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MUSCULOSKELETAL DISORDERS AND ERGONOMIC RISKS IN A FLORICULTURAL COMPANY, MACHACHI, 2023

Maritza Leidy Yánez Morillo[1*] Cristina E. Almeida-Naranjo[2], Juan Carlos Flores[3], Navarrete Alboreda Edmundo Daniel[4]

[1*]Médico General, Estudiante de Magister en Higiene y Salud Ocupacional, Universidad Técnica del Norte.mlyanez@utn.edu.ec
[2]PhD. Universidad Técnica del Norte, Docente-IE-mail: cristina.almeida@utn.edu.ec
[2]Docente Investigador: Grupo de Biodiversidad Medio Ambiente y Salud (BIOMAS), Facultad de Ingeniería y Ciencias Aplicadas, Universidad de Las Américas, Redondel del Ciclista Antigua Vía a Nayón, Quito P.C. 170124, Ecuador. E-mail: cristina.almeida@udla.edu.ec
[3]PhD. Director Vinculo con la Sociedad ITSO Oriente, E-mail: jcflores@itsoriente.du.ec
[4]Ingeniero en Seguridad Industrial, Seguridad Ocupacional y Gestión Ambiental. Máster en prevención de Riesgos de Trabajo. PhD. En Ciencias de la Salud Ocupacional. Universidad Técnica del Norte. E-mail: ednavarrete@utn.edu.ec

*Corresponding Author: Maritza Leidy Yánez Morillo
*Médico General, Estudiante de Magister en Higiene y Salud Ocupacional, Universidad Técnica del Norte.mlyanez@utn.edu.ec

Abstract
This study explored the relationship between ergonomic risks and the development of musculoskeletal disorders (MSDs) among post-harvest personnel at a floriculture company in Machachi during 2023. Using a quantitative approach, two main instruments were employed: the Nordic questionnaire and the RULA method. The research revealed a significant correlation between MSDs and ergonomic risks in the workplace, with a correlation coefficient of 0,457, indicating a meaningful relationship between these variables.

It was observed that bunchers experienced a high incidence of musculoskeletal issues in both arms and forearms, each at 87,5%. Similarly, cutters showed uniform impacts in the same regions. Classifiers reported a high prevalence of neck disorders at 76.9%. Age group analysis revealed that younger workers, aged 20 to 25, primarily experienced leg disorders, represented by 33.3%. In contrast, the 36 to 45 age group showed a very low prevalence of musculoskeletal discomfort, with the neck being the most affected area at only 10.7%. Workers aged 40 to 60 had the highest incidence of leg problems, represented by 33.3%.

In terms of gender, it was found that women experienced musculoskeletal discomfort in the right arm, forearm, and wrist at 57,7%, compared to men who reported 42,3%. Finally, the RULA method assessment identified that the positions of buncher, cutter, and classifier, with a score of 6, require immediate action and task redesign due to a high level of ergonomic risk. In contrast, the packer position scored four, indicating that task changes are needed to mitigate risks.

Keywords: *Musculoskeletal disorders, Ergonomic risks, Packagers, Cutters, Classifiers.*

Introduction

Musculoskeletal disorders (MSDs) include conditions of muscles, tendons, bones, cartilage, ligaments, and nerves. Such disorders encompass a wide range of health problems, ranging from minor injuries to severely disabling conditions (1) . According to Urrejola et al (2) , MSDs emerge as a global concern in occupational health and occupational medicine, affecting various occupations and work contexts not limited to developed countries.

From the perspective of Pacheco et al, MSDs are injuries of the locomotor system frequently originating at work, mainly affecting the back, neck, shoulders and upper extremities. In Latin America, occupational illnesses and injuries account for economic losses of 9 to 12% of the Gross Domestic Product (3) (4) . Torres and Amador point out that, in industrialized environments, the severity of these injuries increases the risk of accidents, affecting various parts of a worker's body at different times. (5)

MSDs range from muscle and joint aches to more severe conditions such as tendonitis, bursitis, carpal tunnel syndrome, and herniated discs. These conditions limit functionality and reduce the quality of life and work performance of those affected (6) . In the workplace, factors such as inadequate ergonomic conditions, maintained postures, repetitive movements and manual handling of loads promote the development of MSDs. (7)

According to Carrasco et al (8) , MSDs are intrinsically related to ergonomic risks (ER). Above all, because these risks arise when the work environment is not adequately adapted to the physical capabilities of the worker, including aspects such as the ergonomics of the job, repetition of movements and exposure to adverse working conditions. A poor adaptation of the workplace can increase musculoskeletal conditions, directly affecting the well-being and efficiency of the worker.

