



**Addis Ababa University**

**College of Health Sciences**

**School of Public Health**

**Assessment The Prevalence Of Work Related Musculoskeletal Disorders And Associated Factors Among Coffee Processing Factory Workers In Addis Ababa City And Gelan- Sub City, Shagger City Oromia, Ethiopia.**

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**A Thesis Report Submitted To the Graduate Program of Addis Ababa University, College Of Health Sciences, and School Of Public Health in Partial Fulfillment for the Degree of Masters of Public Health in Environmental and Occupational Health Specialty**

**December – 2023**

**ADDIS ABABA, ETHIOPIA**



## **ACKNOWLEDGEMENTS**

**May he grant you your heart's desire! And fulfill all your counsel! Psalms 20:4**

First and most I would like to thank the almighty GOD for His guidance, provision and good health for my life and throughout the study period.

This thesis would not have been complete without the generous support and guidance I received from my advisors Teferi Abegaz (PhD) and Samson Wakuma (PhD) may God bless.

My thanks also go to the Department of Preventive Medicine staff for their advice, motivation, and support. I would like to thank the Norwegian Program for Capacity Development in Higher Education and Research for Development (NORHED) for providing financial support for this study, and Oromia Regional Social and Labour Affairs.

I extend my sincere gratitude to my parents for valuing education and supporting me in my academics and who always prayed for me to do well.

Last but not least my special thanks go the Coffee processing Industry managers, the study participants/workers for their cooperation and provision of valuable information as well as all the data collectors.

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## List of Acronyms and Abbreviations

AAU	Addis Ababa University
BOLSA	Bureau of Labor and Social Affairs
BMI	Body Mass Index
COR	Crude Odd Ratio
C-I	Confidence Interval
E.C	Ethiopian Calendar
ETB	Ethiopian Birr
ILO	International Labor Organization
MOLS	Ministry Of Labor and Skills
MSDS	Musculoskeletal Disorders
OSH	Occupational Health and Safety
NIOSH	National Institute of Occupational Safety and Health
SPH	School of Public Health
SPSS	Statistical Package for Social Science
WHO	World Health Organization
WRMSDs	Work Related Musculoskeletal Disorders

## Abstract

**Background:** Globally, work-related musculoskeletal disorders (WRMSDs) account for around 40% of the total compensated cost of occupational diseases and injuries. It has a huge impact on the public health problems and economic loss of the society.

The extent and risk factors for musculoskeletal diseases associated with job among coffee processors have not been examined by researchers. The labor-intensive nature of the coffee processing industry puts employees at risk for musculoskeletal disorders.

**Objective:** The study aimed to assess the prevalence and associated factors of work-related musculoskeletal disorders among coffee processing factory workers.

**Methods:** An institutional based cross-sectional study was utilized to assess the prevalence of work-related musculoskeletal disorders among five selected coffee processing factories (three in Addis Ababa City and two Gelan sub city, Sheggar City) from March to June-2023. Data were gathered in a face-to-face interview using a standardized Nordic questionnaire. Stratified sampling followed by lottery method was used to select 633 of study participants. EpiInfo version 7 was used to enter and clean up the data, which were exported into the statistical package for social sciences software version 23 it was cleaned and make it ready for analysis. Bivariate and multivariate logistic regression models were used to determine potential predictors of MSDs.

**Results-** The prevalence of work-related musculoskeletal disorders over the course of a year was 529 (83.6%). The most affected body parts are shoulders (64.5%) followed by neck (61.8%), upper back (60.2%), lower back (54.0%) and hands (51.2%). Based on the final multivariate logistic regression analysis being male [AOR = 1.82, 95% CI (1.11, 2.97)], marital status (married) [AOR = 2.24, 95% CI (1.33, 3.79)], habit of doing physical exercise [AOR: 2.18, 95% CI (1.14, 4.17)], job-related stress [AOR: 2.09, 95% CI (1.28, 3.43)], health and safety training [AOR: 2.57, 95% CI 2.57 (1.11, 5.96)],work hours[AOR: 2.95, 95% CI (1.16, 7.47)],and repetitive work[AOR: 1.98, 95% CI (1.11, 3.54)] were found to be have statistically significant association with work related musculoskeletal disorder.

**Conclusion and recommendation:** According to study results, workers who process coffee experience a considerable prevalence of musculoskeletal illnesses and their related risk factors. To protect employees from workplace risks, owners and governing authorities should concentrate on preventive measures and safety regulations.

**Key words:** - Ethiopia, Coffee Processing worker, Work related musculoskeletal disorders.

## **Introduction**

### **1.1. Background:**

The term "musculoskeletal disorders" (MSDs) refers to injuries and conditions which affect the musculoskeletal system or the movement of the human body. Pain or functional impairment resulting from various inflammatory, degenerative, and painful illnesses is referred to as work-related musculoskeletal disorders (WRMSDs). WRMSDs are symptoms of disorders in the locomotor apparatus, which includes the muscles, tendons, bones, cartilage, ligaments, and nerves. MSDs include all forms of ill-health ranging from light, transitory disorders to irreversible, disabling injuries, which are induced or aggravated by work and the circumstances of its performance (WHO) (1). Worldwide, the prevalence of musculoskeletal illnesses associated to the workplace is rising. Such conditions have a significant financial impact on the world's population and can negatively impact one's health, quality of life, and status (2).

Globally, work-related musculoskeletal disorders (WRMSDs) account for around 40% of the total compensated cost of occupational diseases and injuries. It has a huge impact on the public health problems and economic loss of the society (3). WRMSDs cost the economy 6.9 million working days on average per case, with 498,000 cases of the work-related musculoskeletal disease out of 1,354,000 cases of work-related illness. Because of the long duration of job impairment and reduced productivity, it has an economic effect (4).

WRMSDs was caused or intensified by poor working environments and high physical demand work tasks such as lifting heavy objects, bending, reaching overhead, pushing and pulling heavy loads, performing similar tasks repeatedly, or performing awkward postures. Poor working conditions often expose workers to many risk factors for musculoskeletal diseases. The duration, frequency, and degree of exposure significantly affect the risk level. Studies on MSD frequently cite a number of physical risk factors: body postures that aren't neutral, exposure to cold, repetitiveness, inadequate recovery time, physical workload, static effort, and mechanical compression of tissues (5).

Factors contributing for the development of WRMSDs in garment, Sugar factory, flour food processing factory, Manual Material Handling factory and coffee harvester workers are wide spread and most of occupational injuries had their own contributing factors. Individual factors (age, sex, physical activities) and organizational factors (employment status, Working hours), work environment (types of work, type of setting chair are also important underlying factors for the progress of WRMSDs (6–8).

## 1.2 Statement of the problem

In Ethiopia, the manufacturing sector and working areas are growing alarmingly. As a result, the problem of severe injury becomes a common problem due to the lack of a healthy working environment in the rate of industrial expansion. Additionally, just 5–10% of Ethiopia's workforce has access to skilled workers and work-related health services, and there are little or no job-related services and psychosocial stress are Exist (9).

The labor-intensive nature of the coffee industry increases the risk of WRMSD because most tasks require exerting effort, repeating motions, and maintaining a still posture for extended periods of time. Coffee processing workers may be subjected to poor working conditions and physically demanding jobs include lifting large goods, bending, pushing, and dragging heavy loads, repeating the same actions, or adopting awkward postures. Workplace risk factors are likely to contribute to the development of WMSD, coupled with health status/personal restrictions and psychological factors including stress(US Department of Health and Human Services) (10).

Given that these industries share many risk factors and that there are no studies that specifically look at this group of workers, research on the prevalence of WMSDs in the garment, flour, manual material handling, construction industries, mining, coffee harvester, and sugar industries was used as a reference to access the prevalence and associated factors of WMSD of coffee processing workers. Ethiopia, like other African countries, is coping with new issues brought on by industrialization and rapid urbanization in addition to a health issue related to occupation(11). The prevalence of work-related musculoskeletal illnesses and their contributing factors among those employed in the coffee processing business in Ethiopia is not well-documented nationally or in Ethiopian studies. Therefore, this study was mainly focus on the prevalence of work-related musculoskeletal disorders (WMSDs) experienced and associated factors among employees in a few Addis Ababa City and Gelan Sub city Shagger City coffee processing enterprises, as well as to provide important information for those industries to reduce WMSDs.

## **1.2. Rationale and Significance of the study**

### **Rationale of the study**

Missed work days, financial losses from medical expenses, and poor working conditions owing to discomfort at work are all significant losses brought on by MSDs. MSDs are among the most common causes of decreased productivity at work due to absenteeism, sick leave, and early retirement (Erick & Smith, 2015) (12).

Many studies in the textile and other industries have been conducted on workplace exposure, including occupational diseases and injuries. However, there have been few studies that have examined the prevalence of musculoskeletal disorders and focused on particular working groups and body regions. This study, however, assess the prevalence of musculoskeletal disorders in coffee processing workers and nine body regions to examine prevalence variation within body regions (16,18).

However, there hasn't been any research done on the frequency of MSD-related labor and its contributing factors in coffee processing plants. In order to fill this knowledge gap, the current study offers a valuable starting point and input for more in-depth research as well as crucial data for managers, employers, government policymakers (MOLS, BOLSA), nongovernmental organizations, and other interested parties working on OHS for further advancements in coffee processing factories workers' health and safety.

### **Significance of the study**

The results of this study assist factories in comprehending the benefits of workplace health and safety, which lowers direct and indirect expenses while enhancing performance and productivity. Additionally, it lowers absenteeism and boosts employee confidence.

Nationally, improved economic performance, increased social benefits, and lower expenses for health care and social security.

In order to create effective methods to prevent and control musculoskeletal illnesses and disability, it is important to understand the factors that affect the prevalence of musculoskeletal disorders among coffee processing employees.

## 2. Literature Review

### 2.1 General over view of WMSDs

WMSDs, which can result in missed work, impaired performance at work, disability, and a decline in quality of life, are one of the most common occupational dangers among industrialized workers (19).

When it comes to serious public health issues linked to unsafe workplace conditions, work-related musculoskeletal disorders (WRMSDs) have been identified as a possible threat. The concerns surrounding occupational safety and health conditions varied throughout nations, organizational sectors, and social groupings.

Muscle, tendon, peripheral nerve, and vascular system ailments known as musculoskeletal diseases (MSDs) result from a variety of inflammatory and degenerative processes. These painful illnesses and their accompanying symptoms that impact the musculoskeletal system are referred to as work-related musculoskeletal ailments. One of the most prevalent occupational risks among industrialized employees is WMSDs, which can cause absences from work, subpar performance at work, disability, and a deterioration in quality of life (15).

The majority of musculoskeletal disorders are caused by low back pain, which accounts for 7.4% of all young life deaths globally and 570 million prevalent instances worldwide (16). Disorders and injuries to the musculoskeletal system are often referred to as musculoskeletal disorders (MSDs). They happen when the physical demands of an activity exceed a person's body's musculoskeletal system's capability or capabilities. MSDs may develop gradually over time or may appear quickly as a result of a single occurrence. One of the leading causes of years spent disabled worldwide is musculoskeletal disorders (MSDs)(17).

With higher compensation and healthcare expenditures, less productivity, and a lower quality of life, WRMSDs are known as a serious occupational concern that contributes to morbidity in many working populations. According to the International Labor Organization (ILO), 2.34 million people die each year from diseases or accidents related to their jobs, and 317 million experience work-related injuries. As a result, one of the most significant occupational health issues is musculoskeletal illnesses at work. This condition results in long-term occupational impairment and decreased production(18,19). Musculoskeletal complaints typically lower quality of life, and illnesses require expensive medical care (20).

### 2.1.2 Magnitude of WMSDs among coffee processing workers

Musculoskeletal diseases (MSDs) are one of the major causes of years spent living with a disability worldwide.(21). Its problems impact people of all ages and stages of life worldwide. They are not just a problem for workers. According to reports from the WHO, musculoskeletal disorders issues were one of the top causes of disability in four out of the six countries/regions in 2017; they were ranked second in the East Mediterranean Region and third in the African Region. There is a correlation between the occurrence of musculoskeletal problems and age; younger persons are also affected, frequently during their years of highest income generation(16).

Globally, 1.71 billion individuals live with musculoskeletal diseases, including low back pain, neck discomfort, fractures, various injuries, osteoarthritis, amputation, and rheumatoid arthritis, according to a recent review of data from the Global Burden of Disease (GBD) 2019 report. People of all ages are affected worldwide, while the prevalence of musculoskeletal diseases varies by age and diagnosis. In terms of population, high-income nations (441 million) are the most afflicted, followed by the WHO Western Pacific Region (427 million) and the South-East Asia Region (369 million). With over 149 million YLDs, or 17% of all YLDs worldwide, musculoskeletal diseases are also the main cause of years lived with disability (YLDs) (16).

