ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

COMPARATIVE CROSS SECTIONAL STUDY ON CHRONIC RESPIRATORY SYMPTOMS AND PULMONARY FUNCTION AND ASSOCIATED FACTORS AMONG FLOUR AND PEPSI FACTORY WORKERS IN HAWASSA CITY, SOUTHERN ETHIOPIA

BY:

ZEMACHU ASHURO (BSc.)

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Comparative cross sectional study on chronic respiratory symptoms, pulmonary function, and associated factors among flour and Pepsi factory workers in Hawassa city, Southern Ethiopia

By: Zemachu Ashuro (BSc) Signature _____ Date _____

Approved by the examining board

	Signature	Date
Chairperson, Department Graduate Committee	_____	_____
Advisors;		
Mr.Worku Tefera (MSc, MPH, Ph. D. fellow)	_____	_____
Mr. Samson Wakuma (MSc, MPH, Ph.D. fellow)	_____	_____
Dr. Abera Kumie (MD, MSc, Ph.D.)	_____	_____
Internal examiner:		
1. _____	_____	_____
External Examiner:		
1. _____	_____	_____

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Acronyms and abbreviations

BMRC	British Medical Research Council Questionnaire
MoLSA	Ministry of Labor and Social Affairs
COPD	Chronic Obstructive Pulmonary Disease
FVC	Forced Vital Capacity
FEV1	Forced Expiratory Volume in one second forced vital capacity
FEV1 %	Percentage of the forced vital capacity
FEF25-75 %	Forced Expiratory Flow rate in the middle part of Forced Vital Capacity
OA	Occupational Asthma
PEFR	Peak Expiratory Flow Rate
PPE	Personal Protective Equipment
SNNPRS	Southern Nations Nationalities and Peoples Regional States

Abstract

Background: Flour is a complex organic dust containing a finished product of flour milling process. Flour dust generated during milling process is released into the air and later inhaled by a worker causes occupationally related lung diseases. Common respiratory health problems among flourmill dust exposed workers include a cough, wheezing, and shortness of breath and reduction of pulmonary function.

Objectives: The aim of this study was to assess prevalence of chronic respiratory symptoms, pulmonary function and associated factors among flour factory workers in Hawassa city.

Methods: Comparative cross-sectional study was conducted from January–April 2018 on a sample size of 406 from flour and Pepsi factories and spirometer test performed for 122 workers. Stratified and Systematic sampling methods used for selecting study subjects from each factory .Data was collected by using questionnaire and pulmonary function test equipment'. Data enter was done by using Epi data version 3.1 and cleaned and analyzed using SPSS version 24.Descriptive statistics and Odds ratios were used to describe the data and associated factors.

Results: The mean age of flour factory and Pepsi factory participants were 32.1±9.99 and 31.28 ±7.87 respectively. This study reported that flour factory workers had significantly higher prevalence rate of chronic respiratory symptoms than Pepsi factory workers (56.6%; OR= 1.32, 95 % CI, 1.05-1.65). Chronic respiratory symptoms among flour factory workers were associated with working departments, (AOR = 5.3, 95% CI = 1.68-16.56), work experience (AOR= 5.1, 95 % CI = 2.05-12.48), working hours (AOR = 2.4, 95 % CI, 1.16-5.10) and educational level (AOR = 6.2, 95 %CI, 1.6-24.40). Significant reduction in the overall mean value, FEV1/FVC ($p \leq 0.003$) in flour factory workers compared to Pepsi factory workers.

Conclusion and recommendation: Based on the results of the study, conclude that exposure to flour mill dust increases the risk of developing occupationally related chronic respiratory symptoms and pulmonary function reduction. The results suggest that there is need to improve dust control measures in flour factory.

Keywords: Flour mill workers, flour dust, chronic respiratory symptoms and pulmonary function

1. Introduction

1.1 Background of study

Occupational related respiratory diseases are due to the deposition of dust in the lungs and which disturb the process of inhalation and exhalation of air and influenced by the type of dust, duration of exposure, the concentration, and size of dust in the breathing zone and genetic factors (1-3).

Dust is small, dry solid particles range from one to hundred micrometers in diameter size and formed by natural forces or human made processes like (crushing, grinding, milling, drilling, demolition, shoveling, conveying, screening, bagging, and sweeping). Major types of dust are organic and inorganic. Inorganic dust comes from nonliving things and includes stones, chemicals, and metals. But, Organic dust comes from living things and include dust from textiles, wood, poultry, leather, grain fungal spores, microbes, and flour (4, 5).

Flour is a complex organic dust containing and powdery finished product of milling cereals like wheat, barley, corn (maize), or a combination of these, obtained after several reduction processes (6). The flour-milling process are, cleaning (separating wheat from seeds, other grains and foreign materials), conditioning **(**mixing water with the grain to get the right moisture level),milling (gradual reduction of the wheat kernels to produce particles of endosperm), reduction of semolina to flour and flour dressing (the separation of flour from the other materials) and loading (7).

Flour milling industries, generate organic dust during industrial processes, such as cleaning, crumbling of the product, milling, packaging, shipping, and maintenance which release dust into the air and later inhaled by workers (8). Exposure to flour dust in the workplace becomes high during the process of mixing and packing in the flour milling process and had high respiratory symptoms (9). In Ethiopia, around 300 flour mills with a total of 3.7 million tons of milling capacity per year (10) and 55,000 workers are engaged in flour mill factories (11).

Pulmonary function tests are useful in assessing the functional status of the respiratory system and based on the measurement of the volume of air breathed in and out in quiet breathing and forced (12). Spirometry is one of the most important diagnostic tools in the diagnosis and

prognosis of respiratory diseases and describes the effects of on the pulmonary function reduction (13).

1.2 Statement of the problem

Chronic respiratory diseases comprise 10% of all occupational diseases reported in industrialized countries such as the United Kingdom but much higher in rapidly developing country like Nigeria (14, 15).

Dusty environment and unfavorable climatic conditions are major occupational hazards in flour factory that influence health workers. Dust generated during flour production have large number of hazardous substance include silica, fungi, their metabolite's (aflatoxins) and endotoxin which causes respiratory sensitization and is known to cause allergic and respiratory disease (1, 16).

Flour mill workers are at risk of developing respiratory health effects due to exposure in their working environment (17). Many studies showed that flour dust exposure cause respiratory symptoms such as chest pain, phlegm, wheezing, cough, shortness of breath in flourmill workers (9, 18-20). In addition, research conducted in Saudi Arabia, Belgium, Iran, and the UK found that a reduction of lung function parameters (FVC, FEV1 and FEV1/FVC) in flour factory workers (21-24).

In Ethiopia, an epidemiological survey conducted before twelve years in small grain mill workers in Kola Diba town in North West showed that higher prevalence of respiratory symptoms like a cough (42.1%), wheezing (35.7%) and chest tightness (35.1%) (25).

Recently, conducted unpublished study in Ethiopia in local grain mill workers showed impairment of pulmonary function and increased respiratory symptoms, such as dry cough, productive cough; wheeze and breathlessness in grain mill dust exposed workers (26).

To researcher knowledge in Ethiopia study done in Kola Diba over 12 years ago and in Addis Ababa local small grain mill workers did not investigated associated factors and pulmonary function together (25, 26). Both studies conducted in local small grain mill workers on small sample size and did not investigated associated factors well. In Ethiopia, there was no study on small and medium scale flour factory since work setup, production capacity and number of workers engaged were different from local grain mill.