In flower businesses in Latin America, where the workforce makes up a significant part of the population and is important to the regional economy, it is essential to ensure safe, satisfactory and healthy working conditions. Setting these standards will not only promote worker well-being, but also optimize performance and production in the sector (9) . Floricultural businesses face specific challenges due to the physical nature of the work, which includes growing, handling, and processing flowers and ornamental plants. The activities mentioned often require manual handling of loads and repetitive tasks, increasing the risk of occupational injuries and illnesses. (10)

A significant risk is that caused by repetitive movements of the upper limbs. These are characterized by constant pressure on muscles, tendons, ligaments, and joints, which can lead to inflammation and MSDs. Caiza et al, define repetitive motions as work cycles of less than 30 seconds, common in tasks that require frequent use of hands, wrists, elbows, and shoulders. (11) (12)

Bojaca & Naranjo analyzed the relationship between ER and MSDs in flower crop workers in Colombia, along with the psychosocial factors that influence these disorders. The results showed that repetitive motions in tasks such as harvesting and pruning impose constant stress on muscles and joints, increasing the risk of developing MSDs such as tendonitis and carpal tunnel syndrome. (13) ,

In Ecuador, Vilañez prepared an ergonomic study and its prevalence in MSDs of the operating personnel of the post-harvest area of the Valentina Flowers Flower Company. It was determined that the production process in this area involved a series of activities that demanded that workers adopt forced postures to carry out their tasks effectively. Certain postures caused discomfort and long-term health problems in the workers. (14) ,

Work-related MSDs have multiple clinical and socioeconomic implications. Among the main consequences is chronic pain, which affects the functionality of body regions such as the back, neck, shoulders and extremities(15). Exposure to prolonged static postures is linked to myalgia and functional impairment in muscles, especially in the cervical region and shoulders. At the same time, degenerative disorders are observed in the spine, particularly in the neck and lumbar region, manifesting themselves in workers who perform manual or physically demanding tasks (16).

Therefore, it is imperative to address MSDs and ER in the workplace, as well as to implement preventive and corrective measures that promote safe and healthy working conditions. Among which are the proper design of workstations, training in ergonomics, use of ergonomic equipment and tools, rotation of tasks and active breaks. For this reason, the main objective of this study is to establish the relationship between SRs and the development of MSDs in the personnel of the post-harvest area of a flower company located in the city of Machachi during the year 2023. (16)

Methodology

The research was based on a quantitative approach, which focused on the collection and analysis of numerical data to answer research questions and evaluate the hypothesis. This method is characterized by its emphasis on objectivity, accuracy, and generalizability of results to a wider population. Standardized measurement instruments, such as questionnaires and physical tests, were used to collect data, which were analyzed using statistical techniques that include descriptive analysis and regression models (17) .

On the other hand, the research was correlational and sought to identify relationships between two or more variables without assuming a direct causal relationship. This method used statistical analyses to calculate the correlation coefficient and determine the strength and direction of the relationships between the variables. By employing this method, associations between variables are identified without implying a direct causal connection, which provides a more complete view of the subject under study(18).

This research study is retrospective in nature, relying on the analysis of past data and events to gain insight into a specific phenomenon. This strategy assessed the presence of MSDs and exposure to ER in an earlier period, allowing for the identification of historical trends and a better understanding of the current situation(19).

Likewise, a cross-sectional research was used, which focused on investigating the prevalence of conditions or characteristics in a population at a given time. With this methodology, information was obtained on the presence of MSDs, exposure to ER, and other variables of interest in the personnel of the postharvest area at a specific time. The population consisted of 33 workers, selected through non-probability sampling.