A study done in flour factories in Hulu Langat, Selangor, Malaysia found that the prevalence of musculoskeletal problems was highest in the ankles and feet (46.2%), followed by the wrists and hands (45.6%), elbows (40.9%), shoulders (31.1%), lower back (28%), neck (25%), knee (20.5%), hips/thighs (15.2%), and upper back (10.6%)(22).

Lower back pain was reported to be 34.8% common, upper back pain was 22.4% common, wrist/hand pain was 10.9%, shoulder pain was 10.0%, elbow pain was 9.0%, neck pain was 7.5%, hip/thigh pain was 7.5%, knee pain was 6.5%, and ankle/foot pain was 5.0% common, according to a study by Aremu et al. in Uganda on musculoskeletal disorders among sugar factory workers (23).

A study involving 600 Bangladeshi garment workers in Dhaka found that the prevalence the majority (57.5%) of the respondents admitted to having musculoskeletal disorders in various body sites.

Among them, 37.7% said they had back pain in the lower back, 26.4% had neck and shoulder pain, 15.1% had chest discomfort, 14.2% had wrist and hand pain, 3.9% had lower abdominal pain, and 3.77% had lower limb pain. Most respondents (70.7%) stated that their pain was intermittent in nature and that it only occasionally manifested itself during periods of intense work load. 3.8% of respondents said their discomfort was intermittent, meaning it began when they went to work. 5.3% of the total respondents also stated feeling numb. (24).

According to a study carried out in the Rupandehi district of Nepal, musculoskeletal disorders are common among garment workers. Of the respondents who reported having musculoskeletal discomforts, the majority (67%), followed by shoulder pain (26.6%), and only 1.1%, reported having hand or leg discomforts. The majority of respondents, or 82% of the respondents, stated that they occasionally had pain during periods of excessive effort (25).

According to a study done on 986 Ethiopian garment workers in Gelan Sub city, Shagger City, self-reported work-related ailments of the neck, shoulder, elbow, and wrist affected 45%, 51.7%, 40%, and 37.7% of the employees, respectively (26).

## **2.2 Factors associated with work related musculoskeletal disorder**

### **2.2.1 Socio demographic factors**

Numerous researches have demonstrated that socio-demographic factors play a significant role in the development of work-related musculoskeletal disorders (WRMSD) in the workplace (6, 16, and 26). Workplace factors (employment status, payment methods, working hours, types of work, working sections, high-loaded work, sitting and standing hours), personal and behavioral factors (BMI, physical activity, smoking), socio demographic factors (age, sex, educational level, monthly salaries and years of service) are all categorized as contributing factors to the development of WRMDs in garment, flour food processing factory, and sugar factory workers(22,25,27,28).

In any region, women are more likely than men to report having WRMSD symptoms. In comparison to their similarly employed male coworkers, women who work in shipyards and assembly plants report higher rates of neck and upper extremity pain (12, 26, 32).

### **2.2.2 Individual and Behavioral factors**

Personal factors include BMI, smoking habits, physical activity routines, and musculoskeletal problem history. (26).

There is evidence in the literature linking WRMSD to a number of socio demographic characteristics. An institution-based cross-sectional study carried out in Ethiopia, Beijing, Malaysia, Thailand, Sri Lanka, and Nepal identified gender, advancing age, educational status, a high or low wage, a lack of exercise, working nights, BMI, and past illness history as significant predictors of WRMSDs (3,13,20,22,25).

The prevalence of MSD has an impact on quality of life, health satisfaction, and perceived general health in most women (54.4%) who rate their overall quality of life as either very excellent or good; 63.8% of women in a Sri Lankan survey of female textile workers reported being satisfied with their health. The average score for the physical domain was the best, coming in at 70.2%, while the psychological domain came in at 42.5% (3).

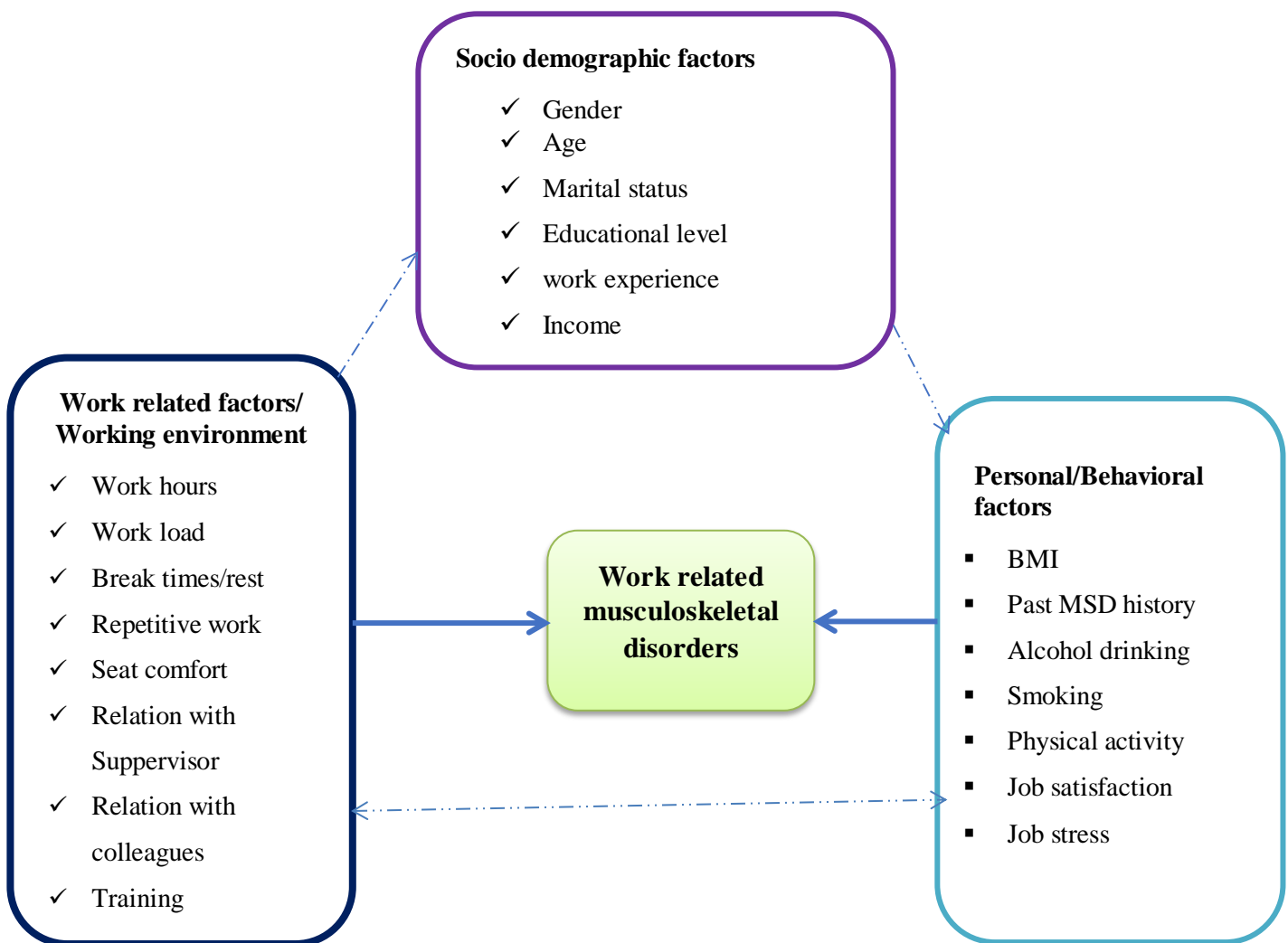
### **2.2.3 Working Environment factors**

In the study Migrant Fruit Farm Workers in the Eastern Region of Thailand, it was shown that the majority of farm workers (49.1% of men and 47.2% of women) carried out their duties in hot environments and that vibration from tools and machinery harmed them (13.8% of men and 10.3% of women). In terms of ergonomics, it was discovered that the majority of tasks performed by both men and women (64.3%) required bending, squeezing, and reaching gestures. These tasks were followed by those carried out while standing (65.7% of men and 55.8% of women) and by lifting hands above shoulder height (55.1% of men and 53.6% of women). Comparatively, these findings revealed considerable gender disparities in the current heavy workload and labor done while standing (20).

According to a study conducted in Ethiopia, the environment may be a risk factor for problems of the elbow, wrist, neck, and shoulder in those who work with clothing. Of the participants, 46.4% were always exposed to repetitive tasks that had to be repeated within 30 seconds, 47.4% performed high-demand tasks during working hours, 87% had enough light to operate sewing machines, and 72% of the operators did not use a chair that could be adjusted. (26).

### 2.3. Conceptual framework

In order to establish this conceptual framework for work-related musculoskeletal disorders, different types of literature on the contributing elements to dependent and independent variables were reviewed. (28). Based on several research reviews of musculoskeletal problems in garment workers, the relevant factors are categorized into three groups. The main causes of musculoskeletal disorders at work are numerous. Age, sex, marital status, level of education, work experience, and monthly income are sociodemographic factors that are linked to WRMSD. Work-related factors include job category, payment methods, workload, repetitive motion, working hours, break times/rest, work posture, and professional training. Personal factors include BMI, smoking, drinking, physical activity, and previous MSD history. (3,13,26,31).



**Figure 1.** Conceptual framework for musculoskeletal disorders and related factors has been refined and incorporated from various research reviews.

### **3. Objectives**

#### **3.1. General objective**

- ✓ The aim of this study was to assess the prevalence and associated factors of musculoskeletal disorders among selected coffee processing factory workers in Addis Ababa city, and Gelan Sub city, Shagger City –Oromia, Ethiopia 2023.

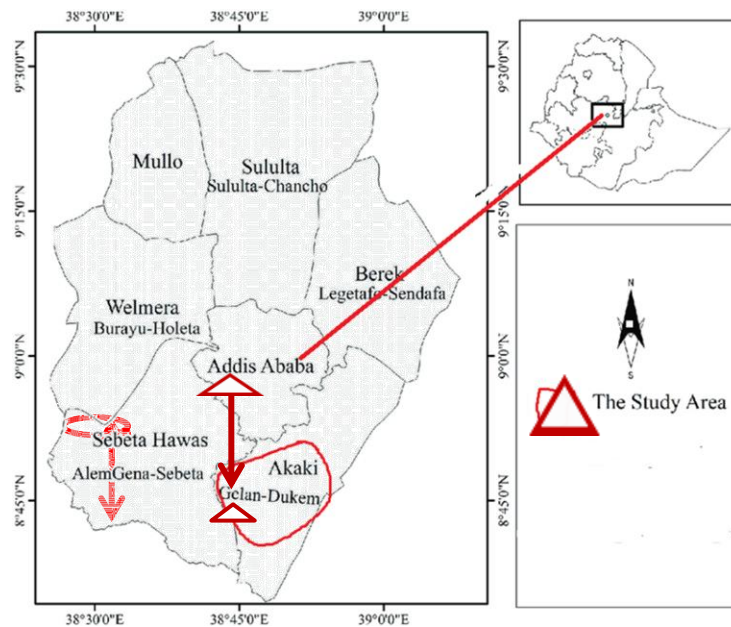
#### **3.2. Specific objectives**

- To assess the prevalence of the work-related musculoskeletal disorder among coffee processing industry workers.
- To identify factors associated with musculoskeletal disorders among coffee processing industry workers.

## 4. Methods

### 4.1 Study Area and Period

This study was conducted in selected five coffee processing industries (three from Addis Ababa City and two from Gelan sub city Sheggar City), from March to June, 2023 (Figure below). There are 54 coffee processing industries in Addis Ababa City based on the evidence obtained from the city administration, and 10 in Gelan sub city Shagger city. Gelan Sub city Shagger City is one of the industrial zones in Oromia regional state, which is located southeast direction of 25 km far from Addis Ababa, the capital city of Ethiopia and contains 10 coffee coffee processing industries. According to the Sub city administration, most of the foreigners and domestic investors are investing in different industrial activities. Among these industrial activities, the coffee processing factories are the common industries in the city. So based on our study objective we have selected five coffee processing industries.



Map of study area

### 4.2 Study Design

A cross-sectional institutional-based study was used to assess the work-related musculoskeletal disorder and identify factors associated with WMSDs among coffee processing factory workers in Addis Ababa city, and Gelan -sub city Shagger City Oromia Regional state, Ethiopia 2023.