Therefore, this study conducted to assess chronic respiratory symptoms and pulmonary function and associated factors among flour and Pepsi factory workers in Hawassa city, Southern Ethiopia.

1.3 Significance of the study

With the above background, it is important to assess chronic respiratory symptoms, pulmonary function, and associated factors. The main findings and the recommendations will contribute for flour factory owners and managers review and work according to these results.

In addition, important for Ministry of Labor and Social Affairs office (MoLSA) of industrial development bureau in Ethiopia as well as Federal ministry of health, Regional health bureau and Non-Governmental Organizations (NGOs) designing a plan to improve the occupational safety and health practice of factories for better health of workers.

Also, used as baseline data for further studies in this area.

2. Literature review

2.1 Socio-demographic factors and chronic respiratory symptoms

There was an evidence on increase of age and occurrence of chronic respiratory symptoms among flour factory workers. A study from Egypt in 2013 showed significant association between age and chronic respiratory symptoms, ($p<0.05$) (9).

A study conducted in America showed that pulmonary diseases affects women with a greater degree of severity than men (27). However, a study in Dejen cement factory showed that males are more likely to develop chronic respiratory symptoms (AOR = 2.07, 95 % CI = 1.18-3.63) than females (28).

2.2 Socio-economic status and chronic respiratory symptoms

Socio-economic status of workers' special income, education, and occupation affects the health of the workers. According to the 2011 Ethiopia Demographic and Health Survey (EDHS, 2011), education is a key determinant of lifestyle and status an individual enjoy in a society and provide people with the skill and knowledge that can lead to a better quality of life. Also, level of education influences the type of occupation and income which can determine the home living condition (29).

A study conducted by in Dejen cement factory workers showed that worker's education level grade 8 or below were more likely to developed chronic respiratory symptoms than workers whose education level was diploma and above (AOR = 4.07, 95 % CI = 1.86-8.92) (28).

Another study from Finland in 2004 found that low education and low household income associated with respiratory health problems. According to the study as educational level low, the risk of asthma and Chronic Obstructive Pulmonary Disease (COPD) increased. Also, low household income increased the risk of asthma and COPD (30).

2.3 Behavioral and safety factors affecting flour mill workers

2.3.1 PPE utilization and chronic respiratory symptoms

Personal protective equipment at workplace important to protect workers against one or more risks to their health or safety. A study conducted in India found that PPEs were not available as well as was not used by any flour mill worker while doing their work (31).

In addition, study from Nigeria in, 2017 among the rice mill workers showed that PPE (face masks) were not readily available for use (32).

But, a study conducted in Dejen town showed that using PPE was not statistically significant association with the development of chronic respiratory symptoms (AOR = 1.42, 95 % CI =0.92-2.19) (28).

2.3.2 Workplace ventilation and chronic respiratory symptoms

Poor ventilation is a basic problem of a workplace in flour factory. Workers in developing countries flour mill industries are exposed to occupational hazards due to lack of awareness, neglected, congested workplace, workers are close to grinding machine, lack of both artificial and natural ventilation and lack of any precautionary measures to prevent flour dust exposure during working hours in industries (22).

A study conducted in Riyadh, Kingdom of Saudi Arabia found that flour dust accumulated in workplace environment because of poor ventilation, hence, workers get exposed to excessive amounts of flour dust (21).

2.3.3 Indoor air pollution and chronic respiratory symptoms

Study from Serbia , in 2011 showed strong association between indoor air pollution and respiratory symptoms (33). In addition , study conducted in Nepalese showed that unprocessed solid biofuels such as cow dung, crop residue, and wood for cooking and heating have higher risk for serious health outcomes compared with those who use cleaner fuels such as kerosene, LPG, and biogas in the exposed population (34).

2.4 Work-related factors and chronic respiratory symptoms

2.4.1 Duration of employment and chronic respiratory symptoms

Duration, of employment is an important epidemiological factor that determines the occurrence of respiratory symptoms in workers. Study conducted in Iraq showed that workers employed in industries longer than 20 years reported higher respiratory symptoms than workers work in industries from 10 to 19 years and less than 10 years and allergic symptoms increase on starting and during work and improve after leaving the workplace, during weekends and on holidays (35).

In addition, study conducted in Egypt showed that higher prevalence of respiratory symptoms among workers with longer duration of employment ($p < 0.002$) and who had spent 5 years and above reported a significantly higher prevalence, 98.2%, than those with shorter duration, 97.8% ($p<0.05$) (9, 19).

But, study conducted from Egypt, in 2017 showed that no statistically significant difference between <10 years working and ≥10 years working for groups with regard upper and lower respiratory and work-related symptoms (36).

2.4.2 Working departments and chronic respiratory symptoms

Workers in flour milling industries exposed to hazardous flour dust at all stage of flour processing. A study conducted in Iraq showed that 65.2% of workers exposed in packing unit had allergy symptoms compared to 31.5% in those with a low level of exposure (all other units) (35). Another study conducted in Egypt showed that 96.8% of workers exposure to flour dust in the workplace (packing unit) and had high respiratory symptoms (9).

In addition, study from Iran , in 2013 found that the maximum exposure to flour dust was seen in the loading-storage section due to direct contact with flour dust and the lowest exposure was in the winnow section probably because the process was confined (37).

2.5Chronic respiratory symptoms among flour mill workers

Different studies conducted among flour mill workers in different countries' food industries like Egypt, Nigeria, India, Saudi Arabia, Iran, and the UK were found that flour dust exposure cause short and long-term respiratory problems like sensitization, irritating, nasal, asthma, grain fever, lung fibrosis, rhinitis, impairment of lung function and COPD (9, 19, 23, 24, 38).

A cross-sectional analytical study conducted in Ibadan, Nigeria found that a higher prevalence of a cough and sputum production among the production staff of flour mill factory($P<0.001$) (39). Similarly, study from Iran , in 2013 among wheat flour mill workers found that statistically significant association between exposure to flour dust with the prevalence of wheezing, productive cough, cough, phlegm ($p<.05$) (37).

Another comparative cross-sectional study from North Central Nigeria, in 2015 among flour mill workers found that statistically significantly higher prevalence of respiratory symptoms ($P<0.05$)

(40). A study conducted in India, in 2014 reported respiratory symptoms in rice mill workers were phlegm, chest tightness and cough (41).

Another study from Egypt , in 2013 among flour milling workers found that the prevalence of respiratory symptoms in flour mill workers shortness of breath, wheezes, productive cough ($p< 0.0001$) higher among flour mill workers (9).

2.6Pulmonary function tests (PFTs).

2.6.1 Anthropometric factors and pulmonary function

Study from India , in 2014 showed that pulmonary function parameters FVC and FEV1/FVC were affected with increasing BMI (42). In addition, study from Riyadh, Saudi Arabia., in 2014 showed that both weight and height is highly correlated with pulmonary function parameter of FEV1 but, height more correlated than weight (43).

2.6.2Flour mill workers and pulmonary function reduction

A study from Pakistan, in 2005 among flour mill workers showed that a significant reduction FVC and FEV1 were observed in wheat flour mill workers (2). A study conducted in Egypt found that there is a significant decline in FVC, FEV1%, FEV1/FVC%, in bakery workers with increasing duration of exposure ($p<0.0001$).According to the study among workers more than 10 years of exposure higher when compared with workers with less than 10 years of exposure (9).