The study was carried out on the staff of the post-harvest area of a flower farm located in the city of Machachi. It included 36 subjects selected according to the inclusion criteria presented in Table 1.

Board 1 ***Inclusion Criteria for Population Selection***

Criterion	Specification	Rationale for selection
Seniority of the worker	Minimum 1 year	Ensures that participants have sufficient exposure to the specific working conditions of the post-harvest area
Age Range	20 to 60 years old	It allows the participation of the active workforce in the company.
Staff characteristics	Relationship of dependency	He ensures that the study covers those who are under the company's health and safety policies

The Nordic Questionnaire was used as an instrument for risk assessment. According to Mateos et al. (20) , the standardized Nordic Questionnaires for the analysis of musculoskeletal symptoms arose as a response to the need to adjust existing data collection tools, with the aim of allowing coherent comparisons between different studies. These instruments were designed to improve accuracy and consistency in the assessment of musculoskeletal problems in various research contexts. In the present research, the questionnaire focuses its questions on the symptoms that are most frequently found in workers who are exposed to physical demands, especially of biomechanical origin.

On the other hand, the RULA method (based on specific observation) was applied in postural evaluation. This scoring system takes into account several factors. Factors include upper and lower body posture, muscle activity, strength and frequency required, and duration of the task (21) . Based on these factors, an ergonomic risk score was assigned, which made it possible to identify areas of

concern and prioritize interventions to improve working conditions and prevent musculoskeletal injuries.
On the other hand, to ensure a rigorous and detailed analysis of the data collected, the statistical software SPSS (Statistical Package for the Social Sciences) was used. The results of this study provided fundamental information on the interaction between the SMD and ER variables and will serve as a basis for the development of effective intervention strategies aimed at improving the health and well-being of health personnel in the area of flower companies.

Correlational Hypothesis

Aguilar et al (22), assert that a correlational hypothesis is a statement that predicts a relationship between two variables. The correlational hypothesis indicates that when one variable changes, the other changes too, but without affirming a direct causal relationship between them. That is, a correlational hypothesis suggests that there is a correlation between two or more variables. However, it does not establish that one variable is the cause of the other. The usefulness of correlational hypotheses lies in their ability to identify variables that are related to each other, which can be a preliminary step before conducting more in-depth studies to explore causal relationships.
The data correlation hypothesis in the present research has been confirmed by the alternative hypothesis, where:
H0: There is no correlation between the variable musculoskeletal disorders and the variable ergonomic risk. If p value is < 0.05, H 0 is rejected and H1 is accepted.
H1: There is a correlation between the variable musculoskeletal disorders and the variable ergonomic risk. If p value is > 0.05, H0 is accepted and H1 is rejected.

Normality test

Normality testing is a statistical procedure used to determine whether a dataset follows a normal distribution. This evaluation is fundamental in statistics because many analysis techniques, such as parametric tests, assume that the data are distributed in a normal way. Some of the most well-known tests to verify normality are the Shapiro-Wilk test, the Kolmogorov-Smirnov test, the Anderson-Darling test, and the D'Agostino-Pearson test. In the present research, the Shapiro-Wilk test was used. (23)

Results

To analyze the study's findings, the statistician Shapiro-Wilk was used. For the TME variable, it was 0.510, with a degree of freedom (gl) of 33 and a bilateral significance (Sig.) of 0.000. While for the RE variable, the Shapiro-Wilk statistic was 0.478, with a degree of freedom (gl) of 33 and a significance (Sig.) of 0.000.
Since the significance level was less than 0.05, it was decided to use non-parametric tests. Therefore, Spearman's correlation test was used to examine the relationship between the variables of interest. Table 2 presents the results of the correlation of the variables. The correlation coefficient between MSDs and ER was 0.457, indicating a significant correlation. This led to the rejection of the null hypothesis and the acceptance of the alternative hypothesis H1.

Table 2 ***Correlation between MSDs and ergonomic risk***

	THANK YOU,	RE
Correlation coefficient	1,000	0,457
Sig. (bilateral)	-	0,007
Correlation coefficient	0,457	1,000
Sig. (bilateral)	0,007	-

Note: Data retrieved from the SPSS data. The term "Sig. (bilateral)" refers to "bilateral significance" or "significance of two variables.