These industries did not allow us to state its name and characteristic in details for privacy issues.

Factory A- with 485 workers, it was established since 1992 E.C.

Factory B- with 136 employees, it was established since 1995 E.C.

Factory C -with 150 employees. The factory was established since 1991 E.C.

Factory D -with 138 employees. The factory was established since 2005 E.C.

Factory E -with 77 employees, it was established since 1994 E.C.

### **4.3 Source population:**

All workers involved in selected coffee processing factory Addis Ababa city, and Gelan Sub city Shaggar City Oromia, Ethiopia are source of population.

### **4.4 Study population:**

All coffee processing factory workers selected by stratified sampling followed by lottery method were our study population.

### **4.5 Eligibility criteria**

#### **4.5.1. Inclusion criteria**

- ✓ The workers who have worked at least one year in coffee processing factory.

#### **4.5.2. Exclusion criteria**

- ✓ Workers who are absent from work during the time of data collection were excluded from the study.

### **4.6 Sample size determination**

The sample size for objective one was calculated using a single population proportion formula, with the following assumptions: 5% margin of error (d), proportion (p) of WRMSDs among coffee processing workers 50% (due to lack of previous studies with similar working condition) and  $Z_{\alpha/2}$  = the value of the standard normal curve score corresponding to the given CI. Accordingly, based on a single population proportion formula:

$$n = \frac{\left(Z_{\frac{\alpha}{2}}\right)^2 p(1 - P)}{d^2}$$

Where ❖ n= Initial sample size for the study population

- ❖  $Z_{\alpha/2}$  = A standard normal distribution value = 1.96, corresponding to 95% CI,
- ❖  $P$  = Assumed prevalence 50% = 0.5.
- ❖  $d$  = margin of error = 5% = 0.05.
- ❖  $Z$  = Design effect = 1.5.

$$n = \frac{(Z_{\alpha/2})^2 p(1-P)}{d^2}, \text{ By inserting in the formula } n = \frac{(1.96)^2 0.5(1-0.5)}{(0.05)^2} = 384 \text{ after adding}$$

10% for non-response rate,  $384 * 0.1 = 38.4$ , and then total sample size was 422. By considering design effect final sample size give  $(1.5 * 422 = \mathbf{633})$  of factory workers.

**For objective two:-** To identify associated factors for work related musculoskeletal disorders, Sample size was calculated using double population proportion formula based on the following assumptions.

$$n1 = \frac{\left[ Z \frac{\alpha}{2} \sqrt{\left(1 + \frac{1}{r}\right) P(1-P)} + Z\beta \sqrt{P1(1-p1) + \frac{p2(1-p2)}{r}} \right]^2}{(P1 - P2)^2}$$

$n1$  = Number of sample,

$P1$ - % of probability of event in the (exposed),

$P2$ -% of probability of event in the (non-exposed),

$\alpha$ - is type 1 error with a value of 5%

$r$ - ratio of exposed to unexposed

$Z_{\alpha/2}$ = critical value of 95% level of significant

$Z\beta$ : power = 80 %

Sample size was calculated using the statcalc for sample size and power for cohort and cross sectional studies of Epi Info version 7, assuming the above criteria.

$P1 = 61.7\%$ , $P2 = 44.1\%$ , Odd ratio = 2.04 Sample size = $254 + \%10 = 279$	Reference (32)
$P1 = 51.7\%$ , $P2 = 31.8\%$ , Odd ratio = 2.3 Sample size = $192 + \%10 = 212$	Reference (48)
$P1 = 56.8\%$ , $P2 = 38.8\%$ , Odd ratio = 2.07 Sample = $244 + \%10 = 268$	Reference (49)

The decision was done by comparing the sample size in objective one (633) and sample size in objective two (304) in terms of representativeness. The 1<sup>st</sup> objective sample size was used.

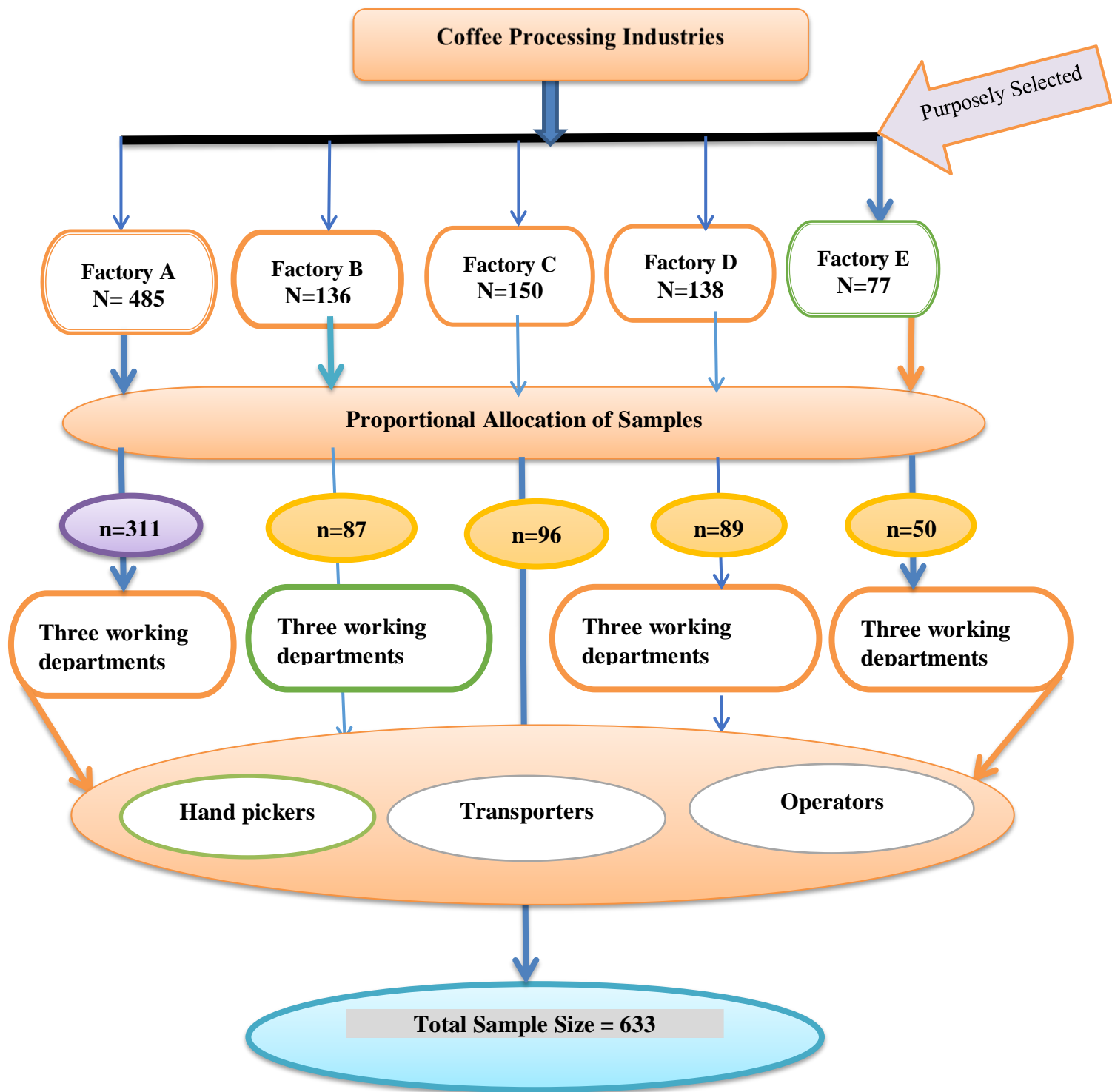
#### 4.7 Sampling Methods:

Stage one selection of factories from Addis Ababa and Gelan sub-city and proportional allocation of sample. The exposure level among different department is not uniform. Therefore using stratification in to three different departments namely hand picker, transporter and operator, the number of samples from each stratum is determined by using proportional allocation formula. Finally, the numbers of representation of study participants were drawn by using lottery method from a list of their payment sheets.

**Table1: Job group and main task of Coffee industries of workers with their work position.**

Job group	Task
The machine room	machine operator—monitoring the processes; mechanic work—ensure the smooth running of the machines; cleaning—clean the machine and the machine area; and feeding hopper—feeding the hopper that is located inside the machine room.
The transport job group	The transport job group included three tasks: loading and unloading—manual transport of coffee beans; mixing—mixing reject coffee; feeding coffee—feeding hopper outside the machine room.
Hand picking job group	Hand picking job group included mainly women involved in manual sorting and removal of defective and discolored coffee beans. Some of these women sit inside the machine room and picks the coffees from the sorting tables or belts whereas others sit on the floor without table and patiently pick through piles of green coffees.

**Source:** Abaya SW, Bråtveit M, Deressa W, Kumie A, Moen BE Personal Dust Exposure and Its Determinants among Workers in Primary Coffee Processing in Ethiopia. *AnnWork Expo Health*. 2018 Nov 12; 62 (9):1087–95.



**Figure2.** Schematic Representation of Sampling technique Coffee Processing Industry Workers, 2023.

Working department	Factory A		Factory B		Factory C		Factory D		Factory E	
	Source	Sample	Source	Sample	Source	Sample	Source	Sample	Source	Sample
<b>Hand Picker</b>	55	35	14	9	105	67	35	22	16	11
<b>Transporter</b>	350	225	102	65	40	26	99	64	55	35
<b>Operator</b>	80	51	20	13	5	3	4	3	6	4
<b>Total</b>	<b>485</b>	<b>311</b>	<b>136</b>	<b>87</b>	<b>150</b>	<b>96</b>	<b>138</b>	<b>89</b>	<b>77</b>	<b>50</b>

**Table2:** Sample size calculation based on their departments in five coffee processing industries in AA City and Gelan sub city Shagger City Ethiopia, 2023.

#### 4.8 Data collection process:

##### 4.8.1 Questionnaire

Face-to-face interview was conducted to collect data by using a standardized Nordic questionnaire for assessing the prevalence of work-related musculoskeletal disorders in different body regions. Nordic questionnaire is repeatable, sensitive, and useful as a screening and surveillance tool for musculoskeletal disorders\_(34). It also assesses the associated factors, which includes socio-demographic characteristics, work related and behavioral factors\_(35). The questionnaire is translated from English to afaan Oromo and Amharic, then independently back-translated to English to ensure consistence. The interviews carried out by using trained data collectors.

##### 4.8.2 Observation check list

The observation checklist was also used during data collection for assessing occupational health and safety in coffee processing areas. Examples of these assessments included whether any department or section of the department was overcrowded and did not allow for free movement, whether or not work surfaces were kept dry and non-slip, whether a health and safety committee was available, whether there were signs of warning and safety rules, whether or not first aid equipment was available, whether workers were trained, if fire extinguishers were present, the way loading and unloading activities were carried out on the work site, and whether or not a health and safety officer was in place.

### 4.8.3 Data collectors and supervisors

Four data collectors with first-degree environmental health professional qualifications and one supervisor with a master's degree in environmental health who had prior experience were trained and participated in the data-collection process.

### 4.8.4 Operational definition

**Body segments:** It includes neck, shoulder, upper back, lower back, hip /thigh, knee/leg , ankle/foot, and wrist /hand of the body (36).

**Work related musculoskeletal disorders:** Coffee processing workers who have experienced pain,ache or discomfort for at least 2-3 work days of the last 12 months in any part of body segments (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 caused, aggravated by work place exposures (37).

**Job stress:** A score measured using the workplace stress scale as YES (16 to 40) (38,39) and NO (lower than or equal 15) (40).

**Job Satisfaction** - It is a score measured using the job satisfaction scale as YES (32–50) and NO (10–31) MSD(32).

**Body mass index:** human weight in kilograms divided by the square of the height in meters ( $\text{kg}/\text{m}^2$ ) (26).

- Underweight= BMI <18.50
- Normal range= BMI b/n 18.50-24.99
- Overweight = BMI between 25.00-29.9 and
- Obese= BMI  $\geq$ 30.00.

**Cigarette Smoking:** is a practice of smoking cigarette by coffee processing workers for at least one sticks of cigarette per day considered as smoker (17).

**Alcohol drinking:** it is a consumption of any kind of coffee processing workers at least for two times per week for different purpose (15,17).

**Physical exercise:** Performing any kinds of physical exercise at list two times per week for 30 minutes (26,41).

**Repetitive work within greater than 30 second-** Perform work by repeating the same activity with less than 30s or no variation every few seconds for 2 or more hours (42).

