ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

Assessment of Work-Related Musculoskeletal Disorders and Associated Factors among Workers in Flower Farms in Southwest Shoa Zone of Oromia, Ethiopia

A research thesis submitted to the Graduate Program of Addis Ababa University, College of Health Sciences, School of Public Health, in partial fulfillment of the degree of Master of Public Health in Environmental and Occupational Health

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June 2025
Addis Ababa, Ethiopia

RESEARCH PROJECT SUBMISSION FORM

ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH

Master of Public Health (MPH) in Environmental and Occupational Health

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Full Title of the Research Project	Assessment of Work-Related Musculoskeletal Disorders and Associated Factors among Workers in Flower Farms in Southwest Shoa Zone of Oromia, Ethiopia
Duration of the project	January 2024 to June 2024
Study Area	Southwest Shoa Zone Flower Farm Sites in Oromia, Ethiopia
Source of Budget	AAU SPH
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APPROVAL SHEET

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COLLEGE OF HEALTH SCIENCES
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Assessment of Work-Related Musculoskeletal Disorders and Associated Factors among Workers in Flower Farms in Southwest Shoa Zone of Oromia, Ethiopia

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ACRONYMS

AAU	Addis Ababa University
AOR	Adjusted Odds Ratio
BMI	Body Mass Index
BoLSA	Bureau of Labor and Social Affairs
CI	Confidence Interval
ERB	Ethical Review Board
MSDs	Musculoskeletal disorders
NMQ	Nordic Musculoskeletal Questionnaire
COR	Crude Odds Ratio
PPS	Probability Proportional to Size
SPH	School of Public Health
SWSZ	Southwest Shoa Zone
WRMSDs	Work-related Musculoskeletal Disorders

ACKNOWLEDGMENTS

Above all, I thank the Almighty God for his everyday help. I am also very grateful to my advisors, Dr. Meaza Gezu and Dr. Teferi Abegaz, for their significant and valuable comments, inspiration, encouragement, and assistance in realizing my thesis research work.

Heartfelt gratitude is extended to the Environmental and Occupational Health team and all staff members for their invaluable advice, unwavering motivation, and steadfast, compassionate support.

I would like to express my sincere gratitude to Addis Ababa University and the School of Public Health for providing the necessary facilities and coordination during my M.Sc. studies.

I am thankful to the Norwegian Program for Capacity Development in Higher Education and Research for Development (NORHED) for publicly funding this research paper as part of my master's degree requirements in Public Health, with a specialization in Environmental and Occupational Health.

Finally, I would also like to express my sincere gratitude to the flower farm managers and coordinators, data collectors, and study participants for their time and cooperation throughout the data collection period.

Abstract

Background: Musculoskeletal disorders (MSDs) are prevalent in workplaces, especially in agriculture and floriculture. Working on flower farms presents significant risks for WRMSDs due to extended postures and repetitive tasks such as cutting, packing, storing flowers, and loading/unloading boxes.

Objective: This study assessed the prevalence of self-reported work-related musculoskeletal disorders and their associated factors among flower farm workers in the Southwest Shoa Zone of Oromia, Ethiopia.

Methods: This cross-sectional study examined WRMSDs and associated factors among 423 flower farm workers in Southwest Shoa, Oromia, from January to June 2024. Data were collected using the Nordic Musculoskeletal Questionnaire and analyzed with descriptive statistics and Chi-square tests ($p < 0.05$). Ethical approval was granted by the Research Ethics Committee of Addis Ababa University's School of Public Health.

Results: This cross-sectional study (Jan–Jun 2024) in Southwest Shoa Zone, Oromia, examined WRMSD prevalence and predictors among flower farm workers using interview data and logistic regression (OR, 95% CI, $p < 0.05$). The prevalence of WRMSDs was 63.36% (95% CI: 58.77–67.95%). Significant factors included age 25–35 years (AOR: 2.09; 95% CI: 1.07–4.08), being married (AOR: 2.09; 95% CI: 1.12–3.91), divorced/widowed (AOR: 5.00; 95% CI: 1.19–21.05), and basic literacy (AOR: 0.28; 95% CI: 0.11–0.67). Occupational and psychosocial factors—such as working in packhouses (AOR: 4.37; 95% CI: 1.51–12.69), awkward bending or twisting (AOR: 18.98; 95% CI: 1.62–221.96), job stress (AOR: 3.67; 95% CI: 1.55–8.64), and job dissatisfaction (AOR: 3.12; 95% CI: 1.56–6.23)—were also significantly associated.

Conclusion: Flower farm workers in Southwest Shoa, Oromia, Ethiopia, exhibited a high prevalence of WRMSDs. Significant factors included age (25–35 years), marital status, literacy level, packhouse work, awkward postures, job stress, and dissatisfaction. These findings underscore the multifactorial nature of WRMSDs and the need for integrated ergonomic and psychosocial interventions.

Key Words: Work-related musculoskeletal Disorders, Associated Factors, Flower Farm Workers, Southwest Shoa Zone of Oromia, Ethiopia

1. INTRODUCTION

1.1. Background

Work-related musculoskeletal disorders (WRMSDs) constitute a significant global health concern, impacting workers in both industrialized and developing countries. These disorders affect various components of the musculoskeletal system, including muscles, joints, nerves, tendons, and spinal structures, and are frequently associated with physical and ergonomic stressors present in occupational settings (1). A wide range of inflammatory and degenerative conditions result in pain and functional impairment of the body's musculoskeletal system (2). Many WRMSD problems are related to awkward and static postures, repetitive work, vibration, and manual handling (3).

Flower farming is crucial to Ethiopia's economy, offering significant employment, especially for women, and positioning the country as Africa’s second-largest flower exporter after Kenya (4–6). While the sector's growth boosts the economy, it also presents challenges related to labor conditions and workers' well-being that require urgent attention and sustainable solutions. Despite its significance, the sector faces numerous challenges, including hazardous working conditions and environmental degradation linked to chemical exposure, which impact workers' health and the environment. While chemical risks often dominate discussions, WRMSDs remain a significant but overlooked issue. WRMSDs are the second-most common cause of disability among flower farm workers globally. In Kenya's flower farming industry (7), factors such as job role, age, and long-term employment heighten the risk of WRMSDs, emphasizing the critical need for policy reform. A study on musculoskeletal disorders in Kenya's flower farms (8) found that hazardous working conditions, including repetitive tasks, prolonged postures, and heavy lifting, contribute to the development of WRMSDs during production and processing. Therefore, this study aims to assess the prevalence of WRMSDs and identify key risk factors among flower farm workers in the Southwest Shoa zone of Oromia, Ethiopia.

1.2. Statement of the Problem

The agriculture sector, along with construction and transport, is among the industries with the highest rates of WRMSDs, which are a leading cause of nonfatal injuries in labor-intensive jobs. Tasks such as repetitive movements, heavy lifting, awkward postures, and prolonged standing put workers at substantial risk. Despite their impact, WRMSDs often go unreported and are inadequately addressed, negatively affecting both worker health and productivity in agriculture. These challenges are closely tied to the SDGs, particularly the goal of ensuring decent working conditions. Tackling this issue is essential, particularly in Sub-Saharan Africa, where such challenges persist and hinder progress (9). Addressing WRMSDs requires a comprehensive approach, including a deeper understanding of risk factors, better ergonomics, and targeted prevention strategies.

A study in Kenya (7) identified factors such as manual lifting, awkward postures, prolonged static positions, labor-intensive tasks, and challenging work environments as key contributors to the risk of WRMSDs. Similarly, a study in Korea (10) found that agricultural workers frequently experience WRMSD symptoms, including nonfatal injuries affecting one or more body parts. Furthermore, a systematic review on Work-Related Musculoskeletal Disorders Among Farmers in the Southeast Asia Region (11) reported that the prevalence of WRMSDs among farmers in Thailand, Indonesia, and Malaysia was 78%, 81%, and 88%, respectively, highlighting a significant association between agricultural occupations and the development of WRMSDs.

Agricultural workers encounter unique risks of developing WRMSDs, yet studies addressing this critical issue are notably limited. In Ethiopia's flower farming industry, no studies have specifically examined WRMSDs, except for two on related health factors. Although awareness of WRMSDs is increasing across various industries, their prevalence, contributing factors, and potential interventions remain inadequately explored in the agricultural sector, especially in floriculture. Tasks such as planting, harvesting, repetitive motions, awkward postures, heavy lifting, and prolonged standing are major contributors to WRMSDs. Additionally, psychosocial and socio-demographic factors are

also underexplored. This lack of knowledge hinders the formulation of effective prevention and intervention strategies, making it challenging to address the underlying causes of WRMSDs among flower farm workers.

Despite the expanding research on work-related musculoskeletal disorders (WRMSDs) across various sectors in Ethiopia, no studies have specifically examined flower farm workers. This absence of evidence constrains the development of targeted occupational health interventions for the rapidly growing and labor-intensive floriculture sector.

Therefore, this study aims to assess the prevalence of work-related musculoskeletal disorders and identify their associated factors among flower farm workers in the Southwest Shoa Zone of Oromia, Ethiopia. By investigating the prevalence and contributing factors of WRMSDs, the research seeks to inform targeted interventions that enhance the health, safety, and overall well-being of workers in the region.

1.3. Rationale and Significance of the Study

WRMSDs are significant public health concerns, often leading to long-term disability and increasing treatment costs (12–14). However, there is limited evidence on the prevalence and impact of WRMSDs among workers in flower farms within the study area. While the flower farm industry in Ethiopia is expanding, workers' awareness of occupational health and safety, particularly regarding musculoskeletal disorders, remains minimal.

This study significantly contributes to public health, particularly for flower farm workers, by providing insights into the scope and causes of work-related health issues. Identifying key occupational risks will raise awareness among farm management and policymakers, prompting timely actions. The findings will also lay the groundwork for developing targeted interventions to prevent musculoskeletal disorders and enhance health and safety standards within the flower farm industry.

2. LITERATURE REVIEW

2.1. Workflow in Flower Farms

According to Munala et al. (2021) (7), flower farming comprises two primary workflow components. The first is flower production, involving tasks such as pre-planting preparations (soil analysis, bed preparation, greenhouse maintenance), planting, weeding, pruning, irrigation, pesticide and fertilizer application, and harvesting. These activities often require repetitive motions, sustained awkward postures, and heavy lifting, exposing workers to poor ergonomics and prolonged physical strain that contribute to WRMSDs (7,15). Following harvest, flowers are transported to packhouses for grading, sorting, and packaging—tasks involving repetitive handling and physical exertion that increase the risk of WRMSDs. The second workflow component, flower processing, includes cooling, grading, bouquet assembly, packing, and loading for shipment. These activities contribute to WRMSDs through repetitive movements, prolonged standing, awkward postures, overreaching, exposure to cold environments, and heavy lifting—all of which strain the back, shoulders, and wrists (7).

2.2. Prevalence of Work-related Musculoskeletal Disorders among Farmworkers

Several studies have highlighted the widespread prevalence of WRMSDs among farm workers in developed and developing countries, with agriculture consistently identified as one of the most hazardous industries, especially in developing nations. For example, a study in Iran (16) reported a high prevalence of MSD symptoms among agricultural workers and recommended eliminating harmful working postures to improve working conditions.

Similarly, studies in Korea underscore the severity of this issue. The first of these studies (10) found a high prevalence of WRMSD symptoms in agriculture, identifying the sector as one of the country's most hazardous, with government interventions proving effective. Another study in Korea (17) characterized farming as a physically demanding occupation with substantial health risks, including musculoskeletal disorders. It highlighted factors

such as the type of agriculture, years of experience, and inadequate ergonomic conditions as key contributors to the increased risk among farmers. Systematic reviews also reported a high prevalence of WRMSDs among farmers in Southeast Asia (11) and among agricultural workers in Thailand (18). These reviews emphasized the need for government support and strategic planning to reduce the prevalence of MSD in the agricultural sector in these regions.

Various studies across countries and sectors (19–24) have consistently documented the high prevalence of WRMSDs in agriculture. These findings emphasize the need for preventive programs to reduce WRMSD incidence, improve worker productivity, and enhance overall well-being. While research on WRMSDs among Ethiopian farm workers remains limited, related studies (25–29) have identified their presence among agricultural workers across different regions of the country.

An ergonomic analysis of postural and musculoskeletal disorders among women working in flower farms in India (30) revealed a high prevalence of WRMSDs, underscoring the need for targeted interventions to mitigate these issues. Similarly, two studies conducted in Kenya (7,31) reported a significant prevalence of WRMSDs among flower farm workers, highlighting the urgent need for policy reforms within the floriculture industry.

A systematic review with meta-analysis of observational studies on the prevalence and risk factors of WRMSDs among adults in Ethiopia (32) reveals the widespread impact of the issue. The findings emphasize the pressing need for policymakers in the occupational health and healthcare sectors to pinpoint critical areas for intervention. This review should serve as a basis for decision-making in musculoskeletal health promotion, workplace exposure assessments, and the design of preventive programs. Focusing on these key areas will enable the development of effective strategies to reduce WRMSDs and significantly improve the health and safety of workers throughout Ethiopia.