A studies from Iran , in 2013 and 2014 among flour mill workers found that significant reduction of FVC, %FVC, and FEV1were observed in the flour mill workers (37, 44). Another, study conducted in Iran among workers of flour production factories found that the ratio of FEV1 / FVC in workers of the production plant decreased (20). An analytic case-control study conducted in India among flour mill workers found that Significant decrease in FVC and FEV1 (8).

A Conceptual framework of the study

Conceptual framework for this study shows how the particular variables in study connect with each other and identifies the variables required in the research investigation. Which, was developed after reviewing different literature about factors has been contributing for the occurrence of chronic respiratory symptoms and pulmonary function reduction among flour factory workers. It used as a road map in pursuing the investigation.

As shown below chronic respiratory symptoms and pulmonary function of flour factory workers can be associated directly with duration of employment, past dust exposure, length of working hours and working departments. Also associated indirectly associated with socio demographic factors (age, sex, education and income), anthropometric variables (weight, height and BMI) and behavioral factors like provision and usage of PPE, training, ventilation and smoking habit.

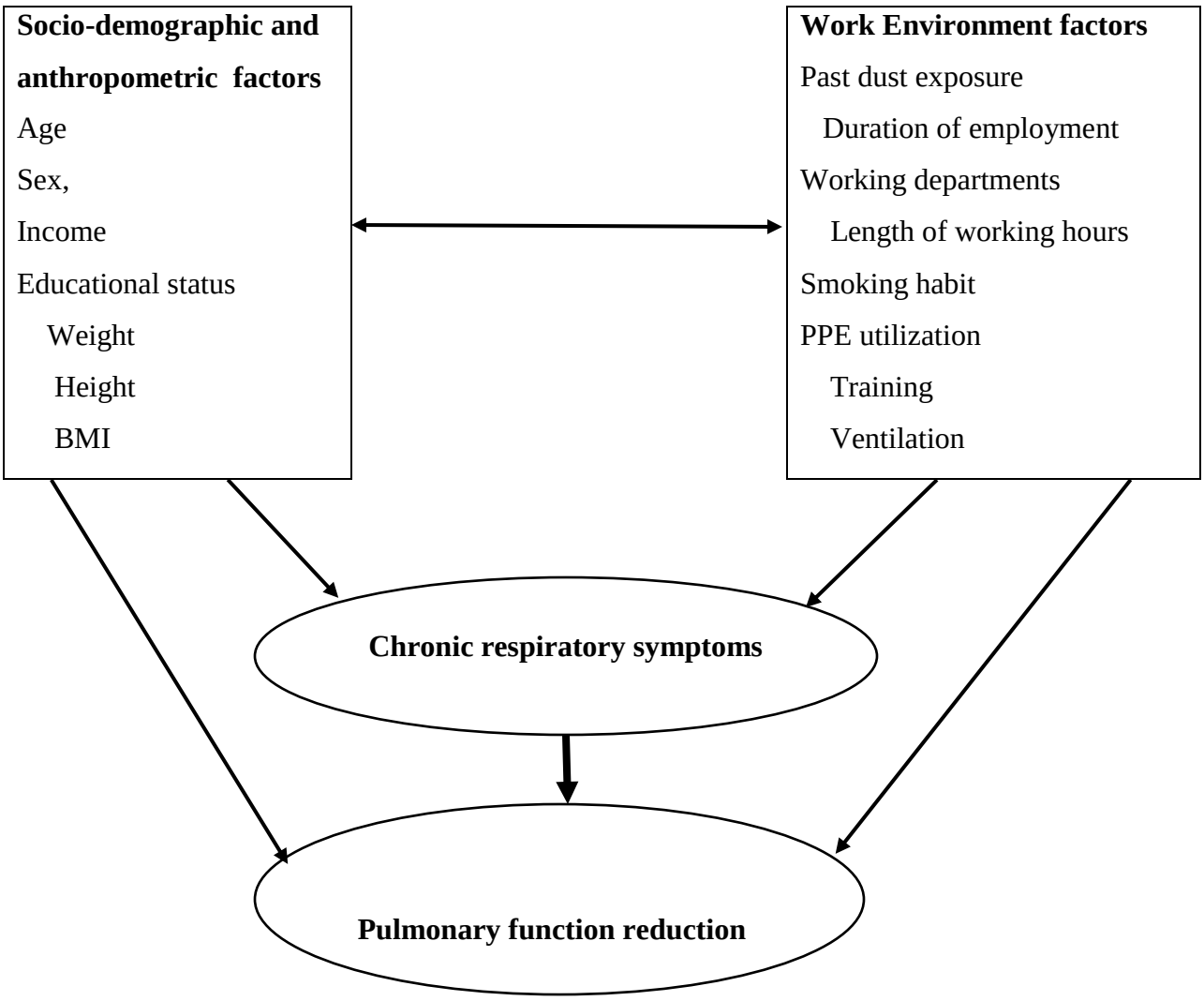

Figure 1. Conceptual framework of the study developed by reviewing different articles

Research hypothesis

Ho =Workers exposed to flour dust do not have risk of chronic respiratory symptoms and pulmonary function reduction compared to non-exposed workers.

H_A=Workers exposed to flour dust have increased chronic respiratory symptoms and reduced pulmonary function compared to non-exposed workers.

3. Objectives

3.1 General objective

To assess the magnitude of chronic respiratory symptoms and pulmonary function and associated factors among flour and Pepsi factory workers in Hawassa city, Southern Ethiopia, 2018.

3.2 Specific objectives

1. To assess the magnitude of chronic respiratory symptoms among flour factory workers.
2. To identify factors associated with chronic respiratory health symptoms.
3. To assess pulmonary function reduction among flour and Pepsi factory workers.

4. Methods and Materials

4.1 Study area

The study was conducted in flour and Pepsi factory of Hawassa city, of Southern Ethiopia. Hawassa City is a capital city of Sidama zonal administration and South Nation Nationalities and People Regional Government (SNNPR) and which found south of 273 kilometers (KM) far from Addis Ababa.

The total population of the city is 358539, of those 181062 are male and the rest 177,479 are females. The dominant activities in the city are commercial activities followed by government workers and large and medium scale manufacturing industries such as textile, food and soft drink processing, soap manufacturing and flour processing. In Hawassa city, there are ten flour-processing industries (4medium scale and 6 small scale) and one Pepsi factory.

4.2 Study period

The study conducted from January –April 2018.

4.3 Study design

Comparative-cross sectional study conducted to assessed chronic respiratory symptoms and pulmonary function reduction and associated factors. The study groups were workers exposed to flour mill dust due to work environment factors.

4.4 Source population

All workers in flour mill factories and Pepsi factory of Hawassa city.

4.5 Study population

Four hundred twenty selected respondents from ten flour factories and one Pepsi factory using stratified and systematic sampling technique.

Exposed group; 210 workers from flour milling factories of Hawassa city.

Non-exposed; 210 workers from Pepsi factory of Hawassa city.

4.6 Inclusion and Exclusion Criteria

Inclusion criteria

Workers who had direct involvement in production and working in the flour factory and Pepsi factory for one year and above were included.

Exclusion criteria

Workers who had heart failure, chronic cough for more than two weeks, recent surgery of thorax, abdomen, and any acute illness excluded from the study.