**Sitting posture:** is a position of coffee processing workers who perform activities by prolonged sitting in a restricted space for 2 hours or above without changing their positions(41,43).

**Standing posture:** is a position of coffee processing workers who perform activities by prolonged standing for 2 hours or above (41,43).

**Doing high loaded work:** attaining forceful carrying above the shoulder, lifting and lowering loads, pushing and pulling heavy coffee sack (bag) weight greater than or equal to 60 kg as reported by workers and supervisors.

#### 4.9 Study variables:

##### **Dependent variable:**

Prevalence of Work related musculoskeletal disorders (Yes /No).

##### **The Independent variable/ Exposure variable**

- ✓ **Socio-demographic variables:** Gender, age, marital status, educational status, income and service year.
- ✓ **Work Environment factors:** - Relation with Supervisor, working hours, total break excluding lunch time, health and safety training, repetitive work within less than 30 second/within few hours, loaded work, and fitness of working machine with sitting chairs.
- ✓ **Behavioral and Personal factors** – Body mass index, physical exercise, smoking behavior, alcohol drinking, and medical history with MSDs.
- ✓ **Psychosocial factors:** - job satisfaction and job stress.

#### 4.10 Data management

Data were checked for completeness during data collection. Each questionnaire coded, stored in appropriate area (computer/flash disk) and checked for completeness by investigator. Data were entered using EPI Info version7 data entry software and exported to Statistical Packages for Social Sciences (SPSS) version 23 make it ready for analysis.

A Likert scale was utilized to assess the degree of satisfaction that employees had with their jobs to determine their job satisfaction. The option was 5 likert scale (1-very dissatisfied, 2-dissatisfied, 3-neutral, 4- satisfied and 5 -very satisfied) with ten items. This part was computed according to Macdonald work place job satisfaction scale. The workers classified in to two categories by using demarcation threshold as satisfied (32-50) and not satisfied (10-31) (35).

Using the American Institute of Stress scale calculation and Marlin Company, workers' job stress was assessed. The workers categorized in to two as had stress ( $\leq 15$ ) and no stress (16-40) (32,44).

We were check missing values and outliers for accuracy, those which causes of outliers and missed values are determined and no data is dropped from analysis.

#### 4.11 Data Analysis

After the data were exported into SPSS version 23 software program, it was cleaned and makes it ready for analysis, odds ratio with 95% confidence interval was used to measure the association between works related musculoskeletal disorders and the independent (socio demographic, work environment related and behavioral) variables.

**For first specific objective:** - descriptive findings were presented by frequency tables, percentage, figures and mean, standard deviation were used summarize the socio-demographic, behavioral and personal factors and working environment.

**For second specific objective:** - to determine the independent factors associated with WRMSDs. Cross tabulation, bivariate and multivariate logistic regression was used to explore presence of statistical association between different independent variables and outcome variables using crude odds ratio (COR) with 95% C-I. Bivariate logistic regression analysis test was performed to see the existence and significance of association between dependent and independent variables.

Then to determine the independent factors associated with musculoskeletal disorders, multivariate logistic regression was carried out. To avoid excessive number of variables and unstable estimate, only variables with P-value  $< 0.2$  in the bivariate analysis were taken in the multivariate analysis. Then, variables with  $P < 0.05$  in the multivariate analysis were considered significant, and presented by adjusted odds ratio (AOR) with 95% C-I.

**Model fitting** - Was checked using Hosmer and Lemeshow goodness of test which showed  $\chi^2 = 6.690$  with degree of freedom (df= 8) and significant of= 0.570. Hence the p-value was above the standardized p-value of 0.05. This indicates Hosmer and Lemeshow test should be insignificant at p-value of 0.05 indicating that the variable entered fits the model. Therefore, the result of the regression analysis has suggested evidence for model adequacy well fitted with the predictors.

**Multicollinearity test** - Was checked by Kendall's tau-b and Spearman rho test. Correlation coefficient of each variable was below 0.75. Which indicate specified independent variable is not explained by other independent variable in the model.

#### **4.12 Data Quality Assurance**

Pre, during, and post data collection, the data quality was assured. The questionnaire was prepared first in English and then translated into Amharic and afaan Oromo finally retranslated back to English by independent translators to check for consistency. Two days training was given for data collectors, to familiarize them with the way data collection process. For the period of the training period topic like the objectives of the study, the procedure of data collection and review of key terminologies and ethical issue of the study was discussed.

Before the actual data collection five percent [%5], (n= 32) of study participant, pre- tested in one coffee processing factory which found in Gelan sub city Shagger City and ambiguous questions was identified during the pre-test study.

In the course of data collection period, the collected data was checked for completeness and for its consistencies by the primary investigators and supervisors on a daily basis. Missed questions and variables during the leading visit were filled by reinter viewing the participants. Later the data collection, the collected data was rechecked for its completeness and consistency by the supervisors and primary investigator.

#### **4.13 Ethical Consideration**

Ethical clearance was obtained from the Ethical Review Committee (REC) of Addis Ababa University School of Public Health. Formal letter for collaboration was obtained from school of public health, College of Health Sciences, Addis Ababa University.

Permission was asked from the the coffee processing industries. Oral consent was obtained from respected participants after a necessary explanation about the purpose, benefit, and risk of the study and their right on the decision of whether or not to participate in the study. The study participants were strongly informed that there is no direct financial benefit and risk from this study, on the other hand, the study findings will be used to design strategies for the prevention and control mechanism of musculoskeletal disorder in the coffee processing industries workers.

Concerning confidentiality, the names of respondents were not included in the questionnaire and any data was coded and kept secret to ensure data confidentiality.

#### **4.14 Dissemination of findings**

The results of this study will be submitted to Addis Ababa University's College of Health Sciences, School of Public Health, upon completion of the research. Once more, it would be distributed to the relevant, Ethiopian Ministry of Labor and Skills (MOLS), Bureau of Labor and Social Affairs (BOLSA), and coffee-processing factories those where data was collected. We'll be working further to get the results published in a national or international journal.

## 5 Results

### 5.1 Socio demographic characteristics of the study participants

The study had 633 people in all, with a 100% response rate. The average age of the participants was 31.04, with a standard deviation (SD) of  $\pm 8.46$ . There were 531 married individuals (81%) and 484 males (76.5%). Out of the survey participants, 230 (44%) had at least completed their secondary school, while just 6.6% were illiterate. Out of all the responders, 171 (or 27%) were under 30 years old. Based on the employment history of the participants, 507 (80.1%) had a tenure ranging from one to five years. The majority of responders (481, or 76%) had monthly salaries of less than 5000 Ethiopian Birr (Table 3).

Table3. Socio-Demographic characteristics of participants in the selected Coffee processing industries in Addis Ababa City and Gelan Sub- city Shagger City, Ethiopia, 2023.

<b>Variables</b>	<b>Frequency(N= 633 )</b>	<b>%</b>
<b>Gender</b>		
Male	484	76.5
Female	149	23.5
<b>Age(Years)</b>		
Below 20	44	7
21 - 24	94	14.8
25 – 29	171	27
30 – 34	150	23.7
35 – 39	87	13.7
≥ 40	87	13.1
<b>Educational level</b>		
Illiterate	42	6.6
primary school	182	28.8
Secondary school	230	43.9
Certificate and above	100	15.8
<b>Marital status</b>		
Single	120	19
Married	513	81
<b>Income</b>		
≤5000 ETB	481	76
> 5000 ETB	152	24
<b>Service Year</b>		
1-5 years	505	79.8
≥ 6 years	128	20.2

## **5.2 Individual and Behavioral characteristics of study participants**

According to self-reported data from study participants, 515 (81.4%) personnel have a normal weight body mass index (BMI) (18.5-24.9 kg/m<sup>2</sup>), 91 (14.4%) are overweight (25-29.9 kg/m<sup>2</sup>), and 27 (4.3%) are underweight based on WHO classification. Out of the five coffee processing factories' workforce, 137 workers (21.6%) exercised at least twice a week. None of the study participants reported having a smoking habit. However, 124 individuals (19.6%) said they drank alcohol at least twice a week for a variety of reasons. Of the responders, 89 (14.1%) have experienced illness in the past. Just 121 (19.1%) of the total respondents are satisfied with their jobs (Table 4).

Table 4: Behavioral characteristics of the study participants among coffee processing workers in Addis Ababa city and Gelan Sub city Shagger City, 2023.

<b>Variables</b>	<b>Frequency(n)</b>	<b>%</b>
<b>Body Mass Index(kg/m<sup>2</sup>)</b>		
Under weight(Below 18.5)	27	4.3
Normal (18.5 – 24.9)	515	81.4
Over weight (25.0 – 29.9)	91	14.4
<b>Habit of doing physical exercise</b>		
Yes	137	21.6
No	496	78.4
<b>Drinking habit of the respondents</b>		
Yes	124	19.6
No	509	80.4
<b>Medical history of illness</b>		
Yes	89	14.1
No	544	85.9
<b>Supervisor relationship</b>		
Good	194	30.6
Poor	439	69.4
<b>Colleague relationship</b>		
Good	472	74.6
Poor	161	25.4
<b>Job stress</b>		
16-40(Yes)	494	78
≤ 15(No)	139	22
<b>Job Satisfaction</b>		
32-40(Yes)	121	19.1
10 – 31(No)	512	80.9

### **5.3 Work-related environment and ergonomic characteristics of study participants**

The percentage of responders who occasionally and consistently worked at a high level was about 159 (25.1%) and 449 (70.9%), respectively. Among all study participants, 533 individuals (79.5%) did not obtain any training related to occupational health and safety matters.

A total of 376 (59.4%) respondents reported working longer than eight hours a day. Apart from lunch, 423 people (66.8%) reported taking pauses lasting less than fifteen minutes. Fifty-nine (17.2%) of the sitting individuals said they worked six days a week, and thirty-four (5.4%) said their seats were uncomfortable for sitting work. Meanwhile, 446 respondents (70.5%) reported having been fixed in a bend for longer than two hours (See table below 5).

### **5.4 Observation Finding**

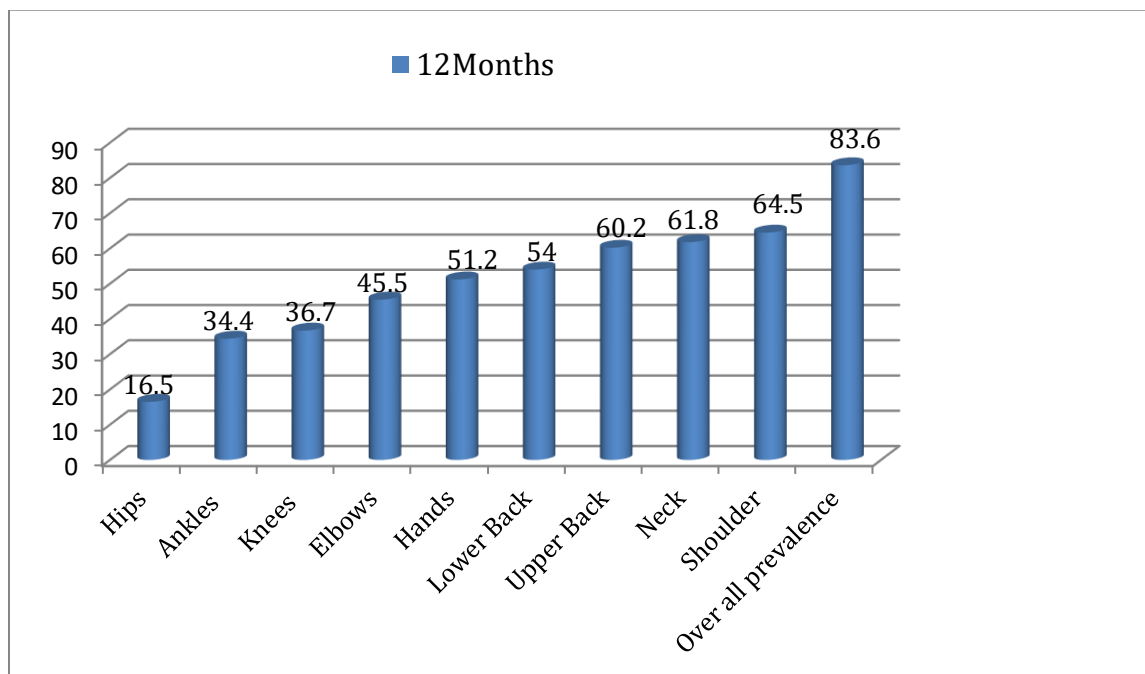
The over all assessed result of observation was focused on work place health and safety factors in coffee processing area such as equipment put in correct place, availability of health and safety committee, sign of warning and safety rule, first aid equipment, training of workers, Fire extinguishers, supervision of work place by safety professionals, loading unloading activities within the working site, health and safety officer were not functioning in most of factory.