Despite the high prevalence of WRMSDs among Ethiopian farmers, research on this topic remains scarce. For example, a study on farming ergonomics in the Dangishta community

(33) identified tasks like soil preparation, sowing, irrigation, and harvesting as major contributors to WRMSDs, affecting body parts such as the lower back, elbow, shoulder, wrist, neck, and knee. Soil preparation and irrigation, in particular, posed the highest risks, underscoring the need for interventions like conservation agriculture, ergonomic tools, and drip irrigation systems to alleviate these issues. Another study on work-related musculoskeletal pain in Tigray (25) highlighted two key factors: agricultural practices and health behaviors. It found that both significantly contribute to musculoskeletal pain and recommended clinical health assessments for the farmers in the region. These findings call for further research to better understand the full scope of WRMSDs among Ethiopian farmers and to develop targeted interventions to improve their health and well-being.

2.3. Factors Associated with Work-related Musculoskeletal Disorders

A study among healthcare providers in the operating rooms of the University of Gondar and Tibebe Ghion Hospitals in Northwest Ethiopia (34) identified WRMSDs as a significant yet often overlooked issue. WRMSDs impact health and strain healthcare services and costs, influenced by socio-demographics, working environment, ergonomics, and individual characteristics.

2.3.1. Socio-demographic factors

Evidence indicates that sociodemographic factors significantly influence the incidence of WRMSDs across settings. In Ethiopia, (34) identified sex, age, marital status, education, work experience, and income as key determinants. The study also found higher WRMSD prevalence among hospital staff working long hours, lacking procedural support, holding lower academic qualifications, and engaged in night shifts.

Additionally, a study on risk factors associated with WRMSDs in dentistry (35) identified cumulative trauma disorders, socioeconomic factors, working conditions, and epidemiological patterns as key contributors to WRMSDs among adults in Brazil. The study highlighted the back, neck, and lower back as the most commonly affected body parts. It emphasized the importance of early ergonomic education for dentists to prevent these disorders effectively throughout their professional careers.

Furthermore, a cross-sectional study in Brazil (36) identified key risk factors for WRMSDs in the footwear industry, emphasizing the interaction of biomechanical and psychosocial factors. Age, sedentary behavior, poor posture, and perceived effort were strongly linked to shoulder symptoms, increasing the likelihood fourfold. Wrist symptoms were associated with poor posture, high perceived effort, and workplace bullying, raising the odds sevenfold. Multisite symptoms, affecting multiple regions, were linked to poor posture, effort, longer tenure, and low social support, increasing the odds up to 30-fold. The study highlights the need to address physical and psychological factors in workplace interventions to reduce WRMSDs.

2.3.2. Working environment and ergonomic factors

Various studies, including cross-sectional risk factors for WRMSDs among footwear industry workers (37) have highlighted the influence of biomechanical, psychosocial, environmental, and individual factors on localized and widespread WRMSD symptoms. The results revealed that biomechanical and psychosocial factors were significantly associated with WRMSD symptoms, with their combined effects increasing the odds of occurrence. Specifically, factors such as age, sedentary behavior, inappropriate posture, and perceived effort were associated with shoulder symptoms, with their combined presence increasing the risk by four times. Similarly, wrist symptoms were linked to inappropriate posture, perceived effort, and bullying, with the combination of these factors raising the risk sevenfold. In other areas, symptoms were associated with inappropriate posture, perceived effort, length of employment, and low social support, with combined factors significantly amplifying the overall risk. Furthermore, a book on WRMSD assessment and prevention (38) emphasized the importance of improving workplace conditions, both physical and mental, to reduce and prevent musculoskeletal problems among office workers.

The factors associated with WRMSDs vary depending on the activities that workers perform. A cross-sectional study on WRMSD risk factors among floor-sitting precision handicraft workers in India (39) highlighted a mismatch between the workers and their occupational environment, emphasizing the need for ergonomic interventions to prevent

adverse effects on their health. Additionally, studies conducted in Kenya and India [e.g., (7,8) and (39,40)], respectively, have consistently reported a high prevalence of WRMSDs across different settings and over time.

2.3.3. Personal/individual factors

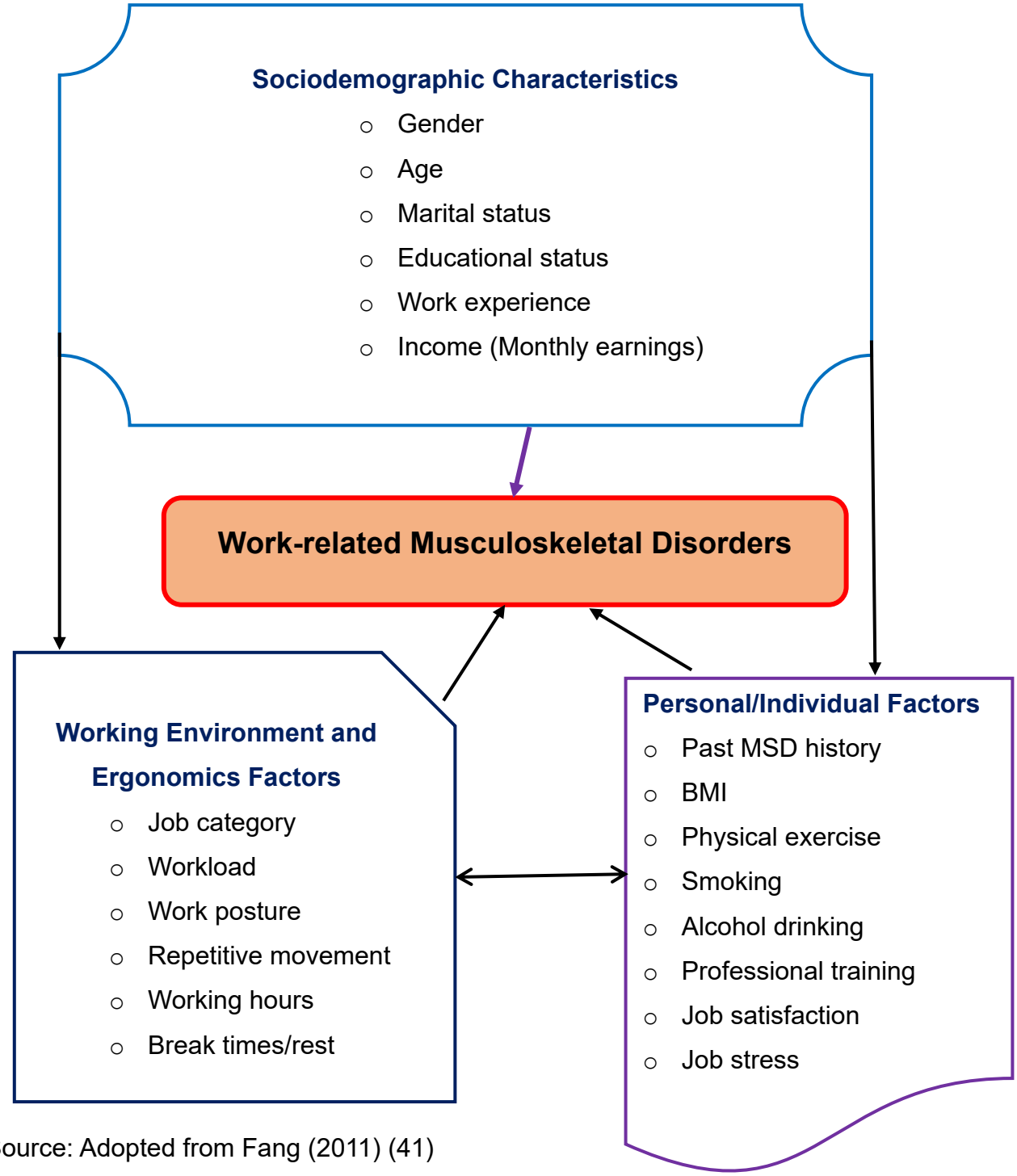
In general, various studies identified common associated factors with WRMSDs. For instance, (41) has specified different factors associated with WRMSDs in the hairdressing industry as socio-demographic factors (such as age, sex, marital status, educational status, work experience, and income); psychosocial factors (namely job satisfaction, job stress, and relationship with others); working environment and ergonomics factors (include job category, workload, work posture, repetitive movement, working hours, and break times); and individual factors (MSD history, BMI, physical exercise, smoking, drinking, and professional training). Many researchers have adapted these factors with specific modifications to evaluate the prevalence or severity of WRMSDs across various industries.

2.4. Conceptual Framework

Different studies provided a conceptual framework to assess the prevalence of WRMSDs and the associated factors for appropriate intervention (42–45).

This study employs the conceptual framework presented in Figure 1 to assess WRMSDs among flower farm workers. The framework outlines the dependent and independent variables. The associated factors are categorized into groups, including sociodemographic, personal/psychosocial, ergonomic, environmental, and individual variables—classifications frequently used in previous studies exploring the prevalence of WRMSDs across different sectors and subsectors. The figure also illustrates the interactions among these variables.

Figure 1. The Conceptual Framework for Study



Source: Adopted from Fang (2011) (41)

3. OBJECTIVES OF THE STUDY

3.1. General Objective

This study aimed to assess the prevalence of self-reported work-related musculoskeletal disorders and associated factors among workers in flower farms in the southwest Shoa zone of Oromia, Ethiopia, in 2024.

3.2. Specific Objectives

The specific objectives of the study include:

i. To evaluate the prevalence of self-reported work-related musculoskeletal disorders among workers in flower farms in the southwest Shoa zone of Oromia, and
ii. To assess the factors associated with work-related musculoskeletal disorders among workers in flower farms in the southwest Shoa zone of Oromia in Ethiopia.

4. METHODS

4.1. Study Area and Period

The study was conducted from January to June 2024 in Woliso, Bacho, and Sebeta Hawas—the only districts in the Southwest Shoa Zone with operational flower farms. These sites were purposively selected as they comprise the entire floriculture industry in the zone, which includes two rose farms and one summer flower farm. Sebeta Hawas became part of the zone following the establishment of Shagar City. The selected farms reflect typical labor conditions in the sector, making them appropriate for assessing WRMSDs in similar contexts across Ethiopia. The zone is one of the 24 administrative zones in Oromia and is 114 kilometers from Addis Ababa, the capital city of Ethiopia. It has an estimated population of 1,101,129. The Southwest Shoa Zone comprises 11 rural administrative districts and one urban district, Woliso (46,47). The zone's economy is primarily driven by agriculture, featuring diverse mixed farming practices. Key crops cultivated in the area include teff, wheat, barley, maize, horse beans, field peas, chickpeas, and linseeds. Floriculture is undertaken in specific areas, while livestock herding—focusing on cattle, sheep, goats, and equines—remains a vital component of the zone's agricultural livelihood.

4.2. Study Design

A cross-sectional study design was employed to evaluate musculoskeletal disorders and their associated factors among workers in flower farms within the study area.

4.3. Source Population

The source included male and female workers involved in production and processing activities across all three flower farms in the southwest Shoa zone.

4.4. Study Population

The study population comprised workers employed in the three operational flower farms in Woliso, Bacho, and Sebeta Hawas districts of the Southwest Shoa Zone, Oromia

Region, Ethiopia. Participants included employees involved in production, packaging, and spraying activities.

4.5. Eligibility

4.5.1. Inclusion Criteria

All workers in the zone's flower farms with at least one year of experience in production and processing were randomly selected to ensure adequate exposure for assessing work-related musculoskeletal disorders.

4.5.2. Exclusion Criteria

The study excluded office workers and individuals with pre-existing injuries to ensure adequate exposure and reduce confounding.

4.6. Variables Identification

4.6.1. Dependent Variable

The dependent variable is work-related musculoskeletal disorders among workers in the flower farms within the study area.

4.6.2. Independent Variables

The independent variables include factors associated with work-related musculoskeletal disorders, categorized as follows.

Sociodemographic characteristics of flower farm workers include gender, age, marital status, educational status, work experience, and income.

Working environment and ergonomics factors include job category, work posture, repetitive movements, working hours, and break times.

Personal or individual factors include MSD history, body mass index (BMI), physical exercise, smoking, drinking, training, job satisfaction, job stress, and relationships with others.

4.7. Sampling Size Determination

The sample size for the first objective:

The study population was randomly selected using Probability Proportional to Size (PPS) sampling from workers in the three flower farms. Due to the lack of prior studies on flower farming in Ethiopia, the sample size was calculated using the formula for estimating a single population proportion, with a 95% confidence level and a 5% margin of error (48):

$$n = \frac{Z^2_{\alpha/2} pq}{d^2}$$

Where n represents the sample size, Z^2 is the square of the standardized Z-value corresponding to the desired 95% confidence level, and d is a 5% margin of error. The Z-value for a 95% confidence level, obtained from the Z-table (a standard normal distribution table showing the area under the normal curve), is 1.96. p represents the proportion of the attribute present in the population, which is assumed to be 0.5 to maximize variability in the proportion. q is the complement of p, calculated as $1 - p$, which also equals 0.5.