Table 3 provides demographic and labor data for the study population. A predominance of women, the youth of the labor force, the diversity of labor roles, and the relatively short time in current jobs are observed. These factors should not only be considered individually, but also in their interrelationship, to develop ergonomic intervention strategies that are effective and specific to the unique characteristics of this working population. According to Gómez et al. Identifying and understanding these factors allows for a more holistic and accurate approach to ergonomic risk assessment and mitigation, thereby promoting a safer and healthier work environment. (24)

Table 3Sociodemographic and employment data

	Number of participants (N)	Percentage (%)
Gender		
Female	19	57,6
Male	14	42,4
Age range (years)		
	N°	%
20-25	8	24,2
26-35	16	48,5
36-45	3	9,1
46-55	6	18,2
Workstation		
	N°	%
Bonchadores	8	24,2
Classifiers	13	39,4
Packers	4	12,1
Cutters	8	24,2
How long you've been doing the same type of work (years)		
	N°	%
1-2	25	75,8%
2-3	6	18,2%
3-4	1	3,0%
More than 4 years	1	3,0%
Work in the week (h/week)		
	N°	%
30-35	0	0,0%
35-40	2	6,1%
40-45	13	39,4%
45-50	18	54,5%

Note: Data retrieved from SPSS data

As a complement to the demographic data provided, Table 4 presents the body mass index (BMI) of the participants, broken down by job position. Overall, the distribution of BMI among different jobs suggests that certain job roles, such as those of bonchadores and cutters, are associated with an increased risk of obesity and preobesity. For Barneo et al. These findings highlight the importance of considering job-specific factors when designing health and well-being interventions. (25) ,

Table 4 ***BMI according to the job position***

Workstation	Workers (%) of (BMI)			
	PN	**SP**	**PO**	**OB**
Bonchadores	21,1	0,0	30,0	50,0
Classifiers	42,1	100,0	30,0	0,0
Packers	15,8	0,0	10,0	0,0
Cutters	21,0	0,0	30,0	50,0

Note: Data retrieved from the SPSS data. BMI represents the body mass index of the employees

who participated in the sample. PN: normal weight; SP: Overweight; PO: Pre-obesity; OB: Obesity.
On the other hand, in this study, it was visualized how MSDs impact each worker studied, also considering the influence of the age, gender and job position of the workers. Table 5 shows the prevalence of MSDs by job position, these data revealed that bonchadores and cutters show the highest rates of problems in the upper extremities and neck. Sorters and packers also present considerable risks, although to a lesser extent. As for the leg area, the bonchadores are the most vulnerable to developing MSDs in this region, while the packers are the ones that face the least risk. These findings underscore the importance of tailoring specific ergonomic interventions for each occupational group, considering the particularities of their tasks and the areas of the body most affected(18).

Table 5 *Prevalence of musculoskeletal disorders by job*

Workstation	Workers (%) affected by:								
	BD	**BI**	**AD**	**AI**	**MD**	**MY**	**CU**	**TR**	**PI**
Bonchadores	87,5	12,5	87,5	12,5	87,5	12,5	87,5	25,9	41,7
Classifiers	69,2	30,8	69,2	30,8	69,2	30,8	76,9	40,7	25,0
Packers	75,0	25,0	75,0	25,0	75,0	25,0	75,0	11,1	8,3
Cutters	87,5	12,5	87,5	12,5	87,5	12,5	100,0	22,2	25,0

Note: Data retrieved from the SPSS data. BD: right arm, BI: left arm, AD: right forearm, AI: left forearm, MD: right wrist, MI: left wrist, CU: neck, TR: trunk, PI: leg.

The prevalence of MSDs according to the age of workers in different areas of the body is shown in Table 6. Overall, the data show that the prevalence of MSDs varies significantly with age, highlighting the importance of age-specific interventions. Young workers have a lower prevalence of MSDs, possibly due to their greater resilience.