**Table5:** Work-related environment and ergonomic characteristics of study participants among coffee processing workers in Addis Ababa City and Gelan Sub city Shagger City, 2023.

<b>Variables</b>	<b>Frequency(n)</b>	<b>%</b>
<b>Doing high loaded work</b>		
Never	25	3.9
Sometimes	159	25.1
Always	449	70.9
<b>Attending on health and safety training</b>		
Yes	130	20.5
No	503	79.5
<b>Work in same position for two hours</b>		
Yes		
No	446	70.5
	187	29.5
<b>Total working hour per Day</b>		
≤ 8 hrs.	257	40.6
>8 hrs.	376	59.4
<b>Working days in sitting position perweek</b>		
6days	109	17.2
7days	35	5.5
<b>Duration of break</b>		
< 15 minutes	423	66.8
≥ 15 minutes	210	32.2
<b>Repetitive work</b>		
Yes	198	31.3
No	435	68.7
<b>Seat comfort</b>		
Non-Comfort	34	5.4
Comfort	110	17.4

### 5.5 Prevalence of work related musculoskeletal disorder in different body parts

WMSDs in 12Months		
Body part	Yes n (%)	No n (%)
Neck	391(61.8 )	242 (38.2)
Shoulder	408 (64.5)	225 ( 35.5)
Upper Back	381 ( 60.2)	252 (39.8)
Elbows	288( 45.5 )	345 ( 54.5)
Hands/Wrists	324 (51.2)	309 ( 48.8)
Lower Back	342 (54.0)	291 (46.0)
Hips/Thigh	104 (16.4)	529 (83.6 )
Knees	232 (36.7)	401 (63.3)
Ankles	218 (34.4)	415 (65.6)
Over all	<b>83.6</b>	



**Figure3** Prevalence of work-related musculoskeletal disorders (WRMSDs) by body regions among workers in coffee processing factories in Addis Ababa city and Gelan Sub city Shagger City –2023 (n=633).



Figure 4: Sample pitchers of Hand picker, transporter and operator job groups.

## **5.6 Factors associated with WRMSD**

### **5.7 Bivariate analysis**

#### **5.7.1 Socio demographic characteristics**

Gender and married status were the variables from the sociodemographic characteristics of study participants that were significantly linked with WRMSDs at  $p\text{-value} < 0.2$ .

Compared to female participants, male individuals had a two-fold higher risk of developing WMSDs (COR= 2.1, 95% CI 1.3, 3.2). According to the respondents' marital status, married respondents had a twofold higher risk of developing WMSDs compared to single respondents (COR = 1.9, 95% CI (1.2, 3.2)). Married workers have multiple social responsibilities in addition to their professions, and they have to take care of household chores. Their likelihood of acquiring WRMSDs is increased by their increased social, psychological/mental, and physical stress levels as well as their decreased likelihood of having leisure time (Table 6).

**Table 6:** Bivariate analysis for socio-demographic factors with WRMSD among coffee processing workers in Addis Ababa and Gelan Sub city Shagger City, 2023 (n=633).

Variables	WRMSDs		COR 95% CI
	Yes	No	
<b>Gender</b>			
Male	417	67	2.1** (1.3, 3.2)
Female	112	37	1
<b>Age(Years)</b>			
Below 20	36	8	1
21 - 24	75	19	0.8 (0.4, 2.2)
25 – 29	136	35	0.9 (0.4, 2.0)
30 – 34	125	25	1.1 (0.5, 2.7)
35 – 39	79	8	2.2 (0.8, 6.3)
≥ 40	78	9	1.9 (0.7, 5.4)
<b>Marital Status</b>			
Single	90	30	1
Married	439	74	1.9** (1.2, 3.2)
<b>Educational level</b>			
Illiterate			0.5 (0.2, 1.1)
Primary school			1.2 (0.7, 2.3)
Secondary school	28	14	1.5 (0.8, 2.7)
Certificate and	153	29	1
Above	267	42	1
<b>Monthly salary</b>			
≤5000 ETB	400	81	0.9 (0.5, 1.5)
>5000 ETB	129	23	1
<b>Working experience</b>			
<b>in years</b>			
1-5 years	424	81	1
≥ 6 years	105	23	0.9 (0.5, 1.5)

\*Significant association; significant at \*P ≤ 0.05, \*\*P ≤ 0.01, and \*\*\*P ≤ 0.001.

### 5.7.2 Individual and Behavioral related factors of WRMSDs

Exercise habits, alcohol use, past medical history of sickness, relationship with supervising employee, job stress, and job happiness were all found to be substantially correlated with MSDs analysis, with a p-value of 0.2.

In comparison to respondents who exercised at least twice a week for at least half an hour, those who did not consistently engage in physical activity had a 1.9 times higher chance of acquiring MSDs [AOR: 1.9, 95% CI (1.1, 3.5)]. Participants in the study who drank alcohol were 2.5 times more likely to have musculoskeletal disorders than those who did not drink alcohol [COR = 2.582, 95%CI (1.3, 5.1)]. An additional reasonable explanation could be that employees with a medical history of disease had a 2.2-fold increased risk of developing WMSDs compared to those without such a history [COR = 2.2, 95% CI (1.0, 4.6)]. Compared to respondents who had a good relationship with their supervisor, those who had a poor relationship were 1.67 times more likely to acquire WRMSDs (COR = 1.7, 95% CI (1.0, 2.7)). The likelihood of acquiring WMSDs was nearly twice as high for participants who reported occupational stress as for those who did not [COR = 1.9, 95% CI (1.2, 3.1)]. Furthermore, respondents who reported lower job satisfaction had a 1.7-fold higher chance of having WMSDs [COR = 1.7, 95% CI (1.1, 2.8)] (Table 7 below).

**Table 7:** Bivariate behavior related factors of WRMSDs among coffee processing workers in Addis Ababa city and Gelan sub city Shagger City, 2023(n=633).

Variables	WRMSDs		COR 95% CI
	Yes	No	
<b>Body Mass Index(kg/m<sup>2</sup>)</b>			
Normal (18.5 – 24.9)	23	4	1
Under weight(Below 18.5)	426	89	0.8 (0.3 , 2.5)
Over weight (25.0 – 29.9)	80	11	1.3 (0.4 , 4.3)
<b>Habit of doing physical exercise</b>			
Yes	102	14	1
No	427	90	1.9* (1.1, 3.5)
<b>Alcohol consumption</b>			
Yes	114	10	2.5** (1.3 , 5.1)
No	415	94	1
<b>Medical history of illness</b>			
Yes	81	8	2.2* (1.0, 4.6)
No	448	96	1
<b>Supervisor relation</b>			
Good	164	30	1
Poor	365	74	1.7** (1.0 , 2.7)
<b>Relationship with other colleagues</b>			
Good	390	82	1
Poor	139	22	1.3 ( 0.8 , 2.2)
<b>Perceived Job stress</b>			
≤ 15 (No)	105	34	1
16-40(Yes)	424	70	1.9**(1.2 , 3.1)
<b>Perceived Job Satisfaction</b>			
10 – 31 (No)	436	76	1.7* (1.1 , 2.8)
32-40(Yes)	93	28	1

\*Significant association; significant at \*P ≤ 0.05, \*\*P ≤ 0.01, and \*\*\*P ≤ 0.001.

### 5.7.3 Work Environment Related Characteristics of Respondents.

A musculoskeletal disorder was substantially correlated with: workplace health and safety training, working hours, duration of breaks excluding lunchtime and repetitive work with in few minutes/hours. The odds of WMSDs among workers who did not get workplace health and safety training were 2.4 times more likely compared to those attending workplace health and safety training [COR = 2.4, 95% CI (1.1, 5.4)]. Odds of respondents who working for more than eight hours per day were 2.4 times more likely to develop WMSDs compared to those perform their activities less than eight hours per day [COR = 2.4, 95% CI (1.1, 5.5)]. Respondents those take breaks < 15 minutes excluding lunchtime were 1.7 times more likely develop WMSDs compared to respondents those take breaks  $\geq$  15 minutes [COR = 1.7, 95% CI(1.0 , 3.0)]. Similarly, respondents those who engaged in repetitive works were 1.741 times more likely to develop WMSDs compared to workers who not engaged in repetitive works [(AOR: 1.7, 95% CI (1.0, 2.9)].

**Table 8:** Bivariate analysis of Work-related environment and ergonomic characteristics of study participants among coffee processing workers in Addis Ababa City and Gelan Sub city Shagger City, 2023.

Variables	WRMSDs		COR 95% CI
	Yes	NO	
<b>Doing high loaded work</b>			
Never	19	6	1
Sometimes	123	36	1.1(0.4 ,2.9)
Always	387	62	1.9(0.8 , 5.1)
<b>Work Department</b>			
Hand Picker	109	35	1.7(0.9 , 3.1)
Transporter	372	43	4.7(2.6 , 8.3)
Operator	48	26	1
<b>Workplace health and safety training:</b>			
Yes	450	97	1
No	79	7	2.4* (1.1, 5.4)
<b>Work in same position for two hours in bend over</b>			
Yes	110	29	0.7 (0.4, 1.0)
No	419	75	1
<b>Working hours per day</b>			
≤ 8 hrs.	20	9	1
>8 hrs.	509	95	2.4* (1.1 , 5.4)
<b>Duration of breaks excluding lunchtime</b>			
< 15 minutes	344	79	1.7* (1.0 , 3.0)
≥ 15 minutes	185	25	1
<b>Repetitive work</b>			
Yes	155	20	1.7* (1.0 , 2.9)
No	374	84	1
<b>Seat comfort</b>			
Yes	82	28	1
No	27	7	1.3 (0.5 , 3.3)

\*Significant association; significant at \*P ≤ 0.05, \*\*P ≤ 0.01, and \*\*\*P ≤ 0.001.

## 5.8 Multivariable analysis

To choose the candidate variables for the multivariable analysis, twelve variables having a p value of less than 0.2 were selected. A large number of variables and an unstable estimate in the multivariate logistic analyses were reduced by choosing a p value of less than 0.2.

Gender and marital Status was substantially connected with a work-related musculoskeletal disorder in socio demographic characteristics of study participants. Male respondents were 1.8 times higher chance of acquiring WRMSDs than female respondents [AOR = 1.8, 95% CI (1.1, 2.9)]. This may due to male respondents involved in carrying out force full work load.

Married respondents were 2.2 times more likely to develop WMSDs compared to single respondents [AOR = 2.2, 95% CI (1.3, 3.8)].

Habit of doing physical exercise and work-related stress, were significant behavioral components. Participants those who did not regularly engage in physical activity had a 2.1 times higher risk of developing MSDs than those who did so at least twice for at least 30 minutes each week [AOR: 2.2, 95% CI (1.1, 4.2)] .Employees who experienced job-related stress had two folds higher to develop WMSDs compared to those who did not [AOR: 2.1, 95% CI (1.3, 3.4)].

Workplace health and safety training, working hours per day and repetitive work were among work-related environment and ergonomic associated with WMSDs. Respondents those did not get professional health and safety training were 2.6 times more likely to develop WMSDs compared to those who had health and safety training in work environment [AOR: 2.6, 95% CI 2.571 (1.1, 5.9)]. Participants those who working more than eight hours per day were three times more likely to develop WMSDs compared to those who working less than eight hours per day [AOR: 2.9, 95% CI (1.2, 7.5)]. Participants those who engaged in repetitive work were two times more likely to develop WMSDs compared to those who did not engaged in repetitive work [AOR: 1.9, 95% CI (1.1, 3.5)] (Table 9 below).

**Table 9:** Multivariate logistic regression of factors associated with WRMSD among Coffee Processing Factory Workers Addis Ababa City and Gelan Sub city Shagger City -2023(n=633).