Inserting these values in the sample determination formula above resulted in the total sample size of the study below.

$$n = \frac{(1.96)^2 * (0.5)(0.5)}{(0.05)^2} = \mathbf{384}$$

Assuming a 10 percent non-response rate (10%) (that is, 384x0.1≈39**),** the overall sample size becomes:

$$n = 384 + 39 = \mathbf{423}$$

The sample size for the second objective:

The second objective aims to identify factors associated with WRMSDs among flower farm workers. The sample size was determined using the double population proportion formula, based on key determinants of WRMSDs. Due to the absence of prior studies in flower farm settings, reference data were taken from a comparable study conducted

among cobblestone workers in Addis Ababa (49), which found 51% of workers exposed to musculoskeletal disorders and 31.8% unexposed. This population was chosen due to comparable occupational risk factors, despite contextual differences, as no directly applicable data were available to inform the initial objective.

The double population proportion formula is given as follows:

$$n = \frac{z_{\alpha/2}\sqrt{P(1-P)} + Z_{\beta}\sqrt{P_1(1-P_1) + P_2(1-P_2)^2}}{(P_1 - P_2)^2}$$

Where:

- $Z_{\alpha/2}$ is the critical value of the normal distribution at ${}^{\alpha}/_{2}$ the 95% level of confidence that equals 1.96,
- Z_{β} implies the critical value of the Normal distribution corresponding to the desired level of power β (for a power of 80% it equals 0.84),
- P shows the pooled prevalence,
- P_1 proportion of exposed=51%=0.51 and
- P_2 is the second proportion=31.8%=0.32.

Using Epi info version 7 by assuming an odds ratio (OR) of 2.79 and a 10% non-response rate, the sample size becomes:

$$n = 192 + 10\% = \mathbf{212}$$

Comparing the sample size for the first (n=423) and second (n=212) objectives, the largest sample, which is 423, was used for both objectives.

The next step involves determining the sample size for each flower farm using Probability Proportional to Size (PPS). The total source population across the three flower farms is 1,020 workers in the targeted departments (production and processing). The sample proportion is approximately 0.4147, calculated by dividing the sample size of 423 (including a 10% non-response rate) by the total population of 1,020. Table 1 below shows

the sample sizes for the three flower farms, calculated using the constant sample proportion relative to the total source population. The subsamples are calculated by multiplying the sample proportion by each flower farm's total population and applying this method to the production and processing departments.

Table 1. Sample size from each farm

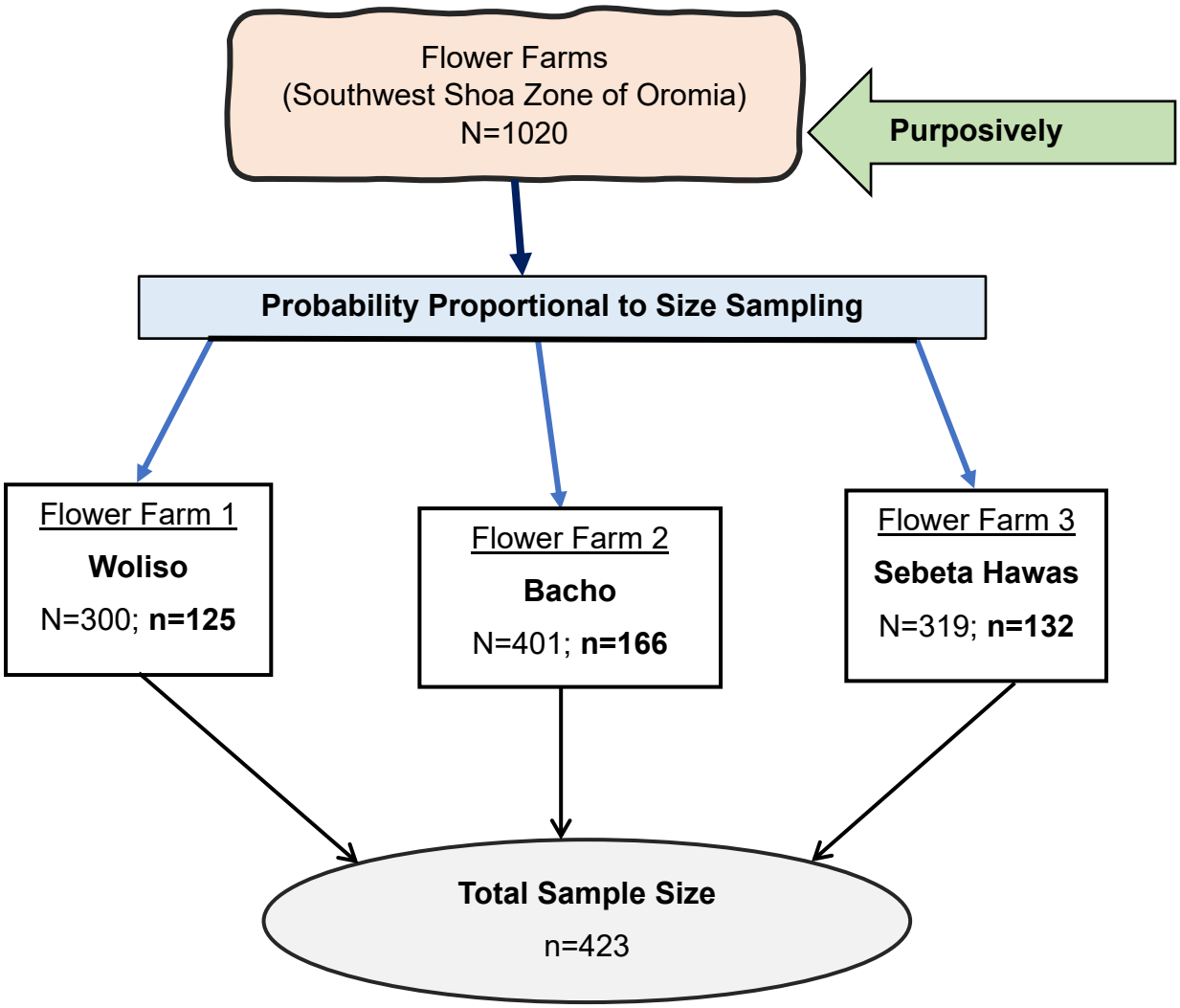
S/N	Name of the District where the flower farm exists	Total source population	Sample size
1	Woliso	300	300x0.4147→≈125
2	Bacho	401	401x0.4147→≈166
3	Sebeta Hawas	319	319x0.4147→≈132
	Total	**1020**	**423**

Source: Computed by the author using data from the SWSZ Workers and Social Affairs Office, 2024

4.8. Sampling Procedures

The study was conducted in three flower farms located in the Woliso, Bacho, and Sebeta Hawas districts of Southwest Shoa Zone, Oromia Regional State, Ethiopia. Participants were selected through systematic random sampling, with prioritization given to workers in high-workload departments to capture those at greater risk of WRMSDs. Furthermore, Figure 2 displays the sketch for the sampling procedure in drawing the samples from the respective flower farms.

Figure 2. Sampling Procedure Sketch/Diagram



Source: Own Sketch, 2024

4.9. Data Collection Procedures

4.9.1. Data Collection Tools and Procedures

Quantitative data on work-related musculoskeletal disorders were collected using an adapted version of the standardized Nordic Musculoskeletal Questionnaire (NMQ), originally developed under the Nordic Council of Ministers (50). The questionnaire, initially in English, was adapted to assess musculoskeletal symptoms across key body regions and translated into '*Afan Oromo'* using standard forward and back-translation procedures to ensure linguistic and conceptual equivalence, given the participants' native language.

Although the NMQ targets musculoskeletal symptoms, height, and weight were measured during data collection to calculate BMI. This allowed assessment of its association with WRMSDs, as body weight is a known risk factor and adds value beyond self-reported data.

Participants were asked about the 12-month prevalence of WRMSDs in each body region, responding with “Yes” or “No.” If they answered "No" to the first question, they moved on to the next one. Sociodemographic, work environment, and psychosocial data were collected using questions modified from previously validated occupational health surveys. Interview procedures were designed to ensure clear communication, data reliability, and representativeness.

Study participants were interviewed face-to-face using a structured, interviewer-administered questionnaire to ensure data consistency and accuracy. Nine trained data enumerators—three assigned to each flower farm—conducted the interviews, with oversight from three supervisors responsible for daily monitoring and quality control. All enumerators and supervisors received standardized training on the study objectives, data collection procedures, ethical protocols, and questionnaire content to ensure methodological rigor and data reliability across all sites.

4.9.2. Operational Definitions

Body segments: include body parts such as the neck, shoulder, upper back, lower back, hip /thigh, knee/leg, ankle/foot, and wrist /hand (51).

Work-related musculoskeletal disorders: a self-reported pain, or discomfort for at least 2-3 workdays during the past week and the last 12 months in any part of the neck, shoulder, upper back, lower back, hip/thigh, knee/leg, and ankle/foot and wrist/hand or at least shown on one of the body parts (52).

Awkward postures (AP): working with the neck bent more than 30 degrees without support, working with a bent wrist, working with the back bent without support, squatting and kneeling for two or more hours (53).

Job satisfaction: A score measured using the generic job satisfaction scale, as yes (32 – 50) and no (10 – 31) (54).

Job stress: A score measured using the workplace stress scale, as yes (16 to 40) and no (lower than or equal to 15) (41).

Body mass index (BMI): It is given in the World Health Organization classification for human weight in kilograms divided by the square of the height in meters (kg/m^2) (55).

- **Underweight**= BMI <18.50
- **Normal range**= BMI b/n 18.50 – 24.99
- **Overweight** = BMI b/n 25.00 – 29.99
- **Obese**= BMI ≥ 30.00

Cigarette Smoking: is a practice of smoking cigarettes by flower farm workers for at least one stick of cigarettes per day (56).

Alcohol drinking: it is the consumption of any kind of alcohol by flower farm workers at least two times per week for different purposes (57).

Physical exercise: Engaging in physical exercise at least twice a week for 30 minutes (58).

4.10. Data Quality Assurance

Data quality assurance was maintained by adhering to standardized data collection protocols and utilizing a pretested questionnaire. The instrument was pretested on 5% of the workers at one of the flower farms before the main data collection, and appropriate revisions were made based on the pretest results. The pretesting procedure helped to make any necessary modifications if there were vagueness and unclear questions that led to misunderstandings. The participants selected for the pretest were excluded from the analysis. Supervisors and data collectors were trained for 3 (three) days on the rules and regulations during data collection, and close supervision was followed. Additionally, after data collection, questionnaires were reviewed and checked for completeness and relevance by supervisors and the principal investigator, and the necessary feedback was given to data collectors the next morning.

4.11. Data Management

Following data collection, data were entered using EpiData version 3.1. Data cleaning was performed within the same software to address missing values, outliers, and inconsistencies through coding, labeling, and running frequency and sorting commands. The cleaned dataset was then exported to STATA for further data management and analysis. Analyses were conducted separately for the first and second specific objectives.

4.12. Data Analysis

Data analysis was conducted separately for each study objective. For the first objective, descriptive statistics were used, including frequencies and percentages for categorical variables; mean, standard deviation, minimum, and maximum values for continuous variables, and 95% confidence interval (CI) for continuous measures and frequencies and percentages for binary (dummy) and categorical variables of interest in the study related to the first specific objective. Graphical presentations (bar graphs) and pie charts were also considered in the descriptive analysis for the outcome variable for different measures to analyze the prevalence of WRMSDs.

Inferential analysis used binary logistic regression to examine the relationship between WRMSDs (a binary outcome) and associated factors. The analysis compared workers with and without WRMSDs using both bivariate and multivariable logistic regression models. The bivariate analysis assessed the unadjusted associations between each independent variable and WRMSDs, reporting crude odds ratios (COR) with 95% confidence intervals (CIs), with statistical significance evaluated using Chi-square tests. Descriptive statistics were first used to summarize the variables, followed by multivariable logistic regression to identify independent predictors of WRMSDs. Results were presented in tables and accompanied by detailed interpretations to contextualize the findings.

Bivariate logistic regression was conducted to identify factors associated with WRMSDs, serving as a preliminary step for the multivariable analysis. Independent variables with a p-value less than 0.20 in the bivariate analysis were included in the multivariable logistic

regression model to determine adjusted associations. Statistical significance was set at $p < 0.05$, and results were reported as adjusted odds ratios (AORs) with 95% confidence intervals (CIs).

4.13. Ethical Considerations

Ethical clearance for the study was granted by the Research Ethics Committee (REC) of the School of Public Health, Addis Ababa University, in January 2024. The study followed ethical principles, including informed consent and confidentiality. It secured permission from the Bureau of Labor and Social Affairs (BoLSA) and the flower farm industry. Participants gave verbal consent after explaining the study's purpose, benefits, risks, and their right to decline. Data was securely coded and stored to maintain confidentiality. Informed participants that there were no direct financial benefits or risks and that the findings would help inform strategies to prevent musculoskeletal disorders. Excluded respondents' names from the questionnaires, and participation was voluntary, with the right to ask questions, decline, or withdraw at any time.

4.14. Dissemination/Communication of Research Output

Upon completion, the study findings will be presented during the final defense and disseminated to relevant stakeholders to raise awareness and foster dialogue on occupational health and safety measures aimed at reducing WRMSDs, particularly in the flower farming sector.