4.7 Sample Size Determination

Subjects who had direct participation in the flour processing was selected as an exposed group, but subjects from Pepsi factory were selected as non- exposed groups.

The sample size were calculated for first and third objective by using double proportion formula and for the second objective mean difference; formula for the observational study was used.

1. **Sample size for first objective (for magnitudes of chronic respiratory symptoms)**

Study conducted in Ethiopia showed that high prevalence of wheeze, chest pain, and cough among small grain mills than non-exposed group (25).
Based on a study finding, sample size calculated using the following double proportion formula.

$$n = \frac{(Z\alpha/2 + Z\beta)^2 * (P1(1-P1) + P2(1-P2))}{(P1-P2)^2}$$

Where,

n= Sample size to be determined

P1= 35.1% (proportion of respiratory symptom (chest tightness) among small grain mills workers)

P2= 19.9 %(proportion of respiratory symptoms (chest tightness) among non-exposed workers)

$Z_{\alpha/2}$ = Level of statistical significance 1.96 at confidence level of 95% and

Z_{β} = Desired power of 85%

P_1-P_2 =Difference between proportions

$n = \frac{(1.96 + 1.04)^2 * (0.351(1-0.351) + 0.199(1-0.199))}{(0.351-0.199)^2} = 167$

Adding 10% for non-response rate, it becomes**184**for each subjects

Total sample size of 368

2. Sample size for second objectives (pulmonary function reduction)

According to the study done in Ibadan, Nigeria found that the mean value for Forced Expiratory Volume at one second (FEV1) among flour dust exposed workers significantly lower than non-exposed group which were 3.1 and 3.5 liters/second respectively(19).

Based on a study finding sample size calculated using the following mean difference formula.

$$n = \frac{(Z\alpha/2 + Z\beta)^2(\delta_1^2 + \delta_2^2)}{(d)^2}$$

Where,

n = sample size

δ= standard deviation of the characteristics (0.7 for both groups)

$Z_{\alpha/2}$ = Level of statistical significance 1.96 at confidence level of 95% and

Z_{β} = Desired power of 85 %

d = mean difference (Mean 1 = 3.1 and Mean 2 = 3.5)

$$n = \frac{(Z\alpha/2 + Z\beta)^2(\delta_1^2 + \delta_2^2)}{(d)^2}$$

$n = \frac{(1.96 + 1.04)^2(0.7^2 + 0.7^2)}{(3.5-3.1)^2} = \mathbf{55}$

Adding 10 % for non-response rate it become**61**for each subject

Total sample size of 122

3. Sample size for third objectives (associated factors)

Study conducted in Egypt showed that the prevalence of work-related respiratory disorders among flour mill workers who are greater than 40 years and less than 40 years old were 93.6 % and 83.3% respectively(40).

Based on a study finding sample size calculated using the following double proportion formula.

$$n = \frac{Z\alpha/2 + Z\beta)^2 * (P1(1-P1) + P2(1-P2))}{(P1-P2)^2}$$

Where,

n= sample size to be determined

P1= 93.6 %(proportion of respiratory disorders among workers age greater than 40 years)

P2= 83.3 %(proportion of respiratory disorders among workers age less than 40 years)

$Z_{\alpha/2}$ = Level of statistical significance 1.96 at confidence level of 95%

Z_{β} = Desired power for 85% power

P_1-P_2 = Difference between proportions

$$n = \frac{Z\alpha/2 + Z\beta)^2 * (P1(1-P1) + P2(1-P2))}{(P1-P2)^2}$$

$$n = \frac{(1.96 + 1.04)^2 * (0.936(1-0.936) + 0.833(1-0.833)}{(0.936-0.833)^2} = 191$$

Adding 10% for non-response it become **210**for each subjects

Total sample size of 420

Table 1: Sample size determination summary of the study

S/no	Variables	Prevalence among exposed group (P_1)		Prevalence among non-exposed group (P_2)		Calculated sample size	Non-response rate (10%)	Total sample size
1	Chest pain	35.1%		19.9%		334	34	**368**
2	Parameters	Mean	SD	Mean	SD	Calculated sample size	Non-response rate (10%)	Total sample size
	FEV1	3.1	0.7	3.5	0.7	110	12	**122**
3	Factors	Prevalence of respiratory disorders		Power		Calculated sample size	Non-response rate (10%)	Total sample size
	Workers age >40 years old	93.6%		85%		382	38	**420**
	Workers age <40 years old	83.3%						

The sample size for the study variable age gives maximum sample size that is 420.Therefore; the sample size for chronic respiratory symptoms and associated factors is 420. Two hundred ten workers selected from flour factory (exposed) and 210workers from Pepsi factory (non-exposed). However, for pulmonary function test done for 122 workers due to a shortage of resource (61 from flour mill factory and61 from Pepsi factory).

4.8. Sampling techniques

In Hawassa city, ten flour factories (4 medium scale and 6 small-scale) and one Pepsi factory were found. Based on number of workers engaged and production capacity flour milling industries Stratified into medium and small manufacturing but for Pepsi factory no need of sampling since in Hawassa city there is only one Pepsi factory. For, selecting study subjects from each departments systematic random sampling methods (SRS) used. In addition, similar method followed for selecting workers from Pepsi factory. First subject selected randomly from each departments then other subjects selected systematically.