Variables	WRMSDs		AOR 95% CI
	Yes	No	
<b>Sex</b>			
Male	417	67	1.8* (1.1, 2.9)
Female	112	37	1
<b>Marital Status</b>			
Single	90	30	1
Married	439	74	2.2** (1.3, 3.8)
<b>Medical history of illness</b>			
Yes	81	8	2.1 (0.9, 4.7)
No	448	96	1
<b>Habit of doing physical exercise</b>			
Yes	102	14	1
No	427	90	2.2** (1.1, 4.2)
<b>Alcohol consumption</b>			
Yes	114	10	2.1 (0.9, 4.3)
No	415	94	1
<b>Relation with supervisor</b>			
Good	103	30	1
Poor	426	74	0.8 (0.5, 1.3)
<b>Job stress</b>			
≤ 15 (No)	105	34	1
16-40(Yes)	424	70	2.0** (1.3, 3.4)
<b>Job Satisfaction</b>			
10 – 31 (No)	436	76	1.6 (0.9, 2.7)
32-40(Yes)	93	28	1
<b>Workplace health and safety training:</b>			
Yes	82	41	1
No	447	63	2.6* (1.1, 5.9)

---

<b>Working hours per day</b>			
≤ 8 hrs.	20	9	1
>8 hrs.	509	95	2.9* (1.1, 7.5)
<b>Duration of break excluding lunch time</b>			
< 15 minutes	344	79	1.7 (0.9, 3.1)
≥ 15 minutes	185	25	1
<b>Repetitive work</b>			
Yes	378	55	1.9*(1.1, 3.5)
No	151	49	1

---

\*Significant association; significant at \* $P \leq 0.05$ , \*\* $P \leq 0.01$ , and \*\*\* $P \leq 0.001$ .

## 6 Discussion

The sex, marital status, exercise habits, work-related stress, workplace health and safety training, number of working hours per day, and repetitive labor all contribute to the notably high prevalence of WMSD in this study.

In the current study, the prevalence of work-related musculoskeletal disorders (WMSDs) symptoms among workers in coffee processing factories over the previous 12 months was 83.6% [95% CI:(80.4, 86.4)]. This finding typically agrees with other studies carried out among different work organizations. The study's results were lower than those of a survey among Nigerian plumbers (84.6%), but higher than those of industrial sector workers, such as coffee harvesters in Chiang Rai, Thailand (81.6%), and quarry workers in Nigeria (83.30%). (45–47), 81.4% among Cobble Stone Workers in Ethiopia , 80.40% among Cambodian Fruit Farm Workers in Eastern Region, Thailand, and 77.1% among Sugar Factory Workers in Jinja-Uganda to what has been previously reported among workers in the different industrial sectors (20,23,48).

Regarding certain body regions, the most common areas with the highest prevalence of pain were the shoulders (64.5%), neck (61.8%), upper back (60.2%), lower back (54.0%) and hands (51.2%). on the other hand, compared to other body parts, the prevalence of hips is lower (16.4%).

Gender and marital status were identified as notable sociodemographic characteristics that had a substantial correlation with WMSDs. There was a 1.8-fold increase in the likelihood of musculoskeletal diseases associated with job among male respondents compared to female respondents. Male workers may be responsible for this since they frequently conduct high-physical-demand jobs such lifting, bending, reaching overhead, pushing, and carrying big loads of coffee sacks (bags) weighing more than or equal to 60 kg. This is in line with studies conducted in garment industries in Gelan sub city, sheggar city Oromia Regional State and among Cambodian Fruit Farm Workers in Eastern Region, Thailand that male respondents were more at risk of develop WMSDs than female respondents (20,26). Yet, the odds of being female were higher than those of the male respondents, according to work-related musculoskeletal diseases and related characteristics among bank workers in Addis Ababa city (41). This discrepancy may be the consequence of differences in the institutional and work environments.

When it came to marital status, married respondents had higher probabilities than single respondents. The results of this analysis were consistent with those of a previous study. Married workers have multiple social responsibilities in addition to their professions, and they have to take care of household chores. Their chance of having WRMSDs is increased because they are less likely to have free time and are experiencing higher levels of social, psychological, emotional, and physical stress (30,49).

Furthermore, we identified a significant association between WMSDs and some behavioral factors, such as regular physical activity and job stress. They were more likely to develop WRMSDs if they did not exercise regularly. Building muscle strength and minimizing illnesses from occurring when exposed to dangerous situations can be achieved through regular physical activity. Exercise increases oxygen intake, temperature, and blood flow to tendons, muscles, and ligaments, all of which provide cellular sustenance and prevent muscles from becoming fatigued. When muscles are not used, they become less flexible or more rigid, which increases their susceptibility to damage. According to this, exercise helps blood vessels function properly, reducing vessel compression, strengthening muscles to tolerate spasms, and relieving pain associated with illnesses(50).

The present study observed that musculoskeletal diseases related to working conditions were significantly predicted by occupational stress. WMSDs were more than twice as likely to develop among those who faced job-related stress compared to those who did not. In Hawassa City, Southern Ethiopia, a study of vehicle repair workers indicated that psychological factors were significant for any kind of MSD. There is a strong correlation between stress-related symptoms and musculoskeletal disorders. In fact, some evidence indicates that stress symptoms may possibly contribute to the development of MSDs. Industrial workers are often faced with a lot of workforces, little freedom on the job, and a lack of social support, every one of which can contribute to high levels of perceived stress. Workers in factories regularly use devices known to be associated with risks for musculoskeletal disorders (51,52).

From work-related environment and ergonomics, we also found that workplace health and safety training, working hours per day, and repetitive work were our key findings

The risk of WMSD is increased by more than 2.5 times in the absence of workplace health and safety training. This result is supported by numerous academics. This study found that receiving health and safety training is statistically associated with a considerable reduction in WMSDs, which is consistent with previous research. Workers who receive health and safety training are motivated and kept up to date on standards, practices, occupational health, and safety, all of which may contribute to a reduction in work-related medical disorders (32,44,48,51). Workers with professional training are more likely to know how to prevent injuries at work and to follow safety requirements.

When comparing the reference group of workers who worked eight hours or less per day to the longer-working employees, it was found a three-fold increase in the risk of developing WRMSDs [AOR: 2.9, 95% C.I (1.2 - 7.4)]. There are irregular to nonexistent breaks in between long hours at work. Additional studies confirmed and reported the findings (43, 44, 52).

Workers who engaged in repetitive motions at work were twice as likely to develop WMSDs as non-workers. These findings indicate that employees who undertake a lot of repetitive jobs are more vulnerable to MSDs. Task frequency is a significant risk factor for WMSDs since a worker's recovery cannot be fully achieved in the brief time between tasks. Another study found that workers who conducted repetitive motions at work had a higher chance of acquiring work-related musculoskeletal disorders (WMSDs) compared with those who did not (32).

## **7 Strengths and Limitations of the study**

### **7.1 Strengths of the study**

- ❖ The study's findings provide evidence from a significant number of study participants.
- ❖ There isn't enough research for the present undertaking.

### **7.2 Limitation of the study**

- Due to its reliance on participant self-reported data, the outcome could be constrained by recall bias.
- We did not employ any scale of measurement to determine the participants' reported levels of pain.

## **8 Conclusions and Recommendations**

### **8.1 Conclusions**

This study came to the conclusion that WRMSDs was widely prevalent among those who process coffee. Shoulders, neck, upper back, lower back, and hands are the body parts most frequently affected by discomfort. Gender, marital Status, a physical activity habit, work-related stress, workplace health and safety training, working hours per day and repetitive works were all found to be significantly associated variables for WRMSDs.

### **8.2 Recommendation**

**The following advice is given based on the study's findings to control WRMSDs:**

#### **Owners of the industry:-**

- ✚ They should look at creating a decent workplace to reduce or remove risk factors for the musculoskeletal disorders that are prevalent among these personnel.
- ✚ Through training, workers' understanding of ergonomics should be raised.
- ✚ Minimize extra working hour duties and increase sufficient recovery time.

#### **Workers:-**

- ✚ It is preferable to exercise during breaks to prevent/reduce muscle tiredness.

#### **Bureau of labor and social affairs (BOLSA)**

- ✚ Health and safety policies are not being implemented at the national level. Thus, regional BOLSA should implement health and safety procedures at the level of the coffee processing sector.

#### **Further Research:**

- ✚ To suggest an all-inclusive ergonomic remedy, more research on working posture analysis of the various ergonomic hazard exposure measuring instruments of coffee processing should be done.

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## ANNEXES

### Annex 1: Participant's Information Sheet (English version)

Hello my name is ----- I am here on behalf of Mr. Getahun Legesse, post graduate student from AAU, School of public health. I am member of research team on assessment of musculoskeletal disorders and associated factors and requesting you to participate in this study which would require your response to an interview on some related issues.

**Title of the study: Assessing the Prevalence Of Work-related MSD and Associated Factors among Coffee Processing Factory Workers in Addis Ababa and Gelan Sub City Shagger City Oromia, Ethiopia**

**Introduction:** The coffee processing sector poses many hazards that can harm to workers in different way. Work related musculoskeletal disorder (WRMSD) has huge impact on the public health problems and economic loss of the society. Occupational injuries of coffee processing workers were neglected in research study and policy action of under developing countries due to limitation of documentation and they are highly exposed by different work related diseases. Further information about prevalence and factors affecting WRMSD for coffee processing workers were not known in Ethiopia. Therefore the main aim of this study will be to see the prevalence and associated factors with work related musculoskeletal disorder among coffee processing workers in Addis Ababa and Gelan Sub- city Shagger City, Oromia, Ethiopia.

**Objective:** The Objective of this study is to assess the prevalence and associated factors of work related musculoskeletal disorder among coffee processing workers in Addis Ababa city, and Gelan Sub- city Shagger City Oromia, Ethiopia 2023.

**Duration of interview:** This interview will take 25- 30 minutes.

**Confidentiality:** To establish secured safeguards of the confidentiality of research data, your name will not be written in this form and all information given by you will be kept strictly confidential.

**Benefit of the study:** The research does not have a short term financial, health care and capacity building benefit to the research participant as an individual or as a group but in the long run it will help the concerned organization and policy makers to have a policy consideration and direction and formulation of strategy and design of occupational health and safety programs based on the recommendations and the findings.

**Risk of the study:** The study has no any risk for the participants except time consumption.

**Right of the participant:** Participating and not participating is the full right and participants can stop from participation in the study at any time. This would have no effect at all on your health benefit or other administrative effect and nobody will enforce you to explain the reason of withdrawal. Participant can skip question which the worker doesn't want to respond.

**Person to Contact:** The participant has the right to ask information that is not clear about the research context and content before and or during the research work. You can contact the principal investigator and his advisors. Moreover, this research undergone ethical reviewed and approved by Addis Ababa university school of public health. The main task of this board is to make sure that the ethical principles are adhered or not the research participants are protected from harm.

### **Address of principal Investigator and Advisors**

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## Annex 2. Informed Consent Form

I have read this form, or it has been read to me in the language I comprehend and understood the condition stated above, therefore, I am willing and confirm my participation by signing the consent.

I have been fully informed in the language I understand about the research project objective and all the information. I shall provide to the interviewer will be kept confidential. I understood that the research has no any risk. I also knew that I have the right to withhold information, skip questions to answer or to withdraw from the study any time, I have acquainted nobody will impose me to explain the reason of withdrawal. It is also enlighten there would have no effect at all in my health benefit or other administrative effect that I get from the coffee processing factory. Agreed to participate in the study: Yes /No (mark one of them for verbal consent)

Signature \_\_\_\_\_ (if written consent)

Name of witness signature \_\_\_\_\_ (Data collector, supervisor, any third person) Signature \_\_\_\_\_ Date \_\_\_\_\_.

### Annex 3. - Informed Consent (Afaan Oromo version)

**Yuniversitii Finfinnee Koolleejjii Saayinsii Eeguumsa Fayyaa Kutaa Barumsa Fayyaa Hawaasaa Ibsa Qo’annoo fi guca feedhii qabessummaa kan ittin guutamu.**

#### **Seensa -**

Akkam jirtu? Ani Obbo/Adde----- jedhama. Kanan as dhufeef qo’annaa kana Kan gaggessuu Yunniversitii Finfinnee Koolleejii Saayinsii Fayyaa kutaa barumsa fayyaa hawaasaa irraa barataa digirii lammaffaa Kan ta’e Obbo Geetaahun Laggasaa bakka bu’ee ti. Magaala Finfinnee/Galaan keessatti kan argaman warshaalee buna Oomishan keessa hojjetoota hojjetan irratti sababa hojii isaanitin walqabatee dhibbaa dhukkuuba maashaalee fi wirtuulee qaamaa fi sababoota wal qabatan qo’achuu dha. Kanaafuu qo’aannoo kana irratti hirmaachuudhaaf fedhii qabaachuu fi akka hin qabaanne muurteesitan ibsa gabaabduu isiiniif goona.

#### **Mata Duree Qo’annoo**

Magaala Finfinnee fi Galaan keessatti Kan argaman warshaaleen buna oomishan keessa hojjetoota hojjetan irraatti hojii isaaniitiin walqabatee dhiibbaa dhukkuba maashaalee fi wiirtulee qaamaa fi sababootaa walqabatan qo’achuu dha.