5. RESULTS

5.1. Sociodemographic characteristics

Females comprised 82.74% of the respondents. About 47.52% were under 25 years, and 36.41% were aged 25–33. Marital status showed 52% were married, 43% single, and 5% divorced or widowed. While 21.99% were illiterate, most had at least primary education. Monthly income ranged from below 2,000 Birr (2.84%) to 4,200 Birr, with 56.97% earning 2,400 Birr or more. Nearly half (47.75%) had under three years of experience, and only 6.15% had nine years or more (Table 2).

Table 2. Socio-Demographic Characteristics of Flower Farm Workers, Southwest Shoa Zone, Oromia (May 2024)

Variables	Frequency (n=423)	Percent (%)
Gender		
Male	73	17.26
Female	350	82.74
Age (years)		
<25	201	47.52
25 – 35	160	37.83
>=35	62	14.66
Marital status		
Single	180	42.55
Married	222	52.48
Divorced/Widowed	21	4.96
Education		
Not read or write	93	21.99
Read and write	54	12.77
Primary school (1 – 8)	145	34.28
Secondary (9–12) & above	131	30.97
Monthly salary (Birr)		
<2000	12	2.84
2000 – 2400	170	40.19
2400 – 2800	85	20.09
2800 – 3200	54	12.77
3200 – 3600	83	19.62
>=3600	19	4.49
Experience (years)		
<3	202	47.75
3 – 5	97	22.93
5 – 7	59	13.95
7 – 9	39	9.22
>=9	26	6.15

Table 3 presents continuous sociodemographic, workplace, and ergonomic variables. The mean age of respondents was 26.87 years (SD = 7.22; range: 18–60), with an average

monthly income of 2,640.95 Birr (SD = 566.17; range: 1,500–4,200) and a mean work experience of 3.57 years (range: 1–12). On average, workers spent 3.5 hours standing daily (SD ≈ 1 hour; range: 0.5–4.5 hours) while performing tasks on the flower farms.

Table 3. Summary statistics for continuous variables

Variables	Mean	Std dev.	Min	Max	[95% CI]
Age (years)	26.87	7.22	18	60	[26, 28]
Monthly salary (Birr)	2640.95	566.17	1500	4200	[2587, 2695]
Experience (years)	3.57	2.61	1	12	[3, 4]
Standing time per day (hours)	3.28	1.05	0.30	4.30	[3.18, 3.38]
Sitting time per day (hours)	0.01	0.11	0	2	[0.00, 0.02]
Observations	423				

5.2. Individual and work-related factors

Table 4 shows personal and work-related factors linked to WRMSDs. Most respondents (84.63%) had a normal BMI (18.5–24.9 kg/m²), while 15.37% were underweight or overweight. Variables like regular exercise and alcohol use were excluded due to low cases (fewer than five), and history of WRMSD symptoms before current employment was also excluded because nearly all respondents reported none. Most workers (87.94%) performed repetitive tasks, and 57.68% did high-load work. Only 23.17% reported taking breaks beyond lunch, while 76.83% did not. Additionally, 28.13% had received work or ergonomics training, but 71.87% had not. Job stress was reported by 29.55% of respondents, and 69.03% indicated job satisfaction.

Table 4. Individual and Work-Related Factors among Flower Farm Workers in Southwest Shoa Zone, Oromia (May 2024)

Variables	Frequency (n=423)	Percent (%)
Body Mass Index (BMI)		
Healthy/Normal	358	84.63
Under/Overweight	65	15.37
Repetitive work within <30 seconds		
Never	38	8.98
Sometimes	13	3.07
Always	372	87.94
Doing high-load work		
Never	111	26.24
Sometimes	68	16.08
Always	244	57.68

Take breaks (other than lunch break)		
Yes	98	23.17
No	325	76.83
Receive training (past 12 months)		
Yes	119	28.13
No	304	71.87
Job stress		
Yes	298	29.55
No	125	70.45
Job satisfaction		
Yes	292	69.03
No	131	30.97

5.3. Working environment and ergonomics factors

Table 5 summarizes the working environment and ergonomic factors associated with WRMSDs. Workers were assigned to the Greenhouse (79.67%), Packhouse (16.55%), and Spray (3.78%) departments based on workload. Greenhouse tasks primarily involved planting and harvesting, while Packhouse work included grading and packing. Spray was treated separately due to its distinct role. Most workers (64.54%) stood for 3.5 hours or more daily; 26.24% stood for 1.5–2.5 hours, 4.73% for 2.5–3.5 hours, and 4.49% for less than 1.5 hours. Only 1.89% engaged in tasks requiring awkward bending or twisting, and 97.87% spent less than 15 minutes sitting daily.

Table 5. Working Environment and Ergonomic Factors among Flower Farm Workers in Southwest Shoa Zone, Oromia (May 2024)

	Frequency (n=423)	Percent (%)
Farm location		
Woliso	125	29.55
Bacho	166	39.24
Sebeta Hawas	132	31.21
Work department		
Greenhouse	337	79.67
Packhouse	70	16.55
Spray	16	3.78
Standing time per day (hours)		
<1:30	19	4.49
1:30 – 2:30	111	26.24
2:30 – 3:30	20	4.73
>=3:30	273	64.54
Bending or twisting awkwardly		
Yes	8	1.89
No	415	98.11
Sitting time per day (hours)		
<15 minutes	414	97.87
>=15 minutes	9	2.13

5.4. Prevalence of WRMSDs in different body parts

The overall prevalence of WRMSDs among flower farm workers in Southwest Shoa Zone, Oromia, Ethiopia was 63.36% (95% CI: 58.77%–67.95%). As presented in Table 6, severe WRMSDs among flower farm workers predominantly affected the lower back (24%), upper back (22%), wrists/hands (21%), and shoulders (15%), while hips/thighs/buttocks (1%), knees (1%), and ankles/feet (2%) were least affected. Neck and elbow pain were reported by 8% and 6% of workers, respectively.

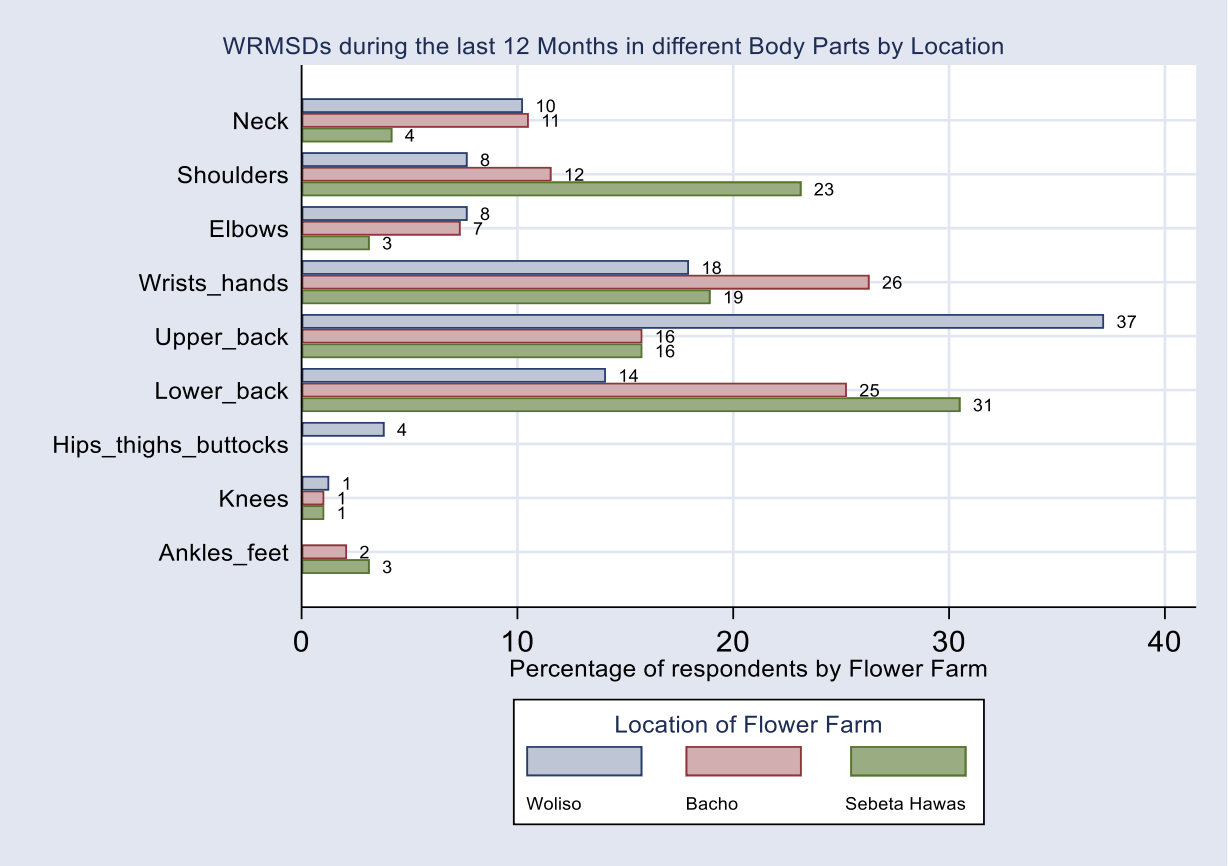
Table 6. WRMSDs and Body Parts among flower farm workers in Southwest Shoa Zone, Oromia (May 2024)

WRMSDs	Frequency	Percent (%)
Overall Prevalence of WRMSDs (n=423)		
Yes	268	63.36
No	155	36.64
WRMSDs in different Body Parts		
Neck (n=268)		
Yes	22	8.21
No	246	91.79
Shoulders (n=268)		
Yes	39	14.55
No	229	85.45
Elbows (n=268)		
Yes	16	5.97
No	252	94.03
Wrists/Hands (n=268)		
Yes	57	21.27
No	211	78.73
Upper back (n=268)		
Yes	59	22.01
No	209	77.99
Lower back (n=268)		
Yes	64	23.88
No	204	76.12
Hips/Thighs/Buttocks (n=268)		
Yes	3	1.12
No	265	98.88
Knees (n=268)		
Yes	3	1.12
No	265	98.88
Ankles/Feet (n=268)		
Yes	5	1.87
No	263	98.13

5.5. Prevalence of WRMSDs by Farm Location

Figure 3 shows WRMSD prevalence by body part among flower farm workers across three districts. In Woliso, 37% reported upper back WRMSDs—the highest in that area. In Bacho, wrists/hands (26%) and lower back (25%) were most affected. Workers in Sebeta Hawas experienced higher WRMSDs in the lower back (31%), shoulders (23%), and wrists/hands (19%).

Figure 3. WRMSDs in 12 Months in different body parts by Farm Location among flower farm workers in Southwest Shoa Zone, Oromia (May 2024)

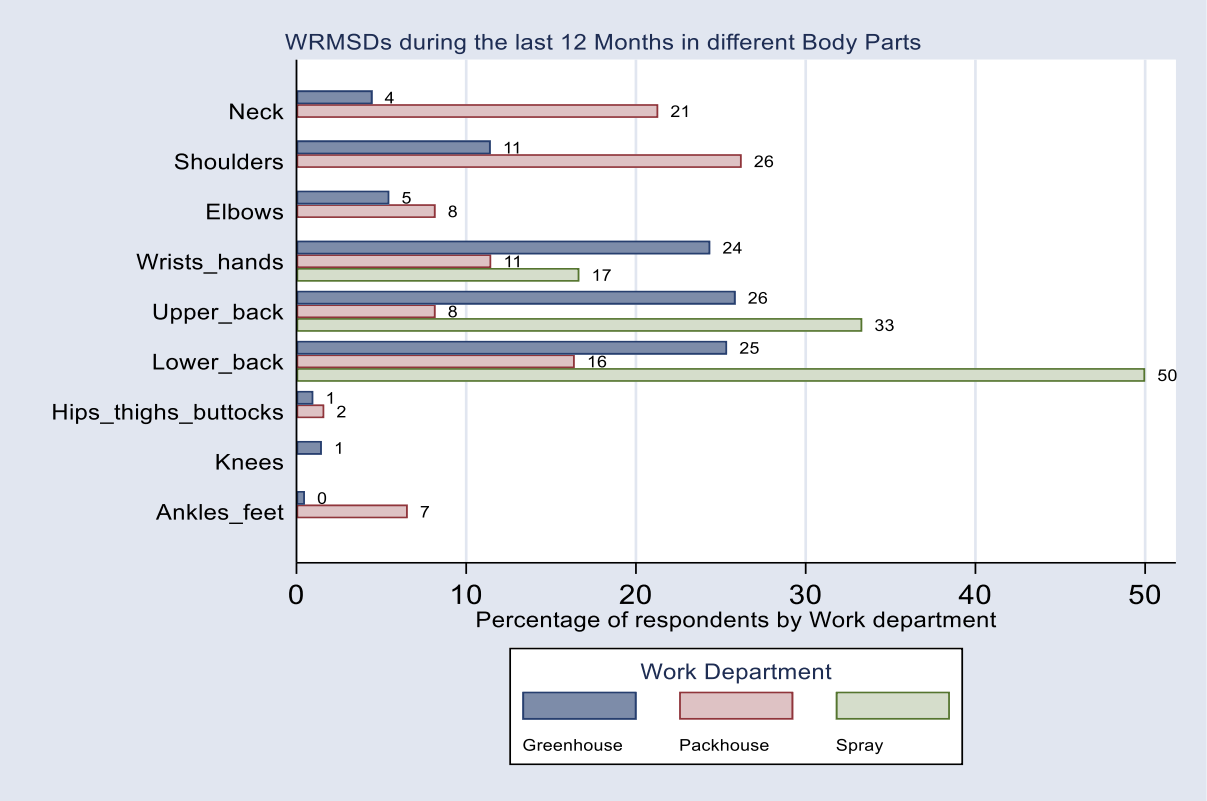


5.6. Prevalence of WRMSDs by Work Department

Figure 4 illustrates the prevalence of WRMSDs (Work-Related Musculoskeletal Disorders) over 12 months across different body parts among workers in flower farms, categorized by three selected work departments in the study area. In the Greenhouse department, workers primarily experience WRMSDs in the upper back (26%), lower back (25%), and wrists/hands (24%), with nearly equal percentages for each. In contrast, the Packhouse department sees the highest prevalence in the shoulders (26%), followed by

the neck (21%), wrists/hands (11%), and elbows (8%). Meanwhile, workers in the Spray work department report the most frequent WRMSDs in the lower back (50%), followed by the upper back (33%) and wrists/hands (17%).

