. This study seeks to encourage other researchers to use this information as a starting point. Likewise, to contribute to the implementation of ergonomics in the Honduran coffee sector, promoting better ergonomic practices for the health and wellbeing of workers.

## II. State of the Art

### A. Ergonomic Risks

Manual coffee harvesting means that workers will be in awkward positions and perform repetitive movements. During harvesting, muscle activity measurements reveal that the carpal extensor muscle is 20% above maximum voluntary contraction [1]. Similarly, in Colombia, it is documented that 79% of coffee growers have lower back pain and 68% have hip pain. This is due to forced postures over long periods of time [2]. Participation in coffee production activities results in musculoskeletal risks and biomechanical overload that will have a negative effect on the individual over time.

Surveys conducted on certified farms in Honduras show that up to 82.9% of workers have musculoskeletal problems in parts of the body such as the lower back, shoulders, and forearms [2]. In addition, a study on a farm located in Quindío, Colombia, shows how certain muscles in the body have high values in their maximum voluntary contraction, causing high levels of musculoskeletal [3]. Coffee growers are exposed to high levels of ergonomic risks, which triggers the

urgency to develop a way to prevent such risks, such as professional training at the time of producing and growing coffee. According to the study conducted by Estrada-Muñoz and Rodríguez-Espinosa, the parts of the body that present the greatest ergonomic risk are: lower back, hips, forearms, arms, knees, and shoulders, as shown in Figure 1.
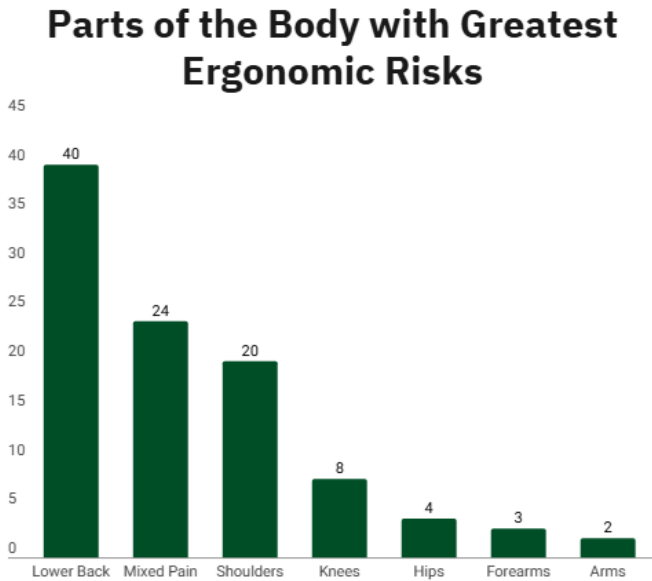
## Parts of the Body with Greatest Ergonomic Risks



Fig. 1. Parts of the Body with Greatest Ergonomic Risks, Own creation.

### B. Working Conditions in the Coffee Sector

Working hours in the coffee sector are usually quite long, from 5 a.m. to 5 p.m., with few breaks and without adequate use of ergonomic techniques [4]. Seventy-one percent of workers work more than eight hours a day on coffee farms; 86% handle heavy loads and 100% work on sloping terrain, forcing workers into awkward postures, as can be seen in Figure 2 [5]. The extreme conditions to which coffee growers are exposed generate various musculoskeletal risks, affecting areas such as the lower back, knees, and arms. This means that workers are more likely to 20 suffer injuries, take longer to recover for the next day, and increase absenteeism in the coffee sector.

Coffee farmers often work without a formal contract, and their employment varies depending on the season. The lack of a structured contract and the lack of tools to care for the body worsen the working conditions [6]. People working in the coffee sector are more likely to suffer musculoskeletal risks, as they must pick large quantities of coffee with repetitive movements and forced positions for long periods. It is important to improve ergonomics in this activity to ensure worker health.