**Faayidaan Qo’aannoo:** Faayidan qo’aannoo kanaa hirmaatootaaf kallittidhaan maallaqaan, tajaajila wal’ansa fayyaa fi kan biroon kan fayyadu osoo hin taane bu’aa qo’aannoo isaa irraa ka’uudhaan qaama dhimmi ilaallatuuf akka galteetti fayyada. Keessattuu qo’aannowwan akka akkanaa fuula duraaf godhamaniif, akka odeefannoo ka’umsaatti fayyada.

**Miidhaa Qo’aannoo:** Hirmaatoota gaafii fi deebii irratti hirmaataniif haala qo’aannootiin dhibbaan isaan irratti qaqqabu hin jiru, yeroo gabaabduu isaan irraa fudhachuu irraan kan hafe.

**Icciiiti Dhoksaan qabuu:** Hirmaatoonni maqaa isaani akka ibsan hin eegamu. Hirmaatoonni kamiyyuu odeefannoo Kennan guutumaan guututti icciitidhaan akka qabamuu seerri qo’aannoon ni dirqamsiisaa. Kanaafuu yaada hirmaataan kennu icciitidhaan waan eeggamuuf dhiibbaa bulchinsaa irraa bilisa.

**Mirga Hirmaatootaa:** Hirmaataan qo’aannoo kana irrattii hirmaachuu ykn hirmaachuu dhisuun mirga dha. Gaafiif deebii irratti hirmaachaa osoo jirtuu yoo hin barbaannee ta’ee yeroo kamiyyuu addaan kutuu/dhaabuu dendeessuu ykn gaafiilee dhihaatan keessaa deebisuu Kan hin barbaannee dhisuu danddessuu. Gaafiif deebiin daqiiqaa 25-30 fudhachuu danda’a. Yeroo gaafiif deebii irratti yaadni ifa hin taane yoo jiratee gaafachuun ni danda’ama.

**Ragaalee kamiyyuuf qaamoolee argachuu barbaaddan yoo jiraatee:**

-Hirmaattottni qo'aannichaa haala qo'aannoo fi qabiyyee irratti ifa yoo isiniif hin taanee yeroo kamiyyuu gafachuun mirga. Kanaafuu abbuummaa dhaan maqaan qo'aannoo gaggessaa Obbo Geetaahun Laggasaa lakk moobaayilaa 0925 406578 'n fi gorsaa qo'aannoo Dr. Tafarii Abagaazi lakk moobaayilaa 0911361607 fi Dr. Saamsoon Waaqumaa lakk moobaayilaa 0923940998 tiin argachuu dandessu. Yeroo ammaa kana waa'ee gaafiif deebii kaayyoo fi qabiyyee irrattii waan nagaafattan jiraa?

**Guca hirmaattonni gaafii fi deebii 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 jira. Yeroo kamiyyuu qo'aannoo irraa adabbii malee dhaabuu akkan danda'u huubadheen jira. Kanaafuu qo'aannoo irratti hirmaachuuf fedhii qabduu?

1. Eyyeen ----- (gara gaafitti galuu)
2. Hinqabuu----- (gara hojjetaa ittii anuuttii demaa).Qo'aannoof sababa feedhii hin qabannee gaafachuudhaan yaadannoo qabachuun to'ataa qo'aannichaaf gabaasa godhi.  
Yeroo jalqabame ----- Yeroon xumuramee -----  
Maqaa gaafii dhiyeessaa ----- Lakk koodii -----  
Maqaan To'ataa gaafii fi deebii mirkaneessee -----  
Qo'aataa Mallattoo: ----- guyyaa -----


## Annex 4. Questionnaire (English version)


### Part 1: Socio demographic characteristics for the study subjects.


Factory Name /Code.\_\_\_\_\_. Working department -----

S. No	Questions /variables	Coding category /possible response	Skip to
101	How old are you	Age in years _	
102	Sex of worker	1. male 2. female	
103	What is your current marital status?	1. Single 2. Married	
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 been worked in coffee factory?	----- years	


### Part 2: Individual and work related factors associated with WRMSDs among coffee processing factory 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/m <sup>2</sup> )	1.Underweight (<18.5Kg/m <sup>2</sup> ) 2.Healthy (18.5–24.9 kg/m <sup>2</sup> ) 3.Overweight (25–29.9 kg/m <sup>2</sup> )	
204	Do you have Habit of doing physical exercise at least twice per week for 30 minutes?	1.Yes 2.No 	

205	If yes for Q204 how often?	1. Two times per week 2. ≥ Four times per week	
206	Do you Smoke cigarette?	1. Yes 2. No 	Q208
207	If your answer is yes for question number 206. How many cigarettes do you smoking per day?	1. -----sticks 2. -----packet	

S. No	Questions /variables	Coding category /possible response	Skip to
208	Do you consume any kind of alcohol at least twice per week?	1. Yes 2. No	
209	Do you have any symptom related to WRMSDs before engaged 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 lunch time?	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	

**Part 3: Working posture factors associated with WRMS Disorders among coffee processing factory workers.**

S. No	Questions /variables	possible response	Skip to
301	How much Time spent in standing to make your task per day?	-----hour	Fill only for standing work posture worker
302	How many days you work in standing position per week?	-----day	
303	Does your job involve Bending or twisting in an awkward way?	1. Yes  2. No	Q 305
304	Do you work in the same position for 2 hours in bend over?	1. Yes 2. No	
305	How much Time spent in sitting to make your task?	-----hour	
306	Types of setting chair?	1.Fixed 2.Adjustable	
307	How many days you work in sitting position per week?	-----day	

**Part 4: Psychosocial factors associated with WRMS Disorders among coffee processing factory workers.**

Questions to measure job stress (Q 401-408)						
S. No	Questions /variables	Job stress score				
		Never =1	Rarely=2	Some times=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 emotional wellbeing					
403	I have high loaded work to do and/or too many unreasonable deadlines.					

404	I find it difficult to express my opinion 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 performance.					
408	I am able to 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: Working environmental associated with WRMSDs among Coffee Processing Workers**

<b>Questions (Q 501-505)</b>			
<b>S. No</b>	<b>No Questions /variables</b>	<b>Possible answer</b>	<b>Skip to..</b>
501	Relationship with other colloquie	1.Good 2.Poor	
502	Relation of boss	1.Good 2.poor	
503	Did you attend formal training of health safety from organization?	1.Yes 2. No	
504	Fitness of the working machine with setting chair?	1.Comfortable 2.Non -comfortable	
505	Types of setting chair?	1.Fixed 2.Adjustable	

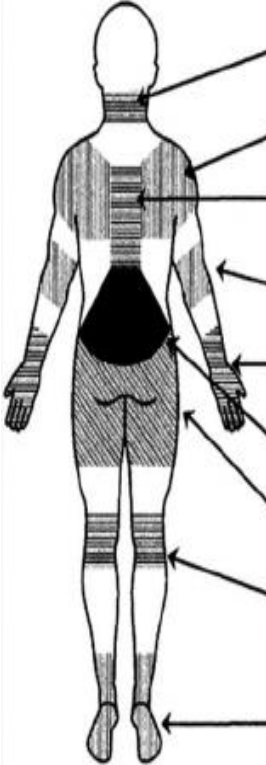
Part 6: Prevalence of WRMSDs among Coffee workers by Nordic Musculoskeletal Questionnaire

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:
<b>1 Neck</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	<b>2 Neck</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	<b>3 Neck</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>
<b>4 Shoulders</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/> in the right shoulder 3 <input type="checkbox"/> in the left shoulder 4 <input type="checkbox"/> in both shoulders	<b>5 Shoulders</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/> in the right shoulder 3 <input type="checkbox"/> in the left shoulder 4 <input type="checkbox"/> in both shoulders	<b>6 Shoulders (both/either)</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>
<b>7 Elbows</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/> in the right elbow 3 <input type="checkbox"/> in the left elbow 4 <input type="checkbox"/> in both elbows	<b>8 Elbows</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/> in the right elbow 3 <input type="checkbox"/> in the left elbow 4 <input type="checkbox"/> in both elbows	<b>9 Elbows (both/either)</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>
<b>10 Wrists/hands</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/> in the right wrist/hand 3 <input type="checkbox"/> in the left wrist/hand 4 <input type="checkbox"/> in both wrists/hands	<b>11 Wrists/hands</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/> in the right wrist/hand 3 <input type="checkbox"/> in the left wrist/hand 4 <input type="checkbox"/> in both wrists/hands	<b>12 Wrists/hands (both/either)</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>
<b>13 Upper back</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	<b>14 Upper back</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	<b>15 Upper back</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>
<b>16 Lower back (small of the back)</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	<b>17 Lower back</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	<b>18 Lower back</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>
<b>19 One or both hips/thighs/buttocks</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	<b>20 Hips/thighs/buttocks</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	<b>21 Hips/thighs/buttocks</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>
<b>22 One or both knees</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	<b>23 Knees</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	<b>24 Knees</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>
<b>25 One or both ankles/feet</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	<b>26 Ankles/feet</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	<b>27 Ankles/feet</b> No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>

Figure 2 Musculoskeletal questionnaire

	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	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
	SHOULDERS	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
	UPPER BACK	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
	ELBOWS	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
	WRISTS/HANDS	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
	LOWER BACK	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
	HIPS/ THIGHS	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
	KNEES	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes
	ANKLES/ FEET	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> Yes

**Annex 5. Questionnaire (Amharic version)**

**Factory Name/Code -----**

የግብርናው ስም ለምሳሌ የግብርናው ስም ለምሳሌ የግብርናው ስም  
 የግብርናው ስም

የግብርናው ስም 1: የግብርናው ስም የግብርናው ስም

የግብርናው ስም: \_\_\_\_\_ የግብርናው ስም -----

ቁ.ግ	የግብርናው ስም	የግብርናው ስም	የግብርናው ስም
101	የግብርናው ስም ስም?	የግብርናው ስም -----	
102	የግብርናው ስም ?	1. የግብርናው ስም	
		2. የግብርናው ስም	
103	የግብርናው ስም	1. የግብርናው ስም/የግብርናው ስም	
		2. የግብርናው ስም/የግብርናው ስም	
104	የግብርናው ስም የግብርናው ስም የግብርናው ስም?	1. የግብርናው ስም/የግብርናው ስም	
		3. የግብርናው ስም የግብርናው ስም (1-8)	
		4. የግብርናው ስም የግብርናው ስም (9-12)	
		5. የግብርናው ስም	
105	የግብርናው ስም የግብርናው ስም የግብርናው ስም?	----- የግብርናው ስም	
106	የግብርናው ስም የግብርናው ስም የግብርናው ስም የግብርናው ስም የግብርናው ስም ?	----- የግብርናው ስም	

የግብርናው ስም 2: የግብርናው ስም የግብርናው ስም የግብርናው ስም የግብርናው ስም የግብርናው ስም የግብርናው ስም  
 የግብርናው ስም የግብርናው ስም የግብርናው ስም የግብርናው ስም

ቁ.ግ	የግብርናው ስም	የግብርናው ስም	የግብርናው ስም
201	የግብርናው ስም የግብርናው ስም	----- የግብርናው ስም	
202	የግብርናው ስም የግብርናው ስም ቁ.ግ - -----	----- ቁ.ግ	
203	የግብርናው ስም የግብርናው ስም የግብርናው ስም (BMI)	1. የግብርናው ስም የግብርናው ስም (<18.5 ቁ.ግ/ቁ.ግ <sup>2</sup> )	
		2. የግብርናው ስም የግብርናው ስም (18.5-24.9 ቁ.ግ/ቁ.ግ <sup>2</sup> )	
		3. የግብርናው ስም የግብርናው ስም (25-32.9 ቁ.ግ/ቁ.ግ <sup>2</sup> )	
		4. የግብርናው ስም የግብርናው ስም (≥30)	

		$\square \cdot \square / \square^2$ )	
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				□□□□ □=5	

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### Annex 6. Questionnaire (Afaan Oromo version)

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

#### Kutaa 1ffaa:- Odeefannoowwan hawaasummaan walqabatee gaafannoowwan dhiyaatan

Maqaa Dhaabbataa /Koodii----- Kutaa hojii -----

. Lakk	Gaafilee	Deebii filannoo	Gara lakkoofisa agarsifameetti darbi
101	Umriin keessn meeqa?	Umrii Waggaa-----	
102	Saala	1. Dhi	
		2. Dha	
103	Haala Gaa'elaa	1. Fuudhe/Heerumte	
		2. Hin Fuudhe / heerumnee	
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	Waggaa-----	

	muuxannoo haagamii qabduu?		
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**Kutaa 2ffaa: Gaafannoo hojii isaaniitin walqabatee dhibbaa dhukkuba maashaalee fi wirtuulee qaamaa sababootaa amala dhunfaatiin wal qabatan irratti Kan dhiyaatu.**