Figure 4. WRMSDs in 12 Months in different body parts by the Work Department



5.7. Multivariate Analysis – Factors associated with WRMSDs

This study examined potential factors associated with WRMSDs, classified as socio-demographic (age, gender, marital status), personal (education, body mass index), work environment (work department, physical workload), and psychological (job stress, job satisfaction). Variables with $p \leq 0.20$ in bivariate logistic regression were included in multivariable logistic regression to control for confounding and identify independent predictors.

Table 7. Multivariate Logistic Regression of factors associated with WRMSDs among flower farm workers in Southwest Shoa Zone, Oromia (May 2024)

Variables	WRMSDs (n=423)		COR [95% CI]	AOR [95% CI]
	Yes (%)	No (%)		
Gender				
Male	35 (48.0)	38 (52.0)	1	1
Female	233 (66.6)	117 (33.4)	2.16 [1.30, 3.60]	2.12 [0.99, 4.52]
Age (years)				
<25	118 (58.7)	83 (41.3)	1	1
25 – 35	109 (68.1)	51 (31.9)	1.50 [0.97, 2.32]	2.09 [1.07, 4.08] *
>=35	41 (66.1)	21 (33.9)	1.37 [0.76, 2.49]	2.16 [0.83, 5.61]
Marital status				
Single	101 (56.1)	79 (43.9)	1	1
Married	150 (67.6)	72 (32.4)	1.63 [1.08, 2,45]	2.09 [1.12, 3.91] *
Divorced/Widowed	17 (81.0)	4 (19.1)	3.32 [1.08, 10.27]	5.00 [1.19, 21.05] *
Education				
Not read or write	56 (60.2)	37 (39.8)	0.79 [0.46, 1.37]	0.51 [0.22, 1.18]
Read and write	22 (40.7)	32 (59.3)	0.36 [0.19, 0.69]	0.28 [0.11, 0.67] *
Primary school (1 – 8)	104 (71.7)	41 (28.3)	1.33 [0.80, 2.21]	1.15 [0.60, 2.20]
Secondary (9 –12) & above	86 (65.7)	45 (34.4)	1	1
Monthly salary (Birr)				
<2000	10 (83.3)	2 (16.7)	2.92 [0.49, 17.32]	3.13 [0.20, 48.07]
2000 – 2400	103 (60.6)	67 (39.4)	0.90 [0.34, 2.39]	1.27 [0.19, 8.76]
2400 – 2800	47 (55.3)	38 (44.7)	0.72 [0.26, 2.01]	0.98 [0.16, 6.16]
2800 – 3200	30 (55.6)	24 (44.4)	0.73 [0.25, 2.14]	0.73 [0.16, 3.29]
3200 – 3600	66 (79.5)	17 (20.5)	2.26 [0.77, 6.62]	2.52 [0.66, 9.60]
>=3600	12 (63.2)	7 (36.8)	1	1
Body Mass Index (BMI)				
Healthy/Normal	219 (61.2)	139 (38.8)	1	1
Under/Overweight	49 (75.4)	16 (24.6)	1.94 [1.06, 3.55]	1.98 [0.94, 4.18]
Doing high-load work				
Never	49 (44.1)	62 (55.9)	1	1
Sometimes	51 (0.8)	17 (0.3)	3.80 [1.95, 7.38]	0.67 [0.23, 1.99]
Always	168 (68.9)	76 (31.2)	2.80 [1.76, 4.44]	1.24 [0.50, 3.06]
Take breaks (other than lunch break)				
Yes	70 (71.4)	28 (28.6)	1	1
No	198 (61.0)	127 (39.0)	0.62 [0.38, 1.02]	1.21 [0.39, 3.76]
Receive training (past 12 months)				
Yes	59 (49.6)	60 (50.4)	1	1
No	209 (68.8)	95 (31.3)	2.24 [1.45, 3.34]	1.60 [0.78, 3.28]
Farm location				
Woliso	78 (62.4)	47 (37.6)	1	1
Bacho	95 (57.2)	71 (42.8)	0.81 [0.50, 1.30]	0.81 [0.50, 1.30]
Sebeta Hawas	95 (72.0)	37 (28.0)	1.55 [0.92, 2.61]	1.55 [0.92, 2.61]

Work department				
Greenhouse	201 (59.6)	136 (40.4)	1	1
Packhouse	61 (87.1)	9 (12.9)	4.59 [2.20, 9.54]	4.37 [1.51, 12.69] *
Spray	6 (37.5)	10 (62.5)	0.41 [0.14, 1.14]	0.16 [0.03, 0.83]
Bending or twisting awkwardly				
Yes	7 (87.5)	1 (12.5)	4.13 [0.50, 33.89]	18.98 [1.62, 221.96] *
No	261 (62.9)	154 (37.1)	1	1
Job stress				
Yes	223 (74.8)	75 (25.2)	5.29 [3.37, 8.28]	3.67 [1.55, 8.64] *
No	45 (36.0)	80 (64.0)	1	1
Job satisfaction				
Yes	160 (54.8)	132 (45.2)	1	1
No	108 (82.4)	23 (17.6)	3.87 [2.34, 6.42]	3.12 [1.56, 6.23] *

Note that a constant estimate for baseline odds is not reported. * Shows P-value < 0.05 significance level

Table 7 shows multivariable analysis identifying key predictors of WRMSDs. Workers aged 25 to 35 had higher odds of work-related musculoskeletal disorders compared to those younger than 25 (AOR: 2.09; 95% CI: 1.07–4.08). Marital status was also significant, with married (AOR: 2.09; 95% CI: 1.12–3.91) and divorced/widowed workers (AOR: 5.00; 95% CI: 1.19–21.05) exhibiting greater risk than singles. Educational status was inversely associated, as workers who could only read and write were less likely to report WRMSDs than those with secondary education or higher (AOR: 0.28; 95% CI: 0.11–0.67). Furthermore, packhouse employees faced a higher risk than those in greenhouses (AOR: 4.37; 95% CI: 1.51–12.69).

Additionally, awkward bending or twisting significantly increased the likelihood of WRMSDs (AOR: 18.98; 95% CI: 1.62–221.96), highlighting poor ergonomic practices. Psychosocial factors were equally important—workers reporting job stress (AOR: 3.67; 95% CI: 1.55–8.64) and those dissatisfied with their jobs (AOR: 3.12; 95% CI: 1.56–6.23) had significantly higher odds of experiencing WRMSDs. These results underscore the multifactorial nature of WRMSDs and emphasize the need for targeted interventions addressing ergonomic risks, workplace organization, and employee well-being.

6. DISCUSSIONS

This cross-sectional study assessed the prevalence and associated factors of WRMSDs among flower farm workers in the Southwest Shoa Zone of Oromia, Ethiopia. The 12-month prevalence of WRMSDs affecting at least one of nine body regions (neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/thighs/buttocks, knees, and ankles/feet) was 63.36% (95% CI: 58.77%–67.95%). The most commonly affected areas were the lower back, upper back, wrists/hands, and shoulders.

The large number of female workers is comparable to a study in Ethiopia (59–61) that reported 86.1% in floriculture and 86% in flower farm workers, respectively. However, in a study conducted among flower farm workers in Kenya performing similar tasks to those in the current study, the gender distribution was evenly split between males and females (50% each) (7). In a related Ethiopian study involving comparable work conditions, the workforce comprised approximately 56% females and 44% males (62). This suggests that the types of work can determine the proportion of males and females. The younger age group also matches Ethiopia (59,61–64). The majority of the workers are up to primary school complete. This is fairly comparable with studies in Ethiopia (59,61,62). The low monthly salary of the majority of workers, both in the same sector and other sectors in Ethiopia, is also comparable to studies (60,61,63).

The WRMSD prevalence (63.36%) aligns with findings from similar studies in Kenyan flower farms (7) and (15), which reported 68.1% and 67%, respectively. These findings suggest WRMSDs are common among flower farm workers in different regions. However, it is lower than 75.2% in East Showa (59) and 73.4% in West Showa, Oromia (61), indicating potential regional or operational differences in the flower farming sector. These variations could stem from differences in work practices, environmental conditions, or access to preventive measures.

Furthermore, the prevalence of WRMSDs observed in this study is consistent with findings from a systematic review of agricultural workers in low- and middle-income

countries, which reported prevalence rates of 61.96% in Africa and 54.16% in Asia (65). This alignment underscores the commonality of musculoskeletal disorders in the agricultural sector, likely due to the physically demanding nature of tasks such as repetitive motions, prolonged standing, heavy lifting, and awkward postures, which are characteristic of manual labor-intensive farming systems prevalent in these regions.

Lower back pain was the most frequently reported WRMSD (24%) among flower farm workers, followed by upper back (22%) and wrist/hand pain (21%). This high prevalence is likely due to physically demanding tasks such as prolonged standing, frequent bending, and manual load handling, which strain the lumbar region. The findings underscore the need for ergonomic interventions to reduce lower back stress and improve worker health. However, the prevalence of lower back pain in this study is lower than that found in a systematic review and meta-analysis in Ethiopia (54.05%) (66) and among flower farm workers in Kenya (38.1%) (7). These discrepancies may stem from different factors, including regional variations in work practices, physical demands, and preventive measures like ergonomic interventions or training programs. Differences in climate, workload, equipment use, and population characteristics (e.g., age, fitness, and health) could also contribute. Further research is needed to explore these factors and develop targeted strategies to reduce WRMSDs across diverse regions and agricultural settings.

Several factors were significantly associated with WRMSDs among flower farm workers in the Southwest Shoa Zone, Oromia, Ethiopia. Socio-demographic predictors included age (25–35 years), marital status (married or divorced/widowed), and low education (basic literacy). Occupational risk factors included working in the packhouse department and frequent awkward bending or twisting. Psychosocial factors, particularly job stress and dissatisfaction, also showed strong associations. These findings highlight the interplay of demographic, ergonomic, and psychosocial factors in the occurrence of WRMSDs.

The prevalence of WRMSDs was significantly higher among workers aged 25 to 35, indicating that musculoskeletal disorders may peak during the most physically active

years of employment. Specifically, individuals aged 25 to 35 had nearly three times higher adjusted odds of developing WRMSDs compared to those under 25 years (AOR: 2.09; 95% CI: 1.07–4.08) (67). This elevated risk may be attributed to the cumulative physical demands encountered during the early to mid-career period, where workers often perform repetitive, strenuous tasks without adequate ergonomic support. Moreover, workers in this age group may be assigned more physically demanding roles due to their perceived strength and stamina, increasing their exposure to biomechanical stressors that contribute to the development of WRMSDs.

Marital status significantly influenced the likelihood of WRMSDs in this study. Compared to single workers, married individuals were over twice as likely to report WRMSDs (AOR: 2.09; 95% CI: 1.12–3.91), with divorced or widowed workers exhibiting an even higher risk (AOR: 5.00; 95% CI: 1.19–21.05). This increased vulnerability may result from the additional domestic duties and psychosocial stress commonly associated with these marital groups, contributing to greater physical and mental strain. Factors such as work-life conflict and reduced opportunities for rest may also exacerbate their risk. These findings are consistent with existing evidence that marital status affects health outcomes through intricate behavioral and psychosocial pathways (68,69), potentially heightening both the incidence and severity of WRMSDs in married and formerly married populations.