Table 6 *Prevalence of musculoskeletal disorders by age*

Age Range	Workers (%) affected by:								
	BD	**BI**	**AD**	**AI**	**MD**	**MY**	**CU**	**TR**	**PI**
20-25	26,9	14,3	26,9	14,3	26,9	14,3	25	25,9	33,3
26-35	42,3	71,4	42,3	71,4	42,3	71,4	42,9	44,4	0,0
36-45	11,6	0	11,6	0,0	11,6	0,0	10,7	11,1	33,3
46-60	19,2	14,3	19,2	14,3	19,2	14,3	21,4	18,6	33,3

Note: Data retrieved from the SPSS data. BD: right arm, BI: left arm, AD: right forearm, AI: left forearm, MD: right wrist, MI: left wrist, CU: neck, TR: trunk, PI: leg.

Table 7 shows a differential distribution of the prevalence of MSDs according to the gender of the workers in different parts of the body. Women are more affected than men in all the areas evaluated, which highlights the need to consider sex in the design of ergonomic interventions and occupational health programs. According to Manterola et al. For women, interventions should focus on reducing static load and repetitive motions in the upper extremities and neck. For men, although the presence of MSDs is lower, it is crucial to address specific ergonomic risks, focusing on education on correct postures, proper use of tools and load handling techniques. (19)

Table 7 *Prevalence of musculoskeletal disorders by sex*

Sex	Workers (%) affected by:								
	BD	**BI**	**AD**	**AI**	**MD**	**MY**	**CU**	**TR**	**PI**
Female	57,7	57,1	57,1	57,1	57,7	57,1	60,7	63,0	58,3
Male	42,3	42,9	42,9	42,9	42,3	42,9	39,3	37,0	41,7

Note: Data retrieved from the SPSS data. BD: right arm, BI: left arm, AD: right forearm, AI: left forearm, MD: right wrist, MI: left wrist, CU: neck, TR: trunk, PI: leg.

On the other hand, Table 8 provides the impediment to work due to MSDs in different areas of the body. Overall, data indicate that MSDs affect workers in various regions of the body, with the most affected areas being the right shoulder and neck. These findings underscore the need for a comprehensive and body-specific approach to the implementation of ergonomic interventions.(26)

Table 8 *Impediment to work due to musculoskeletal disorders*

Region	Workers with a disability to work (%)
HD	30,3
AD	3,0
AI	3,0
MD	12,1
MY	3,0
CU	27,3
TR	9,1
PI	12,2

Note: Data retrieved from the SPSS data. HD: Right shoulder; AD: right forearm, AI: left forearm, MD: right wrist, MI: left wrist, CU: neck, TR: trunk, PI: leg.

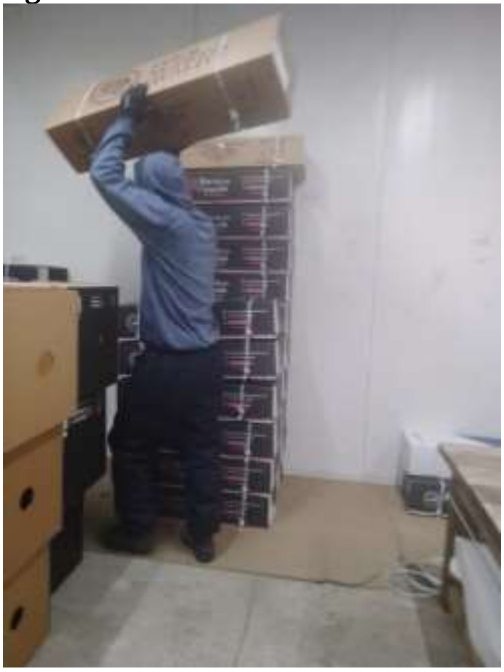
On the other hand, the Rula Method was used to analyze the ER, the application of this method allowed a detailed analysis of the postures and movements of the workers that could potentially lead to injuries or discomfort. The analysis was divided into two groups according to the areas of the body affected: the first group includes the arms, forearms and wrists (Group A), while the second group covers the neck, back and legs (Group B). Figure 1 shows the postures of a worker in the position of bonchador. In group A the arm is rotated between 20° of flexion and 20° of extension. The forearm is between 60° and 100° of flexion. The wrist is extended at more than 15°, so the RULA score is 4, implying a risk level 2. In group B, the neck is flexed above 20° and is lateralized. The trunk is flexed to more than 60° and is also lateralized, obtaining a RULA score equal to 6 and a risk level 3.

Figure 1 *Worker at Bonchador's post*

Note: Taken from https://www.ergonautas.upv.es/ergoniza/app/index.html.

Figure 2 shows the postures of a worker in the position of packer. In group A: the arm is in 90º flexion/raised shoulder and abduction. The forearm is flexed between 60-100º. The wrist is in >15° flexion with radial or ulnar deviation. In addition, the wrist rotates with repetitive movements. Rula score: 3. Risk level: 2. In Group B: the neck is in extension with lateral tilt. The trunk is flexed to more than 60º Rula score: 4. Risk level: 2.

Figure 2 *Worker at the Packer Position*



Note: Taken from https://www.ergonautas.upv.es/ergoniza/app/index.html.

Figure 3 shows the postures of a worker in the position of bonchador. In group A: The arm is flexed between 21 and 45º. The forearm is between 60 and 100 ° of flexion and crosses the midline or performs an activity to the side of it. The wrist is between 0 and 15º of flexion. Rula score: 3. Risk level: 2. In Group B: The neck is in extension with lateral tilt. The neck is flexed above 20º and lateralized. The trunk is flexed and rotated between 21 and 60 º Rula score: 6. Risk level: 3.

Figure 3 *Worker at the cutter post*

Note: Taken from https://www.ergonautas.upv.es/ergoniza/app/index.html

Figure 4 shows the postures of a worker in the position of bonchador. In Group A: The arm is between 20° of flexion and 20° of extension, the arm is abducted. The forearm is between 60 and 100° flexion. The wrist is in a neutral position. Rula Score: 6. Risk Level: 3. Group B: The neck is between 11 and 20° flexion and the neck is lateralized. Trunk flexed between 0 and 20°. Rula score: 6. Risk level: 3.

Figure 4 *Classifier Worker*

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Note: Taken from https://www.ergonautas.upv.es/ergoniza/app/index.html.

Table 9 shows that positions with a RULA score of 6 in both groups, such as the bonchador, cutter, and sorter, require immediate action and task redesign due to a high level of ergonomic risk. On the other hand, although the position of packer scored a 4, it also needs changes in tasks to mitigate risks.

Table 9 *Risk level for each job*

Group	Workstation	Rula Score	Risk level	Performance
To	Bonchador	4	2	Changes in the task may be required, it is advisable to deepen the study.
	Packer	3	2	Changes in the task may be required, it is advisable to deepen the study.
	Cutter	3	2	Changes in the task may be required, it is advisable to deepen the study.
	Sorter	6	3	Task redesign is required. Action is necessary.
B	Bonchador	6	3	Task redesign is required. Action is necessary.
	Packer	4	2	Changes to the task may be required; It is advisable to deepen the study.
	Cutter	6	3	Task redesign is required. Action is necessary.
	Sorter	6	3	Task redesign is required. Action is necessary.

Note: Taken from the evaluation of the workers

Discussion

The results of this study are in line with the findings of Kgakge et al. who reported a significant correlation of 0.45 between the ER and MSDs in the floriculture industry. Likewise, Ratul et al, in their research on the prevalence of Musculoskeletal Pathologies in floriculture, indicated that a large majority of workers experienced discomfort in critical areas such as the neck, shoulder, dorsal, lumbar area, elbow, forearm, and wrist or hand, these discomforts persisted during the last 12 months and were attributed to factors such as the use of scissors, stress, improper posture and excessive strength. These findings validate and reinforce the results of the present research, as they show a significant correlation between MSDs and ERs evaluated. (27) (28)

The study conducted by Simbaña et al., provided a relevant perspective by addressing the correlation between ergonomic conditions in the workplace and the prevalence of MSDs, especially in relation to the lower back. (29) Demographic results showed a predominance of MSDs of men (75%) aged 25 to 35 years. On the other hand, in the present study, women had a higher prevalence of MSDs in several areas of the body, given the predominance of women in the present study. It should be noted that, in both cases, a concentration is observed in a specific age group of 26 to 35 years, which suggests the presence of a young and active working population. In addition, most of the participants in both studies had similar work experience, which could indicate a similar exposure time to working conditions and ergonomic hazards.

The relationship between the studies of Rodríguez et al. and Kaur et al. (30) (31) , and the results of the present research lie in their common focus on ergonomics and occupational health in related sectors, such as floriculture and horticulture. Although the two previous studies address other aspects such as the design of ergonomic tools and the optimization of agricultural jobs, the aim is the same, as the aim is to improve working conditions and prevent musculoskeletal injuries. In this sense, the findings of the present research can benefit from the approaches and practical solutions proposed in these studies. For example, by observing that certain jobs in the analyzed industry have a high ER, the ergonomic tools and strategies developed by these authors could be applicable to reduce these risks and improve the health and safety of workers. Similarly, digital human modeling techniques could provide valuable techniques for designing more ergonomic work environments and preventing musculoskeletal injuries in the population studied.

The research by Munala et al. (33) , on the prevalence of MSDs among flower farm workers in Kenya, found that, of the 270 farmworkers surveyed, 68.1% reported experiencing discomfort in one or more areas of the body during the previous year. It should be noted that MSDs are a significant problem in this population, which could be related to the physical demands of agricultural work (planting, harvesting and handling of heavy tools). The relationship between the results of this study in agricultural workers and the present work related to floriculture is clear, since both involve physically demanding tasks that can lead to MSDs.

Agriculture and floriculture share several similarities, as they are both agricultural activities that involve the cultivation and management of plants. For this reason, Barneo et al. (25) , provides a broad overview of the prevalence of MSDs and ER among farmers, with the lower back being the most affected region (annual prevalence of 47.8%). This implies that farmers in the lower part of the back bear greater physical load, due to activities such as manual handling of loads, uncomfortable and prolonged postures. On the other hand, the prevalence in upper limbs varies widely, from 3.6% to 71.4%. This variability may be influenced by the diversity of agricultural tasks and specific working conditions in different studies.

In the same vein, Ketut. (34) , addressed a study on clove flower pickers in Munduk village, providing a comprehensive overview of SRs and their impact on labour productivity. The data collected included ergonomic hazards from internal and external factors before and after work, using the Nordic Body Map questionnaire to predict MSDs. Fatigue was measured using the Core Quality of Life questionnaire (EORTC QLQ-C30) and heart rate was recorded with a pulse meter. The data obtained were analyzed using the Structural Equation Model (SEM) and the differences with a p-value < 0.05 were considered significant. The results of the research indicated that internal factors, especially age, have a significant negative influence on productivity. Workers aged 46 to 60 tend to experience greater physical difficulties and fatigue, which decreases their efficiency in harvesting tasks.

These findings highlight the importance of considering the age and physical ability of workers when designing and organizing work in the floriculture industry. All in all, the research provides a detailed understanding of how various ergonomic factors affect the productivity of clove flower pickers. The findings underscore the need for a comprehensive approach to managing ER, including improving working conditions, optimizing tools and equipment, and creating a supportive work environment. These recommendations are not only applicable to clove flower pickers, but can also be adapted and applied to other sectors of agriculture and industry to improve ergonomics and labor productivity.

Conclusions

The present research has demonstrated a positive and statistically significant correlation between the ergonomic risk assessed through the Rula Method and the prevalence of musculoskeletal disorders in the workers of a flower company. With a Spearman coefficient of 0.457 and a p-value of 0.007, the importance of addressing ergonomic factors as a means of reducing the prevalence of related disorders in physically demanding work environments is highlighted.

On the other hand, the findings indicate that interventions aimed at improving ergonomics in the workplace could have a significant impact on reducing musculoskeletal disorders, including the need to redesign workstations, review work practices, and provide adequate training to employees to minimize the risks associated with manual handling of loads. inappropriate postures and repetitive movements.

It is important to implement a regular ergonomic assessment within the company to identify and mitigate risks before they become effective injuries. In addition, it would be beneficial to establish a schedule of task rotation and frequent breaks for workers, to avoid overloading specific muscle groups. While the results are promising, the study has limitations, including the relatively small size of the population and the concentration in a single company. Future research should expand the study population and explore different types of work environments to validate and generalize these findings.

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