Lakk	Gaafilee	Deebii	filannoo Gara lakkoofisaa agarsifameetti darbii
201	Dheerina qaamaa meetiridhaan	----- meetirii	
202	Ulfaatina qaamaa k.g dhaan	-----K.g	
203	Ulfaatina qaamaa dheerinna walin yoo wal madaalamuu (BMI)	1. Ulfaatina gadi'anaa (<18.5 kg/m <sup>2</sup> )	
		2. Ulfaatina fayyaa qabeessaa(18.5–24.9 k.g/m <sup>2</sup> )	
		3. Ulfaatina ol'aanaa (25–32.9 k.g/m <sup>2</sup> )	
		4. Ulfaatina garmalee (≥30 k.g/m <sup>2</sup> )	
204	Soochii qaamaa torbaanittii yoo xiqqaatee si'aa 2 daqiiqaa 30f hojjetaa jirtuu?	1. Eeyyeen 2. Hin jiruu	Deebin keessan yoo hin jiruu ta'ee gar gaafii lakk 206 demaa
205	Gaafii lakk 204 deebin keessan Eyyeen yoo ta'ee yeroo hagamiif hojjeettuu?	1. Toorbaanitti yeroo lamaa 2. Toorbaanitti yeroo sadii fi isaa oli	
206	Tamboo xuuxxaa?	1. Eeyyeen 2. Hin jiruu	Deebin keessan yoo hin jiruu ta'ee gar gaafii lakk 208
207	Gaafii lakk 206 deebin keessan Eyyeen yoo ta'ee hangam xuuxxuu?	1.-----firii/guyyaan 2.-----paakkoo/guyyaan	
208	Toorbaanitti yoo xiqqaatee yeroo lamaaf alkoolii gosa kamiyyuu dhugduu?	1. Eeyyeen 2. Hin jiruu	
209	Walumaa galatti osoo asi hin 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	
212	Kutaa hojii idilee keessatti ifaa gahaa jiraa?	1. Eeyyeen 2. Hin jiruu	

214	Guyyaa keessaa yeroo laaqanaan alaa boqonnaa gotuu? jiruu ta'ee gar gaafii lakk 218 demaa	1. Eeyyeen 2. Hin jiruu Deebin keessan yoo hin	
215	Gaafii lakk 214 deebin keessan Eyyeen yoo ta'ee guyyaatti sa'a laaqanaan alaa daqiqaa hagamiif	1. $\leq 15$ daqiqaa 2. $> 15$ daqiqaa	
216	Leejjiin Ogummaa fi nagummaan waliin walqabatee ji'oota 12 asitti keennamee jiraa?	1. Eeyyeen 2. Hin jiruu	
217	Haala kafalttii mindaa?	1. Guyyaadhaan 2. Mindaa dhabbataa	

**Kutaa 3<sup>ffaa</sup> : Sababoota haala hojjiimaataa waliin walqabatee dhibbaa dhukkuuba maashaalee fi wiirtuulee qaamaa irratti gaafii dhiyaatu**

T. Lakk	Gaafilee	Deebii filannoo	Gara lakkoofisaa agarsifameetti darbi
301	Sa'aatii meqaaf dhaabbattee hojii kee iraatii dabarsitaa?	----- sa'atii	Dhaabbatanii kan hojjeetan qofaaf kan gaafatamuu
302	Toorbaanitti guyyaa haagamiif hojii kee dhaabbattee 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 gaafii 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 ta'aanii hojjeetanii qofaaf kan gaafatamuu	Taa'anii kan hojjeetan qofaaf kan gaafatamuu
306	Hojii kana torban keessaa sa'aatii meeqaaf teessee hojjeettaa?	-----guyyaa	
307	Hojiif dhaabbiidhaan haalli teessoon maal fakaataa?	1. Dhaabbi (oliif gadi kan hin jenne) 2. kan oliif gadi socha'u	
308	Haalli teessummaa fi mashinni irraa hojjeettuu wal siimachuu?	1. wal siimata 2. wal hin simatu	

**Kutaa 4<sup>ffaa</sup> : Xiinsammuu hojiin waliin walqabatee dhibbaa dhukkuba maashaalee fi wirtulee qaamaa irratti gaafiin dhiyaatu**

<b>Hojii nuufisiisaa ilaalchisee gaafiin dhiyaatuu ( 401-408 )</b>					
T.Lakk	Gaafilee	Hojii nuufisiisaa kan madaalamuu			
		Goonkumaa = 1	Darbee darbee=2	Yeroo tokko tokko =3	Yeroo baay'ee =4
401	Haalli iddoo hojii kan hin gamachiifnee fi nageenyii isaanii kan hin eegamnee dhaa?				
402	Hojiin kiyya dhibbaa qaamaa fi xinsammuu natti taasisa jettee 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?				

<b>Hojii nuufisiisaa ilaalchisee gaafiin dhiyaatuu ( 401-408 )</b>					
T.Lakk	Gaafilee	Hojii nuufisiisaa kan madaalamuu			
		Goonkumaa = 1	Darbee darbee=2	Yeroo tokko tokko =3	Yeroo baay'ee =4
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 amantuu?				
408	Danddeetti fi muuxannoo koo hojii irratti haala gaaritiin fayyadama jeettanii amantuu?				

**Haala hojii gammachisaa ilaalchisee gaafilee dhiyaatan (409-418)**

	Gaafilee	Hojii gammachisuu kan madaalamuu			
		Baayyeen	Hin	Guddugae	Nan

		gammada miti	Gammadu	essaa	Gammad a	na gammach iisa
409	Hojii haala gaariitiin hojjeedheen beekkamtii naaf keennamaa jeettee amantuu?					
410	Hirriyyoota keessan waliin walittii dhufeenyaa gaarii qaba jettanii isitti dhagahaamaa/yaadduu?					
411	Warshaa bunaa kana keessahojjeechuu 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 gaafiin dhiyaate.**

Ji'ootaa 12 darban keessaa dhibbaa dhukuuba maashaalee fi wirtulee qaamaa irratti miirri dhukkubaa rakkisaa ta'ee isiin muudatee beekaa?		Guyyoota 7 (torbaan tokkoo) darban keessaa miirri dhukkubaa rakkisaa ta'ee isiin muudatee beekaa?		Ji'ootaa 12 darban keessaa dhukuuba maashaalee irratti qaqqabeen hojii keessan idilee akka hin hojjennee isin dhorkee beekaa?	
1	Morma A. Hin jiruu B. Eeyyeen	2	Morma A. Hin jiruu B. Eeyyeen	3	Morma A. Hin jiruu B. Eeyyeen

4	Gateetti A. Hin jiruu B. Eeyyeen yoota'e Gateettii Mirgaan, Gateetti Bitaan Karaa lamaanuu	5	Gateettii A. Hin jiruu B. Eeyyeen yoo ta'ee Gateetti Mirgaan, Gateetti Bitaan, Kara lamaanuu	6	Gateetti (Karaa lamaanuu ykn karaa tokkoon yoo mul'atee) A. Hin jiruu B. Eeyyeen
7	Ciiqilee A. Hin jiruu B. Eeyyeen yoo ta'ee Ciiqilee Mirgaan CiiqileeBitaan Ciiqilee lamaanuu	8	Ciiqilee A. Hin jiruu B. Eeyyeen yoo ta'ee Ciiqilee Mirgaan CiiqileeBitaan Ciiqilee lamaanuu	9	Ciiqilee (Karaa lamaanuu ykn karaa tokkoon yoo mul'atee) A. Hin jiruu B. Eeyyeen
10	Harkaa fi damee A. Hin jiruu B. Eeyyeen yoo ta'ee Harkaa fi damee mirgaan Harkaa fi damee bitaan Harkaa fi damee lamaanuu	11	Harkaa fi dame A. Hin jiruu B. Eeyyeen yoo ta'ee Harkaa fi damee mirgaan Harkaa fi damee bitaan Harkaa fi damee lamaanuu	12	Harkaa fi damee (Karaa lamaanuu ykn karaa tokkoon yoo mul'atee) A. Hin jiruu B. Eeyyeen
13	Duugda olaantuu A. Hin jiruu B. Eeyyeen	14	Duugda olaantuu A. Hin jiruu B. Eeyyeen	15	Duugda olaantuu (Karaa lamaanuu ykn karaa tokkoon yoo mul'atee) A. Hin jiruu B. Eeyyeen
16	Duugda gadaantuu A. Hin jiruu B. Eeyyeen	17	Duugda gadaantuu A. Hin jiruu B. Eeyyeen	18	Duugda gadaantuu A. Hin jiruu B. Eeyyeen
19	Mo'oofi naannoo teessumaa lamaanuu A. Hin jiruu B. Eeyyeen	20	Mo'oofi naannoo teessumaa A. Hin jiruu B. Eeyyeen	21	Mo'oofi naannoo teessumaa A. Hin jiruu B. Eeyyeen
22	Jilba lamaanuu A. Hin jiruu	23	Jilba lamaanuu A. Hin jiruu	24	Jilba lamaanuu A. Hin jiruu

	B. Eeyyeen		B. Eeyyeen		B. Eeyyeen
25	Miila/kooranciisaa lamaanuu A. Hin jiruu B. Eeyyeen	26	Milaa/kooranciisaa lamaanuu A. Hin jiruu B. Eeyyeen	27	Milaa (Karaa lamaanuu ykn karaa tokkoon yoo mul'atee) A. Hin jiruu B. Eeyyeen

*Hirmaannaa keessaniif isiin galateffanna!!*

## Annex 7: Observation checklist

Factory name/Code \_\_\_\_\_

S/No	Observation parameters	Response		Comment
		Yes	No	
1.	Is there warning signs or safety rules?			
2.	Are first aid boxes provided?			
3.	Are means of escape adequate in case of Fire?			
4.	Is electric line cross passage?			
5.	Are tools and equipments arranged properly?			
6.	Does the industry have of health and safety officer?			
7.	Are workers given instructions on safety?			
8.	Is there safety committee functioning?			
9.	Are work surfaces kept clean and slip-resistant?			
10.	Are wastes stored safely and removed from the worksite promptly?			
11.	Is Ventilation satisfactory..?			

12.	Is there a suitable break time?			
13.	Are heavy objects or loads lifted manually?			
14.	Do workers have to carry out repetitive tasks?			
15.	Are measures in place to stop workers and objects from falling?			
16.	Is work surfaces kept dry and slip-resistant?			
17.	Is any department or part of the department over crowded and not free movement?			

### **Annex 8: Declaration**

I, the undersigned declared that this my original work, has not been presented for degree in this or other university and that all sources of materials used for this thesis has been fully acknowledged.

Name: Getahun Legesse

Signature: \_\_\_\_\_

Place: Addis Ababa University

Date of submission: \_\_\_\_\_

This thesis has been submitted for examination with my approval as a university

Advisors,

Name: Teferi Abegaz (Ph.D.) Signature: \_\_\_\_\_

Samson Wakuma (Ph.D.) Signature: \_\_\_\_\_

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Photo

### Personal information

**Name** Getahun Legesse Tedesse

Date of birth 28-11-1993GC.

Sex male

Marital status married

Nationality: Ethiopian

Address: Addis Ababa, Ethiopia

### Educational back ground

#### Primary school

Azer Kerensa Elementary School September 2000 - September 2008 GC

**High School**

Darian Secondary School September 2008 – September 2010 GC

**Preparatory school**

Dejazmach Geresu Duki Preparatory School September 2010 - September 2012 GC

**Higher Education**

Haramaya University with BSc Degree in Environmental Science from October 2012-September 2015

**Work experience**

September, 2016 - July 2018, West Shewa Zone Labour and Social Affairs Office

Labour Inspector.

Since August 2018 GC to now Shegger City, Galan sub city Labour and Social Affairs Office

Labour Inspector.

**Skills- language**

Language	Level of skill			
	Listening	Speaking	Reading	Writing
Afaan Oromo	Excellent user	Excellent user	Excellent user	Excellent user
Amharic	Excellent user	Excellent user	Excellent user	Excellent user
English	Excellent user	Excellent user	Excellent user	Excellent user

**Hobbies**

Reading different books, participating in spiritual programs, reading fictions, watching film.

**Behavior**

Free from any types of addictive, sociable, respectful, hardworking, and ability to work with others