Educational status demonstrated a significant inverse relationship with the occurrence of WRMSDs in this study. Workers with basic literacy skills (able to read and write) were less likely to report WRMSDs than those with secondary education or higher (AOR: 0.28; 95% CI: 0.11–0.67). This unexpected pattern may reflect variations in job assignments based on educational background. Individuals with minimal education may be allocated to roles involving less physical or cognitive strain, while those with higher education may perform tasks requiring prolonged concentration, repetitive movements, or extended periods of standing, which can elevate physical stress. Moreover, differences in health awareness and symptom reporting could contribute; better-educated workers may be more informed about WRMSDs and more inclined to recognize and report discomfort. These findings indicate a nuanced association between education and WRMSDs, shaped

by task distribution, ergonomic exposure, and perceptions of health. Additional studies are needed to clarify these dynamics and inform targeted interventions in physically demanding work environments. Higher educational levels may correlate with roles involving repetitive tasks or prolonged static postures that increase musculoskeletal strain (51). Additionally, better-educated individuals may be more aware of musculoskeletal symptoms and thus more likely to report them (1).

Packhouse workers were significantly more likely to experience WRMSDs than greenhouse workers (AOR: 4.37; 95% CI: 1.51–12.69). This elevated risk may result from repetitive tasks, prolonged standing, and awkward postures commonly involved in packhouse operations such as sorting and packing (70,71). In contrast, greenhouse work may involve greater mobility and task variation, which can help reduce musculoskeletal strain (72). These findings are consistent with prior research showing that monotonous and static work environments—such as those in packing stations—are associated with a higher risk of musculoskeletal injuries (51). These findings underscore the importance of ergonomic interventions, task rotation, and rest breaks to reduce WRMSD risk in packhouse settings.

Awkward bending or twisting was strongly associated with an increased risk of WRMSDs (AOR: 18.98; 95% CI: 1.62–221.96), indicating the influence of inadequate ergonomic conditions. Sustained or repetitive awkward postures significantly increase biomechanical loading on the spine and joints, leading to fatigue and tissue damage (1,73). These findings align with existing evidence linking non-neutral working positions to a heightened risk of musculoskeletal disorders, particularly among workers in manual, repetitive jobs (51). Such postures impose excessive strain on the musculoskeletal system, particularly when sustained or repeated over time. These findings emphasize the necessity of mitigating ergonomic risks to lower WRMSD incidence.

Psychosocial factors dramatically influenced the prevalence of WRMSDs in this study. Workers who experienced job-related stress were more than three times as likely to report WRMSDs compared to those without stress (AOR: 3.67; 95% Confidence Interval: 1.55–

8.64). Similarly, job dissatisfaction was strongly associated with an increased risk of WRMSDs (AOR: 3.12; 95% CI: 1.56–6.23). These results align with existing literature and underscore the significant role of psychosocial stressors—such as job stress, low satisfaction, and inadequate organizational support—as key contributors to the development and exacerbation of musculoskeletal disorders (74,75). Chronic stress can lead to increased muscle tension, poor posture, and reduced recovery, thereby intensifying physical strain (76). Furthermore, unfavorable psychosocial work environments contribute to poor coping mechanisms and reduced motivation, increasing the likelihood of injury (77). These findings confirm the multifactorial nature of WRMSDs, arising from the interaction of physical, organizational, and psychological factors. Effective prevention requires integrated strategies that combine ergonomic improvements with psychosocial interventions, including stress management, supportive supervision, and improved job design to enhance overall workplace well-being.

7. STRENGTHS AND LIMITATIONS OF THE STUDY

7.1. Strengths

This study employed the standardized Nordic Musculoskeletal Questionnaire and a validated data collection tool, ensuring robust accuracy, reliability, and overall quality in the research process. It also conducted a comprehensive analysis by exploring various factors contributing to WRMSDs, including sociodemographic, work-related, ergonomic, and psychosocial elements. This comprehensive approach provides a deeper understanding of the root causes of WRMSDs among workers in the floriculture industry, enhancing the study's relevance and its potential for informing effective interventions.

7.2. Limitations

This study has the following key limitations. Recall bias may have influenced the reported prevalence of WRMSDs over the past 12 months, leading to potential over- or underestimation. The cross-sectional design limits the ability to establish causal relationships, as it captures data at only one point. Pain intensity was self-reported without objective measurement scales. Additionally, ergonomic risk assessment tools were not employed to assess WRMSD prevalence across different body parts, limiting a comprehensive evaluation of the physical risks involved. These limitations highlight the need for future studies with longitudinal designs and objective measurement techniques to provide more reliable insights into WRMSD factors.

8. CONCLUSION AND RECOMMENDATIONS

8.1. Conclusion

WRMSDs were highly prevalent among flower farm workers in the Southwest Shoa Zone of Oromia, Ethiopia, affecting 63.36% of workers during the last 12 months of the specific study period. The lower back was most commonly affected, followed by the upper back and wrists/hands.

This high prevalence indicates the significant physical strain associated with flower farming tasks, particularly those involving repetitive movements, awkward postures, and prolonged physical labor. The concentration of WRMSDs in the lower and upper back suggests the need for ergonomic interventions, such as redesigned workstations, proper lifting techniques, and supportive equipment. Similarly, the frequent occurrence of wrist and hand issues highlights the importance of addressing repetitive hand-intensive tasks through improved tools and task rotation.

This study identified several significant factors associated with the prevalence of WRMSDs among flower farm workers in the Southwest Shoa Zone of Oromia, Ethiopia. Key determinants included sociodemographic variables (age 25–35, marital status, basic literacy), occupational conditions (packhouse work, awkward bending or twisting), and psychosocial factors (job stress and dissatisfaction). These findings underscore the multifactorial and multifaceted nature of WRMSDs, highlighting the need for comprehensive interventions that address ergonomic risks, organizational practices, and worker well-being in labor-intensive agricultural settings.

Without targeted interventions, the high burden of WRMSDs and unaddressed risk factors could lead to decreased productivity, increased absenteeism, and long-term health issues. These challenges affect worker well-being and operational efficiency, threatening the sustainability and growth of the flower farming sector. Proactive measures are essential to protect worker health, boost productivity, and ensure the floriculture industry's long-term viability.

8.2. Recommendations

To mitigate the prevalence of WRMSDs and enhance worker productivity in Ethiopia's floriculture sector, this study recommends targeted interventions. Key measures include improving ergonomic conditions—particularly in high-risk areas such as packhouses—through workstation redesign, task rotation, and scheduled rest breaks. Providing tailored training on safe work practices, especially for workers with limited literacy, is critical. Addressing psychosocial factors through improved communication, employee recognition, and supportive supervision can further reduce job-related stress and dissatisfaction. Additionally, adopting inclusive job design and enforcing clear workplace safety policies are essential to promoting safer and more sustainable working environments.

Government

- Establish and enforce ergonomic labor guidelines tailored to the floriculture sector to ensure worker safety and well-being.
- Strengthen labor inspection mechanisms and occupational health monitoring to uphold safety standards within flower farms.
- Create targeted educational campaigns aimed at preventing work-related musculoskeletal disorders, addressing both supervisors and workers.
- Design and implement targeted training programs on occupational health, focusing on workers with low literacy levels and vulnerable populations.
- Incorporate psychosocial risk factors, such as workplace stress and dissatisfaction, into national occupational health regulations.
- Expand healthcare access to support early detection and management of musculoskeletal disorders in agricultural regions.
- Foster the adoption of exemplary safety measures by implementing recognition or certification programs that reward compliance among flower farms.

Flower Farm

- Redesign workstations and workflows to reduce repetitive strain and awkward postures, especially in high-risk departments like packhouses.
- Implement task rotation and regular rest breaks to reduce physical fatigue and repetitive motion injuries.
- Provide structured training programs on proper lifting techniques, posture, and other ergonomic practices, particularly for workers with lower educational levels.
- Establish supportive supervision and feedback mechanisms to allow workers to express concerns and report symptoms early.
- Promote a positive psychosocial environment by recognizing employee performance, encouraging communication, and reducing work pressure.
- Develop inclusive job designs that match tasks to individual capabilities, taking into account age, experience, and physical condition.
- Regularly assess workplace risks through ergonomic audits and employee feedback to inform continuous improvement.

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10. ANNEX

Annex I. Study Information Sheet (SIS)

Title: Assessment of Work-Related Musculoskeletal Disorders and Associated Factors among Workers in Flower Farms in Southwest Shoa Zone of Oromia, Ethiopia

Study Background: Flower farm is one of the recently evolving industries in Ethiopia. The sector created job opportunities for thousands of people, especially women, and generated a huge amount of foreign exchange earnings for the country. However, it is associated with many occupational hazards and health-related problems. There is a high risk of Work-Related Musculoskeletal Disorders (WRMSDs), which might be due to long-standing work postures like cutting and packing, and repetitive tasks such as weeding and harvesting flowers.

Objective: The objective of the study is to assess work-related musculoskeletal disorders and associated factors among workers in flower farms in the Southwest Shoa zone of Oromia in Ethiopia.

Significance of the study: This study helps to know the magnitude of WRMSDs and associated factors and to improve the working situation.

Study area and period: The study is conducted in the Southwest Shoa zone of the Oromia region in Ethiopia on flower farms from August 2023 to June 2024.

Benefits associated with the study: There is no direct benefit for participating. However, the study findings will be used to know the magnitude of the problem and the importance of improving working conditions.

Risk: There are no risks posed to the participant from the study.

Confidentiality/Justice/Privacy: All workers had an equal chance for the interview. Voluntary participation was a basis for the data collection process and any participant had the right to question, complain, or terminate at any time freely. Information for each participant in the interview is kept confidential. The contact address of the investigator for any questions is the following.

Name of PI: Tsiyon Abera
Address: Tel +251923732755
Email: tsionaberajabessa@gmail.com

Annex III. Informed Consent (Afan Oromo version)

YUNIVARSITII FINFINNEETTI
KOOLLEJJI SAAYINSII EEGUMSA FAYYAA
KUTAA BARUMSA FAYYAA HAWAASAA

Ibsa Qo'annoo fi guca feedhii qabessummaa kan ittin guutamuu

Seensa:

Akkam jirtu? Ani Obboo/Addee----------jedhama. Kan asiin dhuufeef qo'annaa kana kan gaggessuu Yunniversitii Finfinnee Koollejji Saayinsii Fayyaa kutaa barumsaa fayyaa hawaasaa irraa baratuu digirii lammaffaa kan taate Adde Tsiyoon Abarraa bakka bu'eetii. Naannoo Oromiyaatti Godina Kibba Shawaa Lixaa keessatti kan argaman hojeetoota qonnaa Abaaboo keessaatti hojii isaanitin walqabatee dhibbaa wirtulee qaamaa fi sababootaa walqabatan qo'achuu dha. Kanaafuu qo'aannoo irrattii hirmaachuu dhaaf fedhii qabaachuu fi akka hin qabaannee muurtteesitan ibsa gabaabduu isiiniif goonaa.

Mata Duree Qo'annoo

Naannoo Oromiyaatti Godina Kibba Shawaa Lixaa keessatti kan argaman hojeetoota qonnaa Abaaboo keessaatti hojii isaanitin walqabatee dhibbaa wirtulee qaamaa fi sababootaa walqabatan qo'achuu dhaa.

Faayidaan Qo'aannoo: Faayidan qo'aannoo kanaa hirmaatootaaf kallittidhaan maallaqaan, tajaajila wal'ansa fayyaa fi kan biroon kan fayyaduu osoo hintaanee bu'aa qo'aannoo isaa irraa ka'uudhaan qaama dhimmi ilaallatuuf akka galteetti fayyadaa. Keessatuu qo'aannowwan kan akkana fuula duraaf godhamaniif akka odeefannoo ka'umsaattii fayyadaa.

Miidhaan Qo'aannoo: Hirmaatootta gaaffii fi deebii irratti hirmaataniif haal qo'aannootiin dhibbaan isaan irratti qaqabuu hin jiru yeroo gabaabduu isaan irraa fudhachuu malee.

Icciitidahaan qabuu: Hirmaatoonni maqaa isaani akka ibsan hin eegamuu. Hirmaatoonni kamiyyuu oddeefannoo keennan guutumaan guututti icciitidhaan akka qabamuu seerii qo'aannoon nii dirqamsiisaa.

Kanaafuu yaada hirmaataan keennu iccitidhaan waan eeggamuuf dhiibbaa bulchinsaa irraa bilisaa.

Mirga Hirmaattootaa: Hirmaataan qo'aannoo kana irrattii hirmaachuu ykn hirmaachuu dhisuun mirga dha Gaaffii fi deebii irratti hirmaachaa osoo jirtuu yoo hinbarbaannee ta'ee yeroo kamiyyuu addaan kutuu/dhaabuu denddeessuu ykn gaaffiilee dhihaatan keessaa deebisuu kan hin barbaannee dhisuu danddessuu. Gaaffii fi deebiin daqiiqaa 15-20 fudhataa. Yeroo gaaffii fi deebii irrattii yaada ifaa hin taanee yoo jiratee gaafachuun nidanda'amaa.