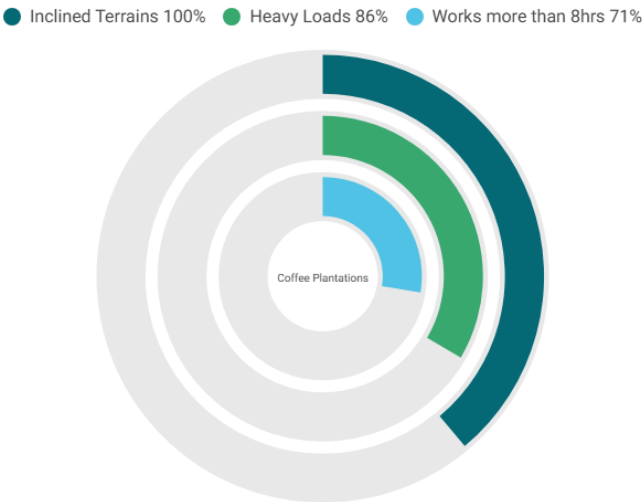## Working Conditions Associated with Ergonomic Risk in the Coffee Sector



Fig. 2. Working Conditions Associated with Ergonomic Risk in the Coffee Sector, Own creation.

### C. Methdologies used to Assess Ergonomic Risks

To measure the musculoskeletal risks to which coffee growers are exposed, instruments such as the Nordic Musculoskeletal Questionnaire, the IPAQ, and observational methods such as REBA and OWAS are used, which allow for the standardized evaluation of postures and loads [6]. In addition, the ERIN method is also used, a tool that serves to measure risks individually and decide which ergonomic changes are most important to implement according to the work activity [7]. These tools and ergonomic knowledge allow precise observations to be made about musculoskeletal risks and provide a diagnosis based on real data. Using electromyography and electro-goniometry, it is possible to accurately determine the load to which coffee growers are exposed. It is also possible to observe how several specific muscles remain in the same position for repetitive periods of time during harvesting, due to forced [8]. Using electromyography adjusted to the maximum strength of the muscle, it can be found that there is high tension in the lower back, which is considered a dangerous activity [7]. The use of these ergonomic tools is essential for obtaining an accurate diagnosis of ergonomic risks in coffee farming activities and for designing strategies or new tools to improve ergonomics in this sector. Figure 3 shows the most common ergonomic assessment methods used, according to the information compiled in the studies cited.

# Most Commonly Used Ergonomic Assessment Methods

● RULA 12.51%  ● Electrogoniometry 20.82%  ● REBA 33.33%
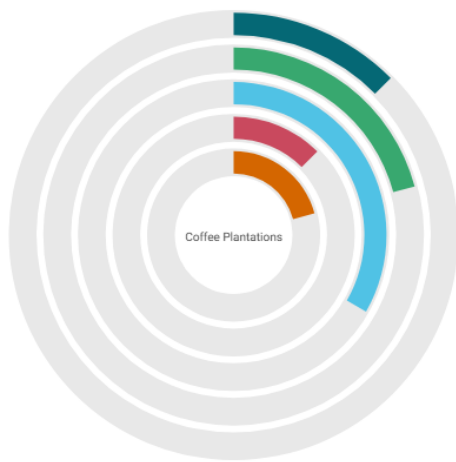● OWAS 12.51%  ● Electromyography 20.82%

Coffee Plantations

Fig. 3.  Most Commonly Used Ergonomic Assesment Methods, Own creation.

## D. Worker Health and Safety

Musculoskeletal disorders account for more than 50% of health problems in the agricultural sector in Europe. Up to eight out of ten workers report symptoms related to these musculoskeletal disorders, as shown in Figure 4 [9]. In Honduras, there are no regulations, policies, or prevention strategies to address the lack of ergonomics to which coffee harvesters are exposed [10]. The reality for coffee farmers is that they do not have adequate working conditions. Therefore, it is essential to improve working methods to ensure health and prevent short- and long-term injuries in this sector.

There are several international and national standards, such as the NOM in Mexico and the guidelines of the ILO. These standards have proven to be highly effective in reducing ergonomic problems through prevention programs, training, and better tools [11]. It is important to adopt and implement work policies that require employers to ensure better ergonomics for coffee farmers. The proper implementation of these policies would reduce accident rates and create a healthier and safer work environment.

# Report of Workers Presenting Musculoskeletal Syptoms

■ With Musculosketal Syptoms

■ Without Musculoskeletal Syptoms

Fig. 4.  Report of Workers Presenting Musculoskeletal Syptom, Own creation.