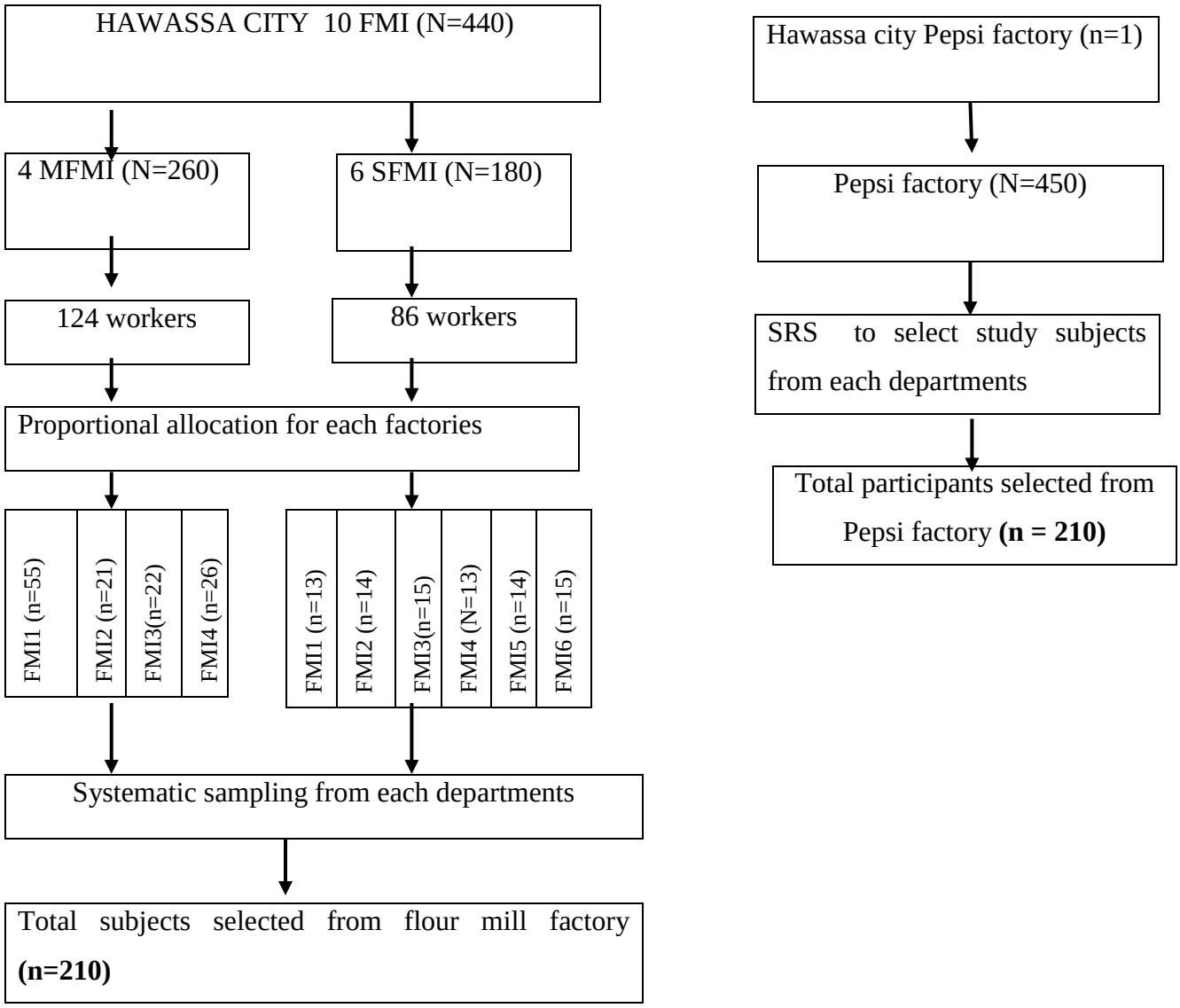

Figure 2: Schematic presentation of sampling procedures

FMI- Flour Milling Industry

MFMI - Medium flour milling industries

SFMI- Small flour milling industries

4.9 Study variables

4.9.1 Outcome variables

- ✓ Pulmonary function parameters (FVC, FEV1and FEV1/FVC %)
- ✓ Chronic respiratory symptoms (cough, cough with sputum, shortness of breath, wheeze, and chest pain)

4.9.2 Exposure variable

- ✓ Duration of exposure
- ✓ Length of Working hours
- ✓ Past dust exposure
- ✓ Working departments.
- ✓ Age, Sex, income, educational status
- ✓ Smoking habit
- ✓ Availability and usage of PPE

4.10 Data collection procedure

Questionnaire

Data was collected by using questionnaire modified from British Medical Research Council (BMRC) (45). The questionnaire translated to Amharic, retranslated to back English to check its consistency with the original one. Before the interview: brief explanation given to the participant about the purpose of the study and administered (face to face) for selected flour and Pepsi factory workers.

The component of the questionnaires was:

- ✓ Socio-demographic characteristics (age, sex, educational status and income)
- ✓ Work history (all activities during and after work shift).
- ✓ Common chronic respiratory symptoms (cough, cough with sputum, shortness of breath, wheeze, and chest pain).
- ✓ Behavioral factors of workers(like smoking habit and usage of PPE)

- ✓ Past medical history (like history of Asthma, Chronic bronchitis, Lung cancer and Tuberculosis)

Checklist

An observational checklist used to assess the usage of personal protective equipment's (PPE) and working environment (ventilation).

Measurement of pulmonary function

Ndd Easy on-pc spirometer used for determining pulmonary function parameters (FVC, FEV1and FEV1/FVC%)in both flour mill and Pepsi factory workers.

Before performing the procedure, the subjects had instructed to practice deep inspiration and complete forceful expiration. The spirometer test was performed before work time. By putting a nose clip to prevent air leak through the nose, the subject was initially breathing for a few breaths normally, followed by deep inhalation and forceful expiration of the air as fast and forcefully as possible.

All measurements performed in the sitting position and repeated 3 times for each person within three to five minutes' rest in between and from those readings, the highest reading recorded. While doing this maneuver, flow and volume curves inspected on the screen for detecting whether subjects displayed enough effort during inspiration and expiration. Before starting measurement, spirometer calibration performed daily and weekly.

Figure 3: Spirometer, nose clip, and mouthpiece

Anthropometric measurements

Weight measured using a standardized electronic weighing machine, with the subjects standing and wearing lighted clothes and height of the subjects measured with the stadiometer with portable field survey scales. Body mass index (BMI) calculated by using ndd medical technologies 'software.

4.11Data processing and management

Collected data was organized and entered in Epi data version 3.1 and cleaning was done to avoid missing values, outliers and other inconsistencies. For data cleaning, frequency, sort and list were used. Cleaned data exported to SPSS version 24 for analysis**.**

4.12Data Analysis

Descriptive statistics used to summarize data. Chi-square was used to see difference between flour factory and Pepsi factory workers. Crude odds ratio with 95% CI computed to see the association between exposure variable and chronic respiratory symptoms. Binary logistic regression, independent t-test and one way ANOVA were used to compare the prevalence of chronic respiratory symptoms and pulmonary function measurements of flour and Pepsi factory workers.

A bivariate analysis used to identify whether exposure variables are significantly associated with outcome variables or not. Those, variables with $p \leq 0.2$were included in multivariable analysis. The multivariable analysis used to identify variables associated with both outcome and exposure and to identify the confounding variables.

4.13 Data quality assurance

To assure data quality standardized questionnaire and trained professional (occupational and environmental health) were involved in data collection. Ndd Medical technology tools and software, anthropometric measurements and questionnaires were pre-tested and data collector's and respondent's gap identified and filled accordingly.

For, pulmonary function test (PFT) trained professional was involved from Addis Ababa Hallelujah hospital. The apparatus calibrated before starting procedure daily and weekly basis. Once the data collected, then it handled in computer and flash disk and double data entry done to keep the accuracy of the data.

4.14Operational definitions

Duration of exposure: -defined as the working hours of workers in the factory per day.

Duration of employment in the factory: defined as current workers experience in the factory.

Previous exposure history: - workers experience in the dusty environment before the current working position.

Chronic respiratory disease: - a respiratory disease like TB, chronic bronchitis, lung cancer, asthma, and heart disease that could be developed before and confirmed by physicians.

Chronic respiratory symptoms:- The development of one or more of the chronic symptoms of a cough, cough with sputum, breathlessness, wheezing, chest illness which lasts at least three months in one year (41).

Chronic Cough:-Experience of a cough for most days of the week (≥4 days) for at least three months in one year (41).

Cough with sputum production :- It is sputum expectoration on most days of the week (5 days) for at least three consecutive months in one year (41).

Chronic Breathlessness:- Is defined as discomfort or difficult to breathe in different activities like walking up a slight hill, when undressing, walking at own pace (46).

Chronic wheezing:-a condition of causing a wheezy or whistling sound heard during inhalation or exhalation (at least three months in a year) (41)

Chronic chest pain: - In the past one year, chest pain that kept off work.

Current smokers:-Workers who were smoking at the time of the study or a person who smoke cigarettes every day or some days (47).

Ever smoker: -a person smoked at least 100 cigarettes in his entire life

FVC:- Is the maximum volume of air that can be breathed out as forcefully and rapidly as possible following a maximum inspiration (48).

Forced expiratory volume in 1 sec (FEV1):- The volume exhaled during the first second of the FVC maneuver (48).