Ragaalee kamiyyuu qaamooleen argachuu barbaaddan yoo jiraatee: Hirmaattottni qo'aannichaa haala qo'aannoo fi qabiyyee irratti ifaa yoo siinif hintaanee yeroo kamiyyuu gafachuun mirga.
Kanuumaaf abbuummaa dhaan maqaan qo'aannoo kan gaggessuu Adde Tsiyoon Abarraa lakk Moobaayilaa +**251923732755**, Imeelii: tsionaberajabessa@gmail.com

Guca hirmaattonni gaaffii fi debii irratti hirmachuun dura fedhii qabaachuu isaanii kan ittin ibsamuu
Armaan oliittii waa'ee qo'aannoo ibsa afaan naaf galuun duubisee ykn naaf dubbifamee naaf galee jiraa.

Yeroo kamiyyuu qo'aannoo irraa adabbii malee dhaabuu akka danda'uu huubadheen jiraa. Kanaafuu qo'aannoo irratti hirmaachuuf fedhii qabduu?
1. Eyyeen ----------(gara gaaffiitti galuu)
2. Hinqabuu----------(gara hojjetaa ittii anuuttii demaa). Qo'aannoof sababa feedhii hinqabannee gaafachuudhaan yaadannoo qabachuun to'ataa qo'aannichaaf gabaasa godhii.

Yeroon jalqabamee---------- Yeroon xumuramee---------

Maqaan gaaffiii dhi'eesaa---------- Lakk koodii ---------

Maqaan To'ataa gaaffii fi deebii mirkaneessee ----------

Qo'aataa Mallattoo 1: - ----------guyyaa ----------

Annex II. Informed Consent (English version)

ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

Hello, my name is _____and I am here on behalf of Tsiyon Abera a postgraduate student from AAU, School of Public Health. I am here to collect information from the study participants about general socio-demographics and factors related to WRMSDs, and requesting you to participate in this study which would require your response to an interview on some related issues.

The objective of this study is to assess work-related musculoskeletal disorders and associated factors that flower farm workers face and to suggest appropriate recommendations to the concerned body. Some research shows a high prevalence of WRMSDs among flower farm workers. Therefore, at the end of the study, appropriate recommendations to improve working conditions will be provided to the concerned body as per the study findings.

If you volunteer to participate in the study, we will stay together for about 20 minutes for an interview. The information you provide will be kept confidential. You are free to answer only what you understand, to ask any question, and to terminate participation in the interview.

Are you volunteering to participate? A. Yes --------Signature---------- (go to interview)

B. No --------- reason----------(Skip to the next interviewee)

Informed consent confirmed by:

Interviewer: Name_____ signature_____

Date of interview_____ Time started_____ Time completed_____

Result of interview: 1. Refused 2. Not around 3. Partially completed 4. Completed

Checked by Supervisor: Name_____

signature_____ Date_____

For any inconvenience, contact the principal investigator.

Tsiyon Abera, Mobile: +251923732755, Email: tsionaberajabessa@gmail.com

Annex IV. Questionnaire (English Version)

Part 1: Sociodemographic characteristics of the study subjects

Individual ID _____ Farm Name /Code _____ Work department _____

S. No	Questions /variables	Coding category /possible response	Skip to
101	Gender	1. male 2. female	
102	Age	**_____ in years**	
103	What is your current marital status?	1. Single 2. Married 3. Divorced 4. Widowed	
104	Educational level	1. Illiterate 2. Primary school completed (1-8) 3. secondary school complete (9-12) 4. Higher Education	
105	Monthly salary (Income)	_____ birr	
106	Overall, how many- years have you worked on a flower farm?	_____ years	

Part 2: Individual and work-related factors associated with WRMSDs among flower farm workers

S. No	Questions /variables	Coding category /possible response	Skip to
201	Height in meter	_____ meter	
202	Weight in kg	_____ kg	
203	BMI (body mass index in kg/m2)	1.Underweight (<18.5Kg/m^2) 2. Healthy (18.5–24.9 kg/m^2) 3. Overweight (25–29.9 kg/m^2) 4.Obese (≥30 kg/m^2)	
204	Do you have the Habit of doing physical exercise at least twice per week for 30 minutes?	1. Yes 2.No →	Q.206
205	If yes for Q204 how often?	1. Two times per week 2.≥Four times per week	
206	Do you Smoke cigarettes?	1. Yes 2.No →	Q208

207	If your answer is yes to question number 206. How many cigarettes do you smoke per day?	1.----------sticks 2.----------packet	
208	Do you consume any kind of alcohol at least twice per week?	1. Yes 2.No	
209	Do you have any symptoms related to WRMSDs before engaging in this work?	1. Yes 2.No	
210	Repetitive work within <30 seconds	1. Never 2. Sometimes 3. Always	
211	Do you take breaks during your job per day excluding lunchtime?	1. Yes 2.No →	Q213
212	If yes Q211, total working breaks excluding lunch break	1. ≤15 minutes 2. above 15 minutes	
213	Doing high-loaded work?	1. Never 2. Sometimes 3. Always	
214	Did you receive any training related to your work in the past 12 months?	1. Yes 2.No	

Part 3: Working posture factors associated with WRMS Disorders among flower farm workers

S. No	Questions /variables	possible response	Skip to
301	How much time is spent standing to make your task per day?	----------hour	Fill only for standing work posture worker
302	How many days do you work in a standing position per week?	----------day	
303	Does your job involve Bending or twisting awkwardly?	1. Yes 2. No →	Q 305
304	Do you work in the same position for 2 hours (Standing, bending over, sitting, etc.)?	1. Yes 2. No	
305	How much time is spent sitting to do your task?	_____hour	

Part 4: Psychosocial factors associated with WRMS Disorders among flower farm workers.

Questions to measure job stress (Q 401-408)						
S. No	**Questions /variables**	Job stress score				
		Never 1	Rarely 2	Sometimes 3	Often 4	Very often 5
401	Conditions at work are unpleasant or sometimes even unsafe.					
402	I feel that my job is negatively affecting my physical or					
403	I have high-loaded work to do and/or too many unreasonable deadlines.					
404	I find it difficult to express my opinions or feelings about my job conditions to my superiors.					
405	I feel that job pressures interfere with my family or personal life.					
406	I have adequate control or input over my work duties					
407	I receive appropriate recognition or rewards for good					
408	I can utilize my skills and talents to the fullest extent at work					
	Final score					

Questions to measure job satisfaction (Q 409-418)						
S. No	No Questions /variables	Job satisfaction score				
		Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied
409	I receive recognition for a job well done.	1	2	3	4	5
410	I feel close to the people at work.	1	2	3	4	5
411	I feel good about working at this company.	1	2	3	4	5
412	I feel secure about my job.	1	2	3	4	5

413	I believe management is concerned about me.	1	2	3	4	5
414	On the whole, I believe work is good for my physical health	1	2	3	4	5
415	My wages are good.	1	2	3	4	5
416	All my talents and skills are used at work.	1	2	3	4	5
417	I get along with my supervisors.	1	2	3	4	5
418	I feel good about my job	1	2	3	4	5

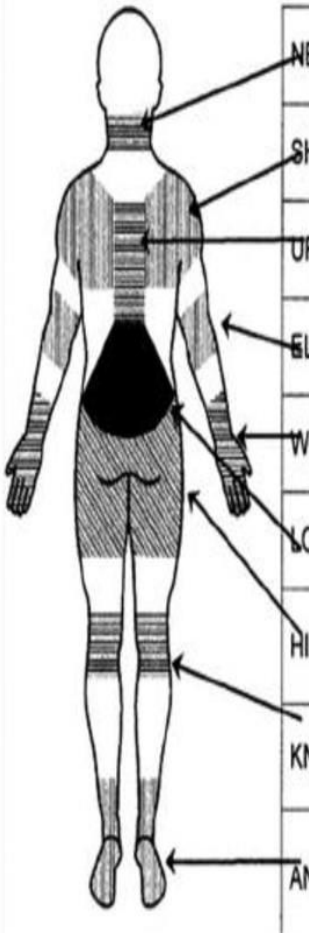
Part 5: Prevalence of WRMSDs among flower workers by Nordic Musculoskeletal Questionnaire

Please answer by using the tick boxes ☑
– *one tick for each question*

Please note that this part of the questionnaire should be answered, even if you have never had trouble in any parts of your body.

Have you at any time during the **last 12 months** had **trouble (such as ache, pain, discomfort, numbness)** in:	Have you had **trouble** during the **last 7 days:**	During the **last 12 months** have you been **prevented** from carrying out normal activities (eg. job, housework, hobbies) because of this trouble:
1 ***Neck*** No 1☐ Yes 2☐	2 ***Neck*** No 1☐ Yes 2☐	3 ***Neck*** No 1☐ Yes 2☐
4 ***Shoulders*** No 1☐ Yes 2☐ in the right shoulder 3☐ in the left shoulder 4☐ in both shoulders	5 ***Shoulders*** No 1☐ Yes 2☐ in the right shoulder 3☐ in the left shoulder 4☐ in both shoulders	6 ***Shoulders (both/either)*** No 1☐ Yes 2☐
7 ***Elbows*** No 1☐ Yes 2☐ in the right elbow 3☐ in the left elbow 4☐ in both elbows	8 ***Elbows*** No 1☐ Yes 2☐ in the right elbow 3☐ in the left elbow 4☐ in both elbows	9 ***Elbows (both/either)*** No 1☐ Yes 2☐
10 ***Wrists/hands*** No 1☐ Yes 2☐ in the right wrist/hand 3☐ in the left wrist/hand 4☐ in both wrists/hands	11 ***Wrists/hands*** No 1☐ Yes 2☐ in the right wrist/hand 3☐ in the left wrist/hand 4☐ in both wrists/hands	12 ***Wrists/hands (both/either)*** No 1☐ Yes 2☐
13 ***Upper back*** No 1☐ Yes 2☐	14 ***Upper back*** No 1☐ Yes 2☐	15 ***Upper back*** No 1☐ Yes 2☐
16 ***Lower back (small of the back)*** No 1☐ Yes 2☐	17 ***Lower back*** No 1☐ Yes 2☐	18 ***Lower back*** No 1☐ Yes 2☐
19 ***One or both hips/thighs/buttocks*** No 1☐ Yes 2☐	20 ***Hips/thighs/buttocks*** No 1☐ Yes 2☐	21 ***Hips/thighs/buttocks*** No 1☐ Yes 2☐
22 ***One or both knees*** No 1☐ Yes 2☐	23 ***Knees*** No 1☐ Yes 2☐	24 ***Knees*** No 1☐ Yes 2☐
25 ***One or both ankles/feet*** No 1☐ Yes 2☐	26 ***Ankles/feet*** No 1☐ Yes 2☐	27 ***Ankles/feet*** No 1☐ Yes 2☐

Figure 5. Human Body Segments



	Have you at any time during the last 12 months had trouble (such as ache, pain, discomfort, numbness) in:	During the last 12 months have you been prevented from carrying out normal activities (e.g. job, housework, hobbies) because of this trouble in:	During the last 12 months have you seen a physician for this condition:	During the last 7 days have you had trouble in:
NECK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
SHOULDERS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
UPPER BACK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
ELBOWS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
WRISTS/ HANDS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
LOWER BACK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
HIPS/ THIGHS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
KNEES	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
ANKLES/ FEET	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes

Annex V. Questionnaire (Afan Oromo version)

Gaafannoo tokkoon tokkoon isaa of feegannoo huubachuudhaan haala gaafatuun itti marsuu ykn barreessuun guutaa

Kutaa 1ffaa: - Odeefannoowwan hawaasummaan walqabatee gaafannoowwan dhiyaatan

Lakk Dhuunfaa_____ Maqaa Dhaabbataa /Koodii _____ Kutaa hojii _____

Lakk.	Gaaffilee	Deebii filannoo	Gara lakkoofisa agarsifameetti darbi
101	Saala	1. Dhi	
		2. Dha	
102	Umuriin keessan meeqaa?	Umurii Waggaa _____	
103	Haala Gaa'elaa	1. Fuudhe/Heerumte	
		2. Hin Fuune/hin Heerumne	
		3. Hiike/Hiikte	
		4. Irraa Du'e	
104	Sadarkaa barnootaa	1. Dubbisuu fi Barreesuu kan hin dandeenye	
		2. Dubbisuufi Barreesuu kan danda'u	
		3. Sadarkaa tokkooffaa kan xumuuran kutaa (1-8)	
		4. Sadarkaa lammaffaa kan xumuuran kutaa (9-12)	
		5. Oguummaa Teekinikaaa ykn Diigirii jalqabaa fi isaa ol kan qaban	
105	Haanga Galii Ji'an	Qarshii _____	
106	Hojii kana irratti muuxannoo haagamii qabduu?	Waggaa _____	

Kutaa 2ffaa: Gaafannoo hojii isaaniitin walqabatee dhibbaa dhukkuba maashaalee fi wirtuulee qaamaa sababootaa dhunfaatiin wal qabatan irratti kan dhiyaatu (201-214)

Lakk	Gaaffilee	Deebii	filannoo Gara lakkoofisaa agarsifameetti darbii
201	Dheerina qaamaa meetiridhaan	_____meetirii	
202	Ulfaatina qaamaa k.g dhaan	_____K.g	
		1. Ulfaatina gadi'anaa (<18.5 kg/m^2)	