## E. Perception of Coffe Growers

Coffee pickers are aware of the risks involved in working in the coffee sector, such as being in awkward positions and performing repetitive movements. However, it is considered that the ergonomic solutions that exist do not provide a solution to the ergonomic problems and the real needs of coffee growers [12]. In Mexico, there is evidence of an imbalance between theoretical knowledge of Occupational Safety and Health (OSH) and its effective implementation in the coffee sector [13]. The involvement of workers in the creation of ergonomic solutions is essential, as they are the ones who experience the risks and fatigue, and are a vital part of creating effective and lasting solutions. If workers are not involved, the factor of their own experience will be missing in the creation of ergonomic techniques [14][15].

Reports given to workers to fill out about their discomfort when participating in a coffee-related activity reveal that the parts of the body that experience the most discomfort are the lower back, knees, and wrists. The most serious discomfort is in the lower back, as shown in Figure 5 [14]. In addition, surveys conducted in Honduras in 2022 reveal that 82.9% of coffee growers have had some musculoskeletal symptoms [6]. This info shows that workers are aware that they're exposed to fatigue and injuries from their work, but it doesn't say if they know this is due to a lack of ergonomics and policies in the coffee sector.
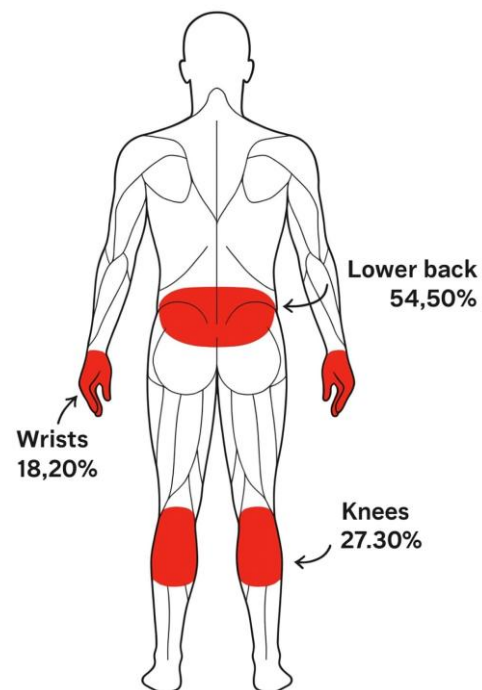
Lower back
54,50%

Wrists
18,20%

Knees
27.30%

Fig. 5.  Body Areas with Highest Discomfort Reported During Coffee-Related Activities, Own creation.

## F. Ergonomics

Ergonomics has established itself as the scientific discipline dedicated to exploring the relationship between workers and the various elements of their work environment. It seeks to improve this relationship in order to ensure people's well-being and

improve the efficiency of the system [12]. Although ergonomic practices were tacit, it was in 1949 that the term was formalized and fully encompassed the study of work in relation to the work environment and its tools [11]. Ergonomics is a scientific field in which focus must never be lost, because it is this science that helps to design workplaces that prioritize workers' well-being and, at the same time, optimize their performance.

The application of ergonomic tools and principles in coffee production allows the identification and elimination of causes that exceed the maximum effort that a worker should exert during manual harvesting, such as posture and force, which exceed the recommended thresholds for this repetitive activity [15]. In Colombia, studies have been conducted that show a lack of adaptation of tools and techniques for coffee harvesting. During harvesting, muscle loads exceeding 20% of maximum voluntary contraction are generated, which can lead to injury risks [7]. The lack of ergonomic knowledge in this activity means that specific ergonomic adjustments must be implemented, such as adapting certain tools, better training for workers, and postural training. This is essential to reduce musculoskeletal risks and prioritize the health of the individual.

## III. METHODOLOGY

The methodology used in order to achieve the general objective of the study, which is the analysis of the degree of implementation of ergonomics in the Honduran coffee sector, is a quantitative and descriptive design. This research adopts such methodology [16] for research related to perception and health in coffee growing. Structured surveys will be conducted with coffee growers to obtain the data needed. The data collected allows the study to quantify perceptions, identify individual factors and characterize the working conditions that generate ergonomic risks in workers.

### A. Variables

A dependent variable was taken from four independent variables. The dependent variable is the level of knowledge about ergonomics risks the workers have and the four independent variables are:

- Sociodemographic data
- Working Conditions
- Perception of ergonomic risks
- Adoption of ergonomic practices

### B. Methods

- Microsoft Visio: Microsoft Visio is a tool that allows you to create various diagrams such as a flowchart, block diagrams and more. In addition to being able to create diagrams, Visio has the ability to create business matrixes in an intuitive way. It also offers accessibility features so that diagrams can be modified to the user's liking [17].
- Microsoft Project: Microsoft Project is a tool that allows and facilitates the planning, scheduling, and tracking of tasks in complex projects. This tool includes timelines, Gantt charts and resource tables

that help to choose personnel, control costs, view times, among others [17].

- Google form: Google Form is a tool designed to create questionnaires, forms, and online surveys. It is widely used for surveys to collect large volumes of data in a standardized and anonymous way [18].
- Canva: Canva is an online platform that allows users to make a wide variety of graphic designs, presentations, posters, advertisements, brochures, publications, and more. The platform is known for its ease of use and pre-designed templates. Since Canva is free, its users range from people with no graphic design experience to professionals [19].
- Inforgram: Infogram is an online tool that allows you to create interactive charts, reports, and attractive and interactive data visualizations without the need for programming knowledge. This tool has pre-designed templates such as Canva which can be integrated with different sources such as Google Sheets. In addition, Infogram presents the results in a clear and dynamic way, attracting more users [20].
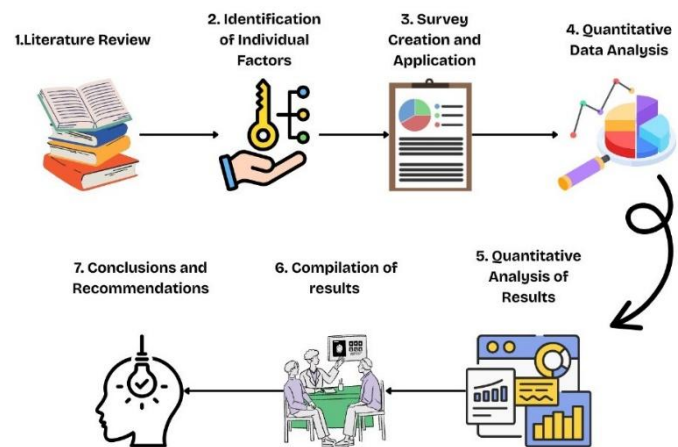
### C. Methodological process



Fig. 6. Methodological process used, Own creation.

The priority of this study is to focus on investigating individual factors, such as age, experience and level of education, which influence the perception and implementation of ergonomic practices. These factors influence the perception and implementation of ergonomic practices, as well as the way in which coffee growers perceive ergonomic risks, like the forced postures they face on a daily basis. To this end, a literature review was carried out on ergonomics in the coffee sector, reviewing regulations such as the OIT. A structured survey was developed and applied to 41 coffee growers to collect quantitative data on the perception of risks, the frequency of musculoskeletal symptoms and the use of ergonomic techniques applied. In addition, observations were carried out on two coffee farms to determine the working conditions that increase the risk to physical integrity of coffee growers, such as sloping terrain. The data collected were

organized to perform a descriptive analysis of percentages in which ergonomic perceptions and practices were characterized. Finally, both blocks of information were combined to highlight the most important conclusions and develop recommendations focused on ergonomic practices.

## IV. ANALYSIS AND RESULTS

This section presents the results obtained from the survey applied to a total of 41 people working in the coffee sector and cooperatives in Honduras. These people are coffee growers and workers of coffee cooperatives. By surveying them, it was possible to obtain a broader vision of working conditions, ergonomic risks, and the factors that influence the adoption of ergonomic practices. The objective is to analyze the perception of ergonomic risks, working conditions, and whether they are adopting any type of ergonomic practices such as the use of gloves. The results are directly related to the objectives of the research, showing and highlighting the main factors that can influence the implementation of ergonomic practices and the well-being of coffee workers.

### A. Working Conditions

One of the main findings was that lower back pain is the most commonly reported symptom among respondents, as shown in Figure 2. This symptom is caused by performing repetitive activities on inclined terrains, lack of breaks, and the absence of ergonomic techniques. 30% of the individuals present frequent discomfort in the lower back and 19.5% always have discomfort when carrying out a coffee activity. 26% of the individuals have pain sometimes and 19.6% rarely. The 4.9%, which comes from individuals under 25 years of age, never have discomfort in the lower back. This may be due to the fact that people of this age have greater elasticity and capacity for recovery after much effort or sustained postures.
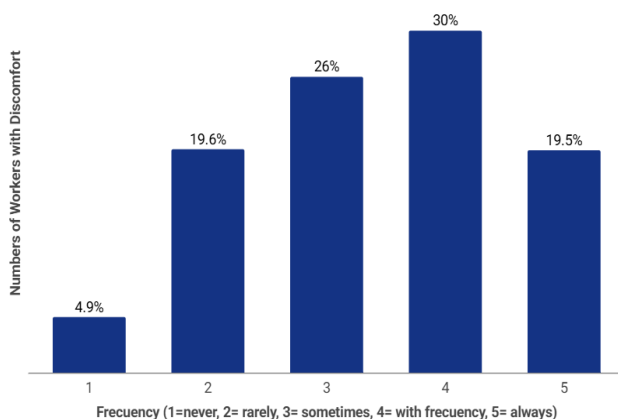


Fig. 7. Discomfort in lower back, Own creation.

In addition, a possible correlation was found between the frequency with which bent postures are adopted and the level of lower back pain. Figure 3 shows how the data collected from the surveys prove that workers who are never in an inclined

posture report less lower back pain. On the other hand, it is not possible to observe a progressive increase between the frequency from rarely to always. This is because the sample is too small to represent the progressive pattern. However, the data carried out by other studies [6], have a sufficiently large sample with which they can demonstrate that forced postures and repetitive movements considerably increase the risk of developing a musculoskeletal symptom. This confirms the correlation that increased frequency of bending over is associated with greater low back pain.
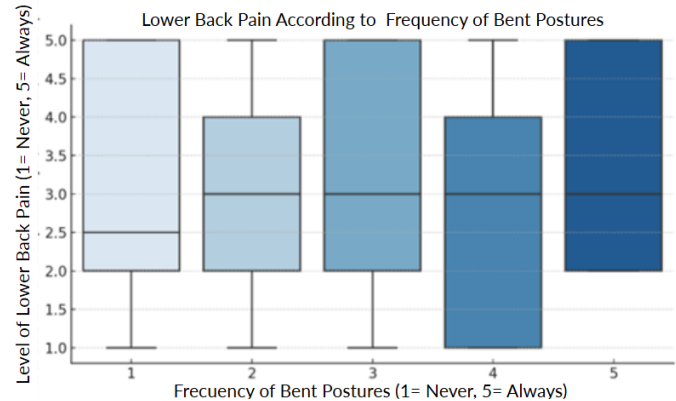


Fig. 8. Pain in the lower back according to frecuency of bent Postures, Own creation.

The working conditions in which coffee activities are carried out present several constant physical challenges for workers. Among them, one of the most relevant factors is the handling of heavy loads, as shown in Figure 4. The survey results show that 29.3% indicated that they never handle objects over 50 pounds. However, 17.1% said that they rarely do so. 19.5% do it sometimes. 22% indicated that they do it frequently and finally, 12.2% said that they always perform this task. These data show that, although a high percentage of respondents do not perform this activity frequently, more than 34% of workers do handle heavy loads on a regular basis. This represents an ergonomic risk for workers, which can lead to musculoskeletal injuries such as lower back, shoulder and knee injuries.
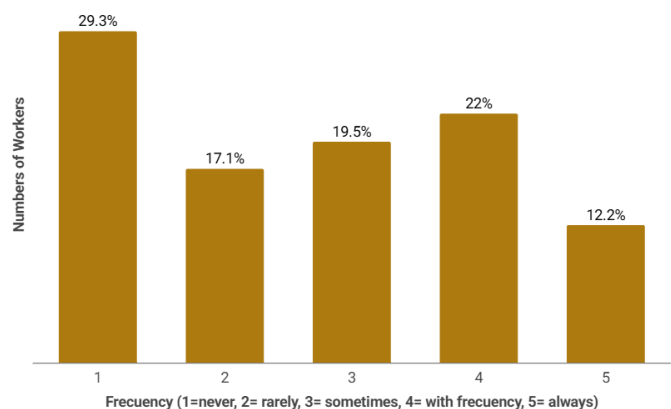
Fig. 9. Handle of heavy loads over 50 pounds, Own creation.

In addition, there is another relevant factor, the degree of slope of the land on the farms. 66% of the workers answered that the land where they carry out coffee activities is moderately inclined or very inclined. Figure 5 shows in more detail the percentage of slope that each type of land has. The surveys indicate that the land where coffee growers work tends to be moderately or very steep. Working on an inclined terrain has important physical implications because the worker needs to maintain balance, adopt a forced posture, and make more effort if he/she needs to carry a load or tool.
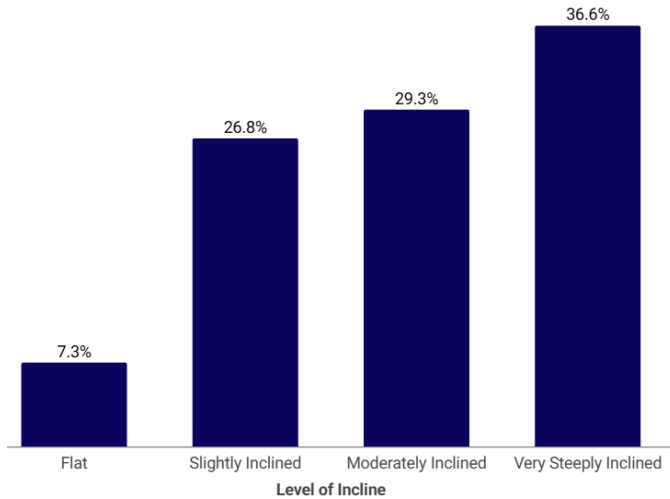


Fig. 10. Level of incline in the Honduran coffee farms, Own creation.

Finally, the physical effort required in the field is high due to the steep terrain and long working hours. Figure 6 shows that 34.1% of the workers consider that the sloping terrain sometimes increases the difficulty of the work, while 22% responded that it always makes it difficult. Likewise, 17.1% said that the terrain often makes their tasks difficult. These results show that the terrain increases daily physical labor, limits safety, and decreases task efficiency.
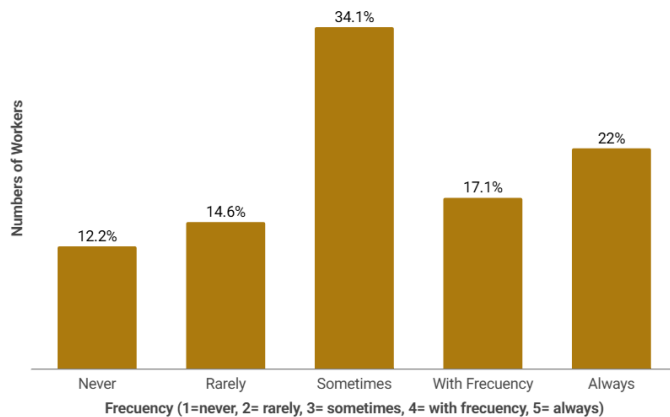


Fig. 11. Increased difficulty of working on steep terrains, Own creation.

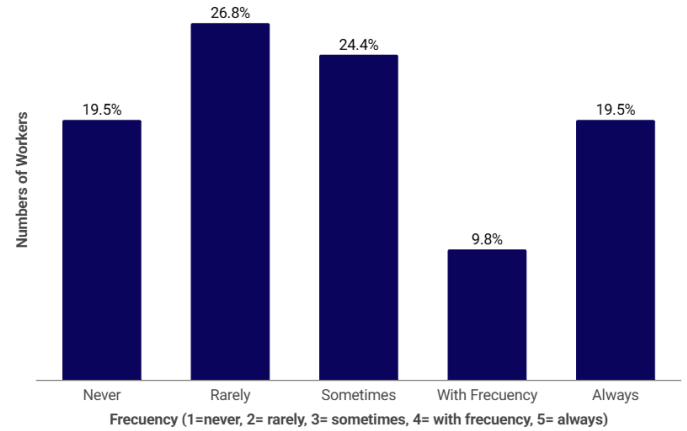## B. Influence of Individual Factors on Adoption of Ergonomic Practices



Fig. 12. Do you bend your knees instead of bending over with your back to lift or move objects? Own creation.

Figure 7 shows how 46.3% of the workers do not bend their knees instead of bending with their backs. Only 34.2% do it regularly or from time to time and only 19.5% always do it. The results indicate that the majority of coffee growers do not use the correct technique of bending their knees when bending over, causing musculoskeletal symptoms over time. In addition, Figure 6 shows that 41.4% do not take stretching breaks, while 41.5% do so frequently or always. This indicates that there is a better adoption of ergonomic practices than in Figure 7. However, the fact that more than 40% do not stretch regularly indicates that basic ergonomic knowledge is needed to avoid injuries and maintain the well-being of workers.
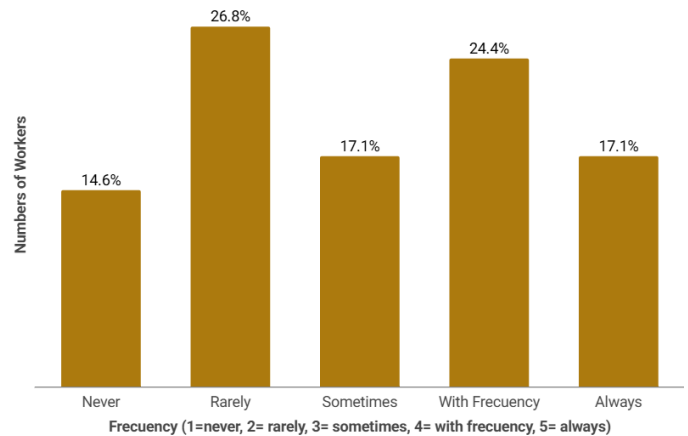


Fig. 13. Do you take breaks to stretch your back, arms, or legs every so often? Own creation.

Finally, Figure 9 shows that workers under 25 years of age have the lowest frequency of posture adjustment. It is demonstrated through the data that there is an ascending tendency in which the older the worker the greater the need to adjust their posture. This means that older workers have developed a greater perception of the impact that coffee activities have on their bodies. This is due to the fact that they have experienced discomfort more frequently and understand

the origin of the pain. Likewise, experience allows them to associate pain with inadequate practices. This way, they know how to recognize when they are in a forced posture or performing an excessive effort which will cause them some type of symptom. In addition, people over 55 have greater discomfort in their bodies. This relationship between age and posture adjustment emphasizes the importance of technical training, especially for younger workers, so that they can avoid musculoskeletal symptoms.
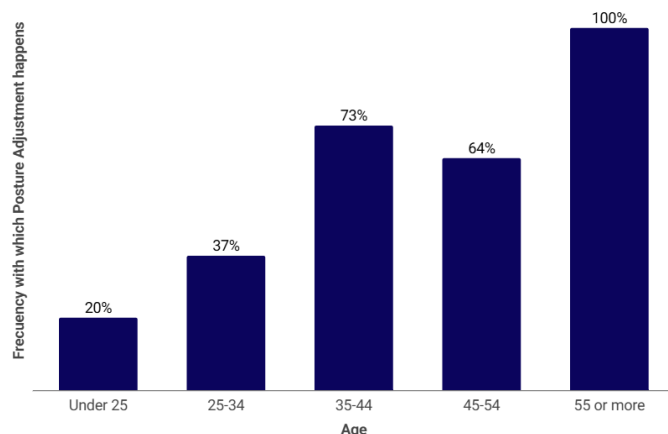


Fig. 14. Posture adjustment according to age group, Own creation.

## V. CONCLUSIONS

Coffee growers and cooperative workers do perceive and recognize the musculoskeletal discomfort that comes from forced postures, repetitive movements, inclined terrains and more. A total of 19.5% reported lower back pain "always", only 29.3% flex their knees so as not to bend frequently or always, and 41.5% take breaks to stretch every so often. This shows a gap between risk awareness and the adoption of preventive measures.

The results reveal that personal factors such as age, gender and experience do have some influence on whether ergonomic practices are adopted or not. 100% of workers over 55 adjust their posture on a regular basis because they may be in discomfort more frequently. In addition, their experience has taught them to easily recognize when they are overexerting their posture. Leaving aside those over 55 years of age, only 20% of those under 25 years of age adjust their posture regularly, proving the lack of ergonomic techniques. It is worth noting that 97% of respondents do not go beyond high school. This goes hand in hand with the lack of implementation of preventive actions. Due to the lack of education, it is possible that coffee growers do not know the importance of taking breaks during their work activities and maintaining a neutral posture. Improving academic education and training are key to improving ergonomic habits.

The physical conditions of the coffee fields aggravate the situation faced by coffee growers. According to the survey, 66% of the workers work on farms with moderate or very steep terrain and 34% handle loads of more than 50 pounds. 71% of the individuals work more than eight hours a day without sufficient breaks. The combination of climate, long working hours, steep terrain, heavy loads and lack of ergonomic tools generates high levels of risk for workers. Finally, this indicates the need for interventions in this sector to improve the way work is done on coffee farms.

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