FEV1/FVC: The percentage of the FVC expired in the first second of maximal forced expiration following full inspiration. Predicted values greater than 80% is usually considering as normal (48).

Medium flour milling industry: -Industry engages 31 to 100 workers.

Small flour milling industry: -Industry engages 6 to 30 workers.

4.15 Ethical Consideration

The study was conducted after having an ethical clearance from Addis Ababa University Ethical Committee. Before performing the procedure, verbal and written consent was obtained after explaining the procedure, purpose, and the importance of the study to confirm willingness for participation. In addition, participants informed that they have a full right to refuse or discontinue participating at any point of the study. During data collection, period one participant from Pepsi factory who had asthma liked to private hospital.

4.16 Dissemination of results

The findings of the study will be submitted to School of public health Addis Ababa University, Southern Regional Bureau of Labour and Social Affairs, for Ministry of industry, for flour millers association, Food beverage, and pharmaceutical institute and for each factory.

5. Results

5.1 Socio-demographic characteristics of respondents

Four hundred twenty workers were selected from flour mill and Pepsi factory to participate in the study, of which 406 workers were involved with 96.7 % response rate. Out of 406 study participants, 318 (78.3%) were males and 88 (21.7%) were females.

Mean age of flour factory workers (exposed group) were 32.1 with ± 9.99 standard deviation and for Pepsi factory, workers (non-exposed group) were 31.28 with ± 7.87 standard deviation and ranging from 20 to 63 years.

One hundred thirty one, (67%) of participants from flour factory had attained primary level of education and about 103(49%) of Pepsi factory participants had attained diploma and above level of education. One hundred sixty three, (83.2%) of participants from flour factory had median monthly income between 600 to 1900 and 167 (79.5%) of Pepsi, factory participants were got ≥ 1900 median monthly income.

Smoking is not common among flour and Pepsi factory workers with, 31 (15.8%) of flour factory participants, and 13 (6.2%) of Pepsi factory participants were ever cigarette smokers and eight (4.1%) of flour mill participants and two (1%) of Pepsi factory participants were currently smoked cigarettes.

There were a significant difference between flour and Pepsi factory participants in terms age, educational status, income and smoking habit (ever and current) ($p \leq 0.05$). However, in terms of sex, mean age and anthropometric measurements there were no significant differences between flour factory and Pepsi factory participants, $p > 0.05$ *(Table 2).*

Table 2: Socio-demographic characteristics of flour and Pepsi factory workers, Hawassa city, 2018

Variables	Flour factory (n=196)	Pepsi factory(n=210)	P-value
	n (%)	n (%)	
Sex of respondents			
Male	157(80.)	161(76.7)	0.401[a]
Female	39 (19.9)	49(23.3)	
Age (in years)			
≤ 40	30(15.3)	31(14.8)	0.890 [a]
>40	166(84.7)	179(85.2)	
Mean ± SD	32.1± 9.99	31.28 ± 7.87	0.36[b]
Educational status			
Illiterate	13(7)	2(1)	
Primary education	131(67)	40(19)	0.000[a]
Secondary education	36(18)	65(31)	
Certificate and above	16(8)	103(49)	
Monthly income			
600-1900	163(83.2)	43(20.3)	0.000 [a]
≥1900	33 (16.8)	167(79.5)	
Current smokers			
Yes	31(15.8)	13(6.2)	0.041[a]
No	165(84.2)	197(93.8)	
Ever smokers			
Yes	8(4.1)	2(1)	0.002[a]
No	188(97.4)	208(99)	
Height (meter)	1.69±0.07	1.69±0.07	0.750 [b]
Weight (kg)	60.4±9.5	66.2±9.5	0.180 [b]
BMI (Kg/m^2)	21.98±2.7	23.21±3.1	0.091 [b]

Note: [a] χ^2 test, [b]independent sample t-test, $p \leq 0.05$

5.2 Work related factors among flour mill and Pepsi factory workers

Out of 406 study participants, 101 (51.5%) of flour mill factory workers and 24(14.4%) of Pepsi factory workers were exposed to dusty working environments before they were started this job.

Out, of the flour factory workers about 34%and 36 % had a work experience in factory for six years or more and for more than ten years respectively. One hundred forty five, (69%) of Pepsi factory and 95 (46.5%) of flour factory workers were working greater than 8 hours per a day. Sixty-three, (32%) of flour factory and 84 (40%) of Pepsi factory workers were engaged in loading department.

Majority of flour factory workers,(77 %) and Pepsi factory workers (76.2%) used firewood and charcoal for energy sources at home. Few flour mill, 11(5.6%) and Pepsi factory workers, 9 (4.3%) were reported the presence of chronic respiratory disease confirmed by physicians before they have started a job in the factory. There were a significant difference between flour factory and Pepsi factory participants in terms working departments, length of working hours and past dust exposure, $p \leq 0.05$.

No significant difference was found between flour mill and Pepsi factory participants in terms fuel used at home, confirmed respiratory disease and work experience($p>0.05$).

Table 3: Work related factors and past respiratory illnesses of flour mill and Pepsi factory workers, Hawassa city, 2018

Variables	Flour factory (n=196)	Pepsi factory (n=210)	P-value
	n (%)	n (%)	
Working departments			
Cleaning	30(15)	37(18)	
Loading	63(32)	84(40)	0.002[a]
Mixing (production)	86(44)	42(20)	
Packaging(Quality control)	17(9)	47(22)	
Work experience			
1-5 years	60 (30)	83(39.5)	
6-9 years	66(34)	69(32.9)	0.110[a]
≥ 10 years	70(36)	58(27.6)	
Working hours per day			
8 hours	101(51.5)	65(31)	0.013[a]
>8 hours	95(48.5)	145(69)	
Past dust exposure			
Yes	101(51.5)	24(11.4)	0.000[a]
No	95(48.5)	186(88.6)	
Energy used at home			
Charcoal	151(77)	160(76.2)	0.840[a]
Electricity	45(23)	50(23.8)	
Previous respiratory illness			
Yes	11(5.6)	9(4.3)	0.648[a]
No	185(94.4)	201(95.7)	

Note: [a] χ^2 test, $p \leq 0.05$

5.3 Prevalence of chronic respiratory symptoms

As shown in Table 4, the difference in prevalence of respiratory symptoms between flour mill and Pepsi factory workers were statistically significantly for cough (39.3%; OR = 1.53, 95 % CI = 1.53-2.03), cough with sputum (17.86%; OR = 1.34, 95 % CI = 1.02-1.76), wheezing (17.35%;

OR = 1.33, 95 % CI = 1.01-1.75), breathlessness (18.9%; OR = 1.42, 95 % CI = 1.08-1.87) and at least one chronic respiratory symptoms(56.6%; OR = 1.32, 95 % CI = 1.05-1.65).

The likelihood of a flour mill worker developing at least one respiratory symptom was 1.32 times statistically significantly higher than that of Pepsi factory worker.

Table4: Prevalence of respiratory symptoms in flour mill and Pepsi factory workers, Hawassa city, 2018.

Variables	Flour factory (n=196)	Pepsi factory (n=210)	Prevalence OR[a](95%CI)[b]
	n (%)	n (%)	
Cough	77(39.3)	12(5.7)	1.53(1.15,2.03) *
Cough with sputum	35(17.86)	9(4.3)	1.34 (1.02,1.76) *
Wheezing	34(17.35)	8(3.8)	1.33 (1.01,1.75) *
Breathlessness	37(18.9)	11(5.2)	1.42 (1.08,1.87) *
Chest pain	23(11.9)	6(2.9)	1.20 (0.73,1.97)
At least one chronic respiratory symptoms	111(56.6)	27(12.9)	1.32(1.05,1.65) *

*Note: [a]prevalence odds Ratio, [b] 95% confidence interval and * $p \leq 0.05$*

Respiratory protective devices

Respiratory protective devices were available for only eight (4%) of flour factory workers. However, (71 %) of Pepsi factory participants used respiratory masks. The main reasons mentioned by the respondents for none use of PPE were not provided 188(98%) for flour factory and 17 (27%) of Pepsi factory participants and 35(58%) of Pepsi factory workers believed that no harmful dust particles in a factory *(Figure 4).*

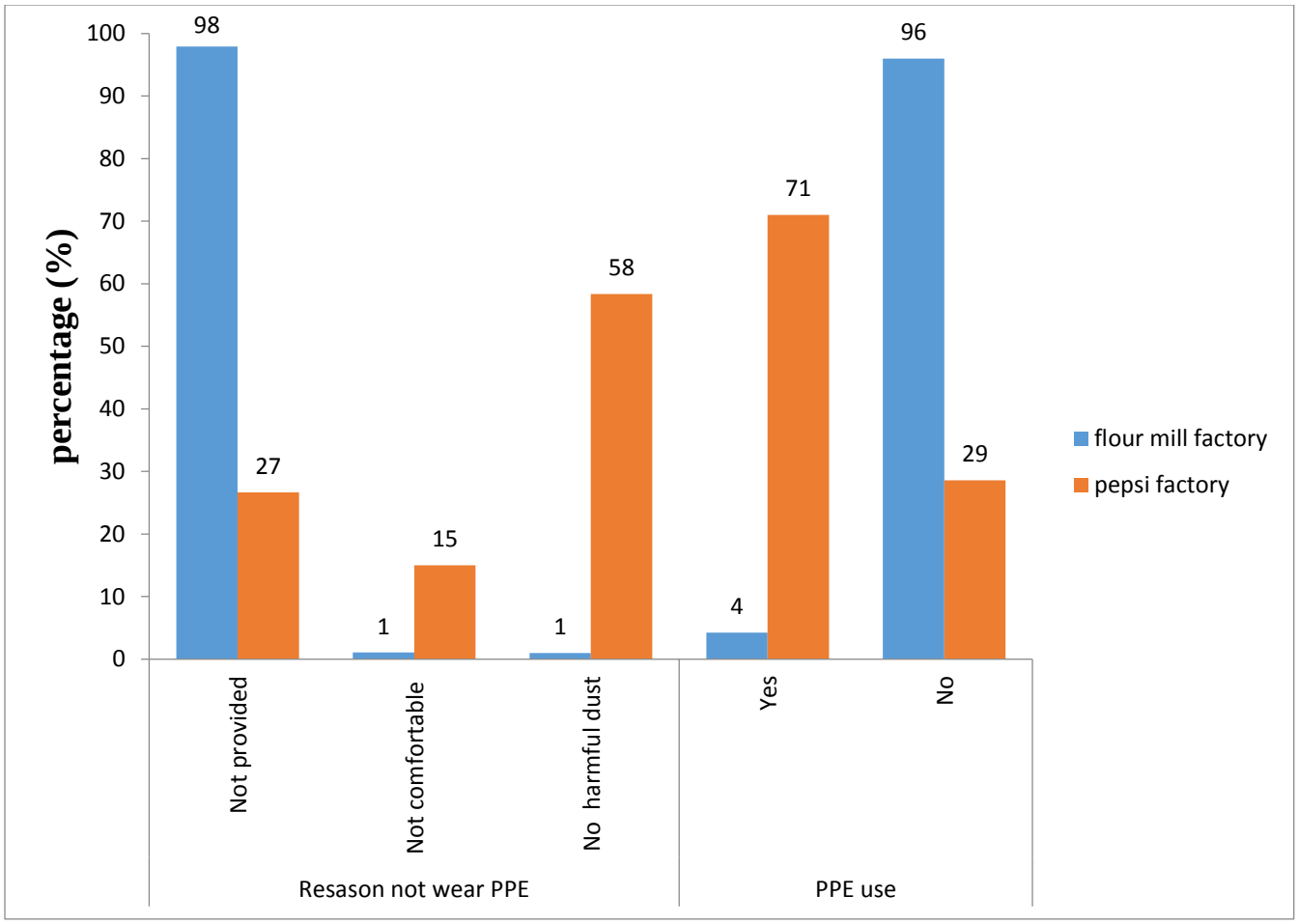

Figure 4: Personal protective devices availability and the reason not used by factory workers

5.4 Work place observation

Observational findings of the study showed that flour mill dusts were accumulated on the walls and floors of different working sections, and especially high in the flour milling, loading, and packaging sections of the factory due to lack of dust absorber, artificial and natural ventilation. Regarding personal protective equipment usage organization did not provide sufficient respiratory protective device for flour factory workers.

Not all flour factory workers had training on occupational health and safety issues. However, 185(88.1%) of Pepsi factory workers had occupational health and safety training.

Figure 5: Mixing department worker (Photograph by Zemachu A.)

5.5 Associated factors and chronic respiratory symptoms

The bivariable and multivariable analysis summarized in *(Table 5)* showed that sex, age and educational status of participants were significantly associated with chronic respiratory symptoms in univariate analysis ($p \leq 0.05$)., However, average monthly income of the participants was insignificant in univariate analysis ($p \geq 0.05$). From, socio-demographic factors only educational status (primary education) of workers were significant in multivariable analysis ($p \leq 0.05$).Workers whose education level was primary (Grade 1-8) were more likely to develop chronic respiratory symptoms than workers whose education level was secondary (Grade 9-12) and above (AOR= 6.2, 95 % CI = 1.6-24.4).

Working department, service years in the factory and working hours per a day were significant in both univariate ($p \leq 0.2$) and multivariable ($p \leq 0.05$) analysis. However, smoking habit (ever and current smokers), energy used at home (firewood and charcoal) and past chronic respiratory illness was not significant in both univariate and multivariable analysis>0.2. However, past dust exposure were associated with chronic respiratory symptoms in univariate analysis ($p \leq 0.2$) *(Table 5).*

Working departments were significantly associated with chronic respiratory symptoms among flour factory workers. Workers who were engaged in mixing section (AOR = 5.3, 95% CI = 1.68-16.56) were more likely to develop chronic respiratory symptoms than workers engaged in cleaning and packaging sections.

Service years in the factory was significantly associated with chronic respiratory symptoms. Workers who had work experience 6-9 years (AOR= 5.1, 95 % CI = 2.05-12.48) and ≥ 10 years (AOR= 2.5, 95 % CI = 1.01-6.11) had the odds of developing chronic respiratory symptoms 2.5 and 5.3 times more than workers who had work experiences between 1-5 years respectively.

Length of working hours per a day was also significantly associated with chronic respiratory symptoms in the flour factory workers. Workers who stay greater than 8 hours per a day (AOR=2.4, 95% CI, (1.16-5.10) were more likely to develop chronic respiratory symptoms than those who had 8 hours or less *(Table 5).*

Table 5: Respiratory symptoms and associated factors among flour factory workers, Hawassa city, 2018

Variables	At least one chronic respiratory symptoms		COR(95%CI)	AOR (95%CI)
	Yes	No		
Sex				
Male	95	62	2.2 (1.08,4.5) *	0.84(0.31,2.27)
Female	16	23	1.00	1.00
Age (in years)				
20-29	48	52	1.00	1.00
30-39	41	25	3.2 (0.94,3.35) *	1.4 (0.65,3.10)
40-49	6	2	3.2 (0.63-16.9) *	1.96 (0.29-13.4)
50-59	11	4	3.0 (0.89-10.0) *	2.5 (0.61-10.7)
≥60	5	2	2.7 (0.9-9.98)	2.9 (0.27-31.4)
Educational status				
Illiterate	9	4	5.0 (1.02-24.1) *	2.9(0.42-20.4)
Primary education	81	50	3.6 (1.17-10.9) *	**6.2(1.6-24.40)****
Secondary	16	20	1.8 (0.51-6.1)	3.1(0.7-13.30)
Certificate and above	5	11	1.00	1.00
Past dust Exposure				
Yes	66	45	2.1 (1.18-3.7) *	1.5(0.73-3.2)
No	35	50	1.00	1.00
Working departments				
Cleaning	11	19	1.00	1.00
Loading	37	26	2.5 (1.0-6.0) *	3.1(0.98-9.6)
Mixing	60	26	4.0 (1.6-9.6) **	**5.3(1.68-16.6)****
Packaging	3	14	0.4 (0.09-1.6)	0.52 (0.1-2.7)
Work experience				
1-5 years	19	41	1.00	1.00
6-9 years	44	26	5.7(2.67-12.4) *	**5.1(2.05-12.5)****
≥ 10 years	48	18	3.6 (1.76-7.6)*	**2.5(1.01-6.1)****
Working hours per day				
≤8 hours	37	47	1.00	1.00
>8 hours	74	38	2.5(1.38-4.4)*	**2.4(1.16-5.1)****

*Note: 1.00 = reference value *p ≤0.2 for COR **p ≤ 0.05 for AOR*

5.6. Pulmonary Function Tests

The independent sample t-test analysis showed that the mean score of pulmonary function parameters (FVC, FEV1, FEV1/FVC) in the flour factory workers were lower than Pepsi factory. The differences observed in these mean values were statistically significant for FEV1/FVC, $p \leq 0.05$. However, there were no significant difference for FEV1 and FVC (Table 6).

Table 6: Comparison of pulmonary function parameters of flour and Pepsi factory workers, Hawassa city, 2018

Parameters	Flour factory (n=56)	Pepsi factory (n=56)	P-value
	Mean ±SD	Mean ±SD	
FVC (L)	3.98± 0.95	3.87± 0.69	0.488[a]
FEV1 (L)	2.99± 0.83	3.19 ± 0 .62	0.165[a]
FEV1/FVC (%)	74.92 ± 10.09	81.05 ± 11.46	**0.003[a]**

Note: $p \leq 0.05$ [a] independent sample t-test

5.7 Distribution of pulmonary function test with duration of employment

One-Way ANOVA result showed that there is a significant difference ($p<0.05$) in pulmonary function parameters (FVC and FEV1) among the flour mill factory workers between different duration of employment. Flour mill factory workers exposed for ≥ 10 years, showed a significant reduction in FVC (3.09 ±0.62) and FEV1 (2.23±0.74) compared to the workers with less duration of work exposure.

Table 7: One Way ANOVA results distribution of pulmonary function tests in 56 flour mill workers by duration of employment, Hawassa city, 2018

Parameters	Duration of employment			P- value
	1-5 years	6-9 years	≥ 10 years	
	n= 30	n= 16	n= 10	
	Mean ±SD	Mean ±SD	Mean ±SD	
FVC (L)	3.84± 0.96	3.33±0.73	3.09± 0.62	**0.031**[c]
FEV1 (L)	2.95± 0.84	2.57±0.65	2.33± 0.74	**0.033**[c]
FEV1/FVC (%)	77.21± 10.12	76.67±5.43	70.61 ± 12.04	0.157[c]

Note: [c]Fisher's exact-test and $p \leq 0.05$

6. Discussion

This study showed that the prevalence of chronic respiratory symptoms were higher in flour mill factory participants (56.6%) compared to Pepsi factory (12.86%).This finding was consistent with studies done in Ibadan and Ilorin, Nigeria, which indicated higher prevalence of chronic respiratory symptoms like cough, cough with sputum, wheeze and breathlessness among flour mill workers compared to controls (39, 40).

The higher prevalence of chronic respiratory symptoms in the flour mill participants might be due to lack of personal protective equipment's 8 (4%), longer duration of exposure to flour mill dusts and lack of occupational health and safety trainings compared to Pepsi factory.

Personal protective equipment utilization behavior of the flour factory workers was low. However, majority of workers agreed on the importance of PPE using for preventing themselves from flour dust particles, but the factory don't supply PPE for workers and which is in line with the result of study done in India and Nigeria flour milling factory workers (21, 32).

In this study, primary school education was significantly associated with chronic respiratory symptoms of workers. This result was in line with study conducted in Ethiopia (28). This might be due to higher education provides the knowledge about how to protecting themselves from health effects associated with their work.

In this study, mixing department workers were more likely to develop chronic respiratory symptoms than workers in packaging, loading and cleaning department were. This finding was inconsistent with study conducted in Iraq, which reported that packaging department workers had high prevalence of chronic respiratory symptoms compared to in those of mixing, loading and cleaning departments workers (35). This might be due to difference in working condition such as ventilation type, machine type and use of protective device.

Work experience 6-9 years and ≥ 10 years were significantly associated with chronic respiratory symptoms. This finding was in line with the studies conducted in Iraq and Egypt flour mill workers (9, 35). This might be due to increased dust accumulation in respiratory system associated with prolonged exposure at work places.

In addition, working more than 8 hours per day was significantly associated with chronic respiratory symptoms. This finding was similar with a study conducted in Iraq (35).This might be due to exposure for extended hours increased dust accumulation in the respiratory system.

Pulmonary Function Tests

The result of this study showed that statistically significant reduction in mean values of FEV1/FVC ($p \leq 0.003$) in the flour factory workers as compared with Pepsi factory workers. However, the reduction in FEV1 and FVC were not statistically significant, $p > 0.05$.

This study results were consistent with study conducted in Iran among workers of flour production factories (20). Also, the findings of this study were consistent with study conducted in Pakistan and Riyadh, Kingdom of Saudi Arabia as regard FV1/FVC (2, 21). However, in this study, FVC and FEV1 were not significant, this might be due to respondent's bias special some participants were not voluntary to tell their exact age and observer variation during height measurements.

The reduction of the parameters might be due to dust exposure and duration of work.

In this study, significant reduction in pulmonary function parameters (FVC and FEV1) in flour factory workers as duration of employment increases. This finding was consistent with study conducted in Egypt flour mill workers (9).

This might be due to, an increase in exposure to flour dust as service year of flour factory workers increase.

7. Strength and limitations of the study

Strength of the study

- ✓ Comparative study design
- ✓ Spirometer test was performed
- ✓ All flour factory in Hawassa were included in the study.

Limitations of the study

- ✓ Participants recall bias and interviewer bias might have influenced the results for reported age, past dust exposure and past respiratory disease.
- ✓ Even if comparative study, it may not be strong enough to show cause and effect relationship