203	Ulfaatina qaamaa dheerinna walin yoo wal madaalamuu (BMI)	2. Ulfaatina fayyaa qabeessaa(18.5– 24.9 k.g/m2)	
		3. Ulfaatina ol'aanaa (25–32.9 k.g/m²)	
		4. Ulfaatina garmalee (≥30 k.g/m²)	
204	Soochii qaamaa torbaanittii yoo xiqqaatee si'aa 2 daqiqaa 30f	1. Eeyyeen 2. Hin jiruu	Deebin keessan yoo hin jiruu ta"ee gar gaafii lakk 206
205	Gaaffii lakk 204 deebin keessan Eyyeen yoo ta"ee yeroo hagamiif	1. Toorbaanitti yeroo lamaa 2. Toorbaanitti yeroo sadii fi isaa oli	
206	Tamboo ni xuuxxaa?	1. Eeyyeen 2. Hin jiruu	Deebin keessan yoo hin jiruu ta'ee gar gaafii lakk 208
207	Gaaffii lakk 206 deebin keessan Eyyeen yoo ta'ee hangam xuuxxuu?	1.----------firii/guyyaan 2.----------paakkoo/guyyaan	
208	Toorbaanitti yoo xiqaatee yeroo lamaaf alkoolii gosa kamiyyuu dhugduu?	1. Eeyyeen 2. Hin jiruu	
209	Walumaa galatti osoo a galiin duraa rakkoo fayyaa maashaa fi narvii isiin muudatee jiraa?	1. Eeyyeen 2. Hin jiruu	
210	Iddoo hojii idilee kee irraa daddeebii hojii kan baayyatee (seekoondii 30 keessaatti hojii irraa deeddebi'uu) qabaa?	1. Mitii 2. Darbee darbee 3. Yeroo baayyee	
211	Hojii idilee kee irratti dhibbaa hojii isii mudatee beekaa?	1. Mitii 2. Darbee darbee 3. Yeroo baayyee	
212	Guyyaa keessaa yeroo laaqanaan alaa boqonnaa gotuu? jiruu ta"ee gar gaaffii lakk 218 demaa	1. Eeyyeen 2. Hin jiruu Deebin keessan yoo hin	
213	Gaaffii lakk 214 deebin keessan Eyyeen yoo ta"ee guyyaatti sa'a laaqanaan alaa daqiqaa hagamiif boqonnaa	1. ≤ 15 daqiqaa 2. > 15 daqiqaa	
214	Leejjin Oguummaa fi nagummaan waliin walqabatee ji'oota 12 asitti keennamee jiraa?	1. Eeyyeen 2. Hin jiruu	

Kutaa 3 ffaa : Sababoota haala hojimaataatiin waliin walqabatee dhibbaa dhukkuuba maashaalee fi wiirtuulee qaamaa irratti gaaffii dhiyaatu (301-306)

Lakk.	Gaaffilee	Deebii filannoo	Gara lakkoofisaa agarsifameetti darbi
301	Sa'aatii meqaaf dhaabbattee hojii kee iraatti dabarsitaa?	_____ sa'atii	Dhaabbatanii kan hojjeetan qofaaf kan gaafatamuu
302	Toorbaanitti guyyaa haagamiif hojii kee dhaabbbatte hojjeettaa?	_____guyyaa	
303	Hojiin kee haala rakkisaatiin micciramtee akka hojjeettu si taasisaa?	1. Eeyyeen 2. Hin jiruu	Gaaffii lakk 303f deebiin keessan yoo hin jiru ta'e gara gaaffii lakk. 305 darbaa.
304	Hojii tokkoo haala walfakkaatuun sa'aatii lamaaf gad jattee hojjeettaa?	1. Eeyyeen 2. Hin jiruu	
305	Hojii kanaa guyyaa keessaa sa'atii meeqaaf teessee hojjettaa?	_____sa'aatii	Taa'anii kan hojjeetan qofaaf kan gaafatamu
306	Hojii kana torban keessaa sa'aatii meeqaaf teessee hojjeettaa?	----------guyyaa	

Kutaa 4 ffaa : Xiinsammuu hojiin waliin walqabatee dhibbaa dhukkuba maashaalee fi wirtulee qaamaa irratti gaaffiin dhiyaatu

Hojii nuuffisiisaa ilaalchisee gaafiin dhiyaatuu (401-408)						
Lakk.	Gaaffilee	Hojii nuufisiisaa kan madaalamuu				
		Goonkumaa 1	Darbee darbee 2	Yeroo tokko tokko 3	Yeroo baay'ee 4	Yeroo hundaa 5
401	Haalli iddoo hojii kan hin gamachiifnee fi nageenyii isaanii kan hin eegamnee dhaa?					
402	Hojiin kiyya dhibbaa qaamaa fi xinsammuu natti taasisa jeettee yaaddaa?					
403	Dhibbaa hojii baay'ee nan qabaa jettee yaaddaa?					
404	Haala hojii keetii anga'ootaatti duubachuudhaaf natti ulfaataa jettee amantaa?					
405	Dhibbaan hojii jireenya dhunfaa koo fi matii waliin waliitti bu'aa jettee amantaa?					
406	Qooda/Gahee hojii koo haala gaariitiin raawwachuu fi to'aachuu nan danda'aa jettanii amantuu?					
407	Hojii haala gaariitiin hojjedheen beekamtii/badhaasa naaf keennamaa jeettanii amanttuu?					
408	Danddeetti fi muuxannoo koo hojii irratti haala gaaritiin fayyadama jeettanii amanttuu?					

Haala hojii gammachisaa ilaalchisee gaaffiilee dhiyaatan (409-418)						
Lakk.	Gaaffilee	Hojii gammachisuu kan madaalamuu				
		Baayyeen gammadaa miti	Hin Gammadu	Guddugaeessaa	Nan Gammada	Baay'ee na gammachiisa
409	Hojii haala gaariitiin hojjeedheen beekkamttii naaf keennamaa jeettee amanttuu?					
410	Hirriiyyoota keessan waliin walittii dhufeenyaa gaarii qaba jettanii isitti dhagahaamaa/yaaduu?					
411	Qonna Abaaboo kana keessa hojjeechuu keessaniif gammachuun isitti dhagahamaa?					
412	Hojii keessaniin nageenyuummaa natti dhagahaammaa jettanii yaadduu?					
413	Itti gaafatamtoonni waa'ee koo waan gaarii yaadu jettanii yaadduu?					
414	Walumaagalatti hojiin fayyaa qaamaaf gaarii dhaa jettanii yaadduu/amantuu?					
415	Mindaan naaf kafalamuu garii/gahaa dhaa jettanii yaadduu?					
416	Danddeetti fi muuxannoo koo hojii irratti haala gaariitiin fayyadamaa jettanii yaadduu?					
417	Hoggantootaa koo dhiyoo waliin waligaltee qabaa jettanii yaadduu?					
418	Hojii kootiin hanga tokko gammachuu qaba jettanii yaadduu?					

Kutaa 5ffaa: Ji'ootaa 12 darban keessaadhibbaa dhukkuba maashaalee fi wirtulee qaamaa beekuuf haala istaandardii Nordiikin gaaffiilee dhiyaatan

500 (a) Ji'ootaa 12 darban keessaa dhibbaa dhukuuba maashaalee fi wirtulee qaamaa irratti miirri dhukkubaa rakkisaa ta'ee isiin muudatee beekaa?		500 (b) Guyyoota 7 (torbaan tokkoo) darban keessaa miirri dhukkubaa rakkisaa ta'ee isiin muudatee beekaa?		500 (c) Ji'ootaa 12 darban keessaa dhukuuba maashaalee irratti qaqqabeen hojii keessan idilee akka hin hojjennee isin dhorkee beekaa?	
501	Morma A. Hin jiruu B. Eeyyeen	510	Morma A. Hin jiruu B. Eeyyeen	519	Morma A. Hin jiruu B. Eeyyeen

502	Gateetti A. Hin jiruu B. Eeyyeen yoo ta'e Gateettii Mirgaan, Gateetti Bitaan Karaa lamaanuu	511	Gateettii A. Hin jiruu B. Eeyyeen yoo ta'ee Gateetti Mirgaan, Gateetti Bitaan, Kara lamaanuu	520	Gateetti (Karaa lamaanuu ykn karaa tokkoon yoo mul'atee) A. Hin jiruu B. Eeyyeen
503	Ciiqilee A. Hin jiruu B. Eeyyeen yoo ta'ee Ciiqilee Mirgaan CiiqileeBitaan Ciiqilee lamaanuu	512	Ciiqilee A. Hin jiruu B. Eeyyeen yoo ta'ee Ciiqilee Mirgaan CiiqileeBitaan Ciiqilee lamaanuu	521	Ciiqilee (Karaa lamaanuu ykn karaa tokkoon yoo mul'atee) A. Hin jiruu B. Eeyyeen
504	Harkaa fi damee A. Hin jiruu B. Eeyyeen yoo ta'ee Harkaa fi damee mirgaan Harkaa fi damee bitaan Harkaa fi damee lamaanuu	513	Harkaa fi damee A. Hin jiruu B. Eeyyeen yoo ta'ee Harkaa fi damee mirgaan Harkaa fi damee bitaan Harkaa fi damee lamaanuu	522	Harkaa fi damee (Karaa lamaanuu ykn karaa tokkoon yoo mul'atee) A. Hin jiruu B. Eeyyeen
505	Duugda olaantuu A. Hin jiruu B. Eeyyeen	514	Duugda olaantuu A. Hin jiruu B. Eeyyeen	523	Duugda olaantuu (Karaa lamaanuu ykn karaa tokkoon yoo mul'atee) A. Hin jiruu B. Eeyyeen
506	Duugda gadaantuu A. Hin jiruu B. Eeyyeen	515	Duugda gadaantuu A. Hin jiruu B. Eeyyeen	524	Duugda gadaantuu A. Hin jiruu B. Eeyyeen
507	Mo'oofi naannoo teessumaa lamaanuu A. Hin jiruu B. Eeyyeen	516	Mo'oofi naannoo teessumaa A. Hin jiruu B. Eeyyeen	525	Mo'oofi naannoo teessumaa A. Hin jiruu B. Eeyyeen
508	Jilba lamaanuu A. Hin jiruu B. Eeyyeen	517	Jilba lamaanuu A. Hin jiruu B. Eeyyeen	526	Jilba lamaanuu A. Hin jiruu B. Eeyyeen
509	Miila/kooranciisaa lamaanuu A. Hin jiruu B. Eeyyeen	518	Milaa/kooranciisaa lamaanuu A. Hin jiruu B. Eeyyeen	527	Milaa (Karaa lamaanuu ykn karaa tokkoon yoo mul'atee) A. Hin jiruu B. Eeyyeen

Hirmaannaa keessaniif isiin galateffanna!!

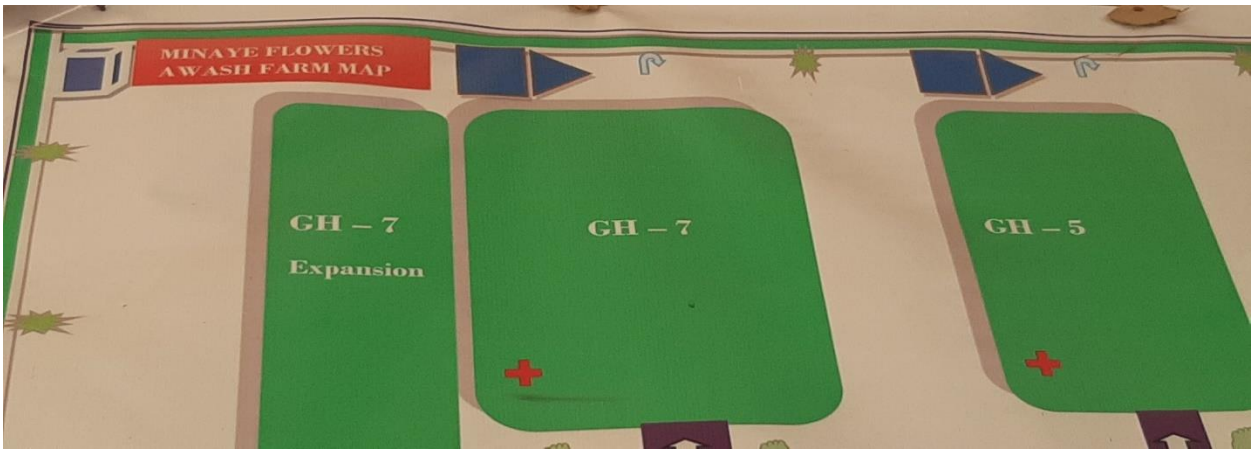
Annex VII. Sample Pictures During Data Collection

1) Flower Farms

a) Woliso Flower Farm (Assella Flower Farm PLC)

b) Bacho Flower Farm (VEGPRO AGRICULTURAL PLC)

c) Sebeta Hawas (Minaye Flower Farm)



2) Sample Interview Pictures

3) Work Departments

i) Greenhouse and selected activities

Soil bed preparation

Manual Watering

Pipeline watering

Greenhouse workers during data collection

Greenhouse workers on their regular tasks

ii) Selected Packhouse Operations

Cold room

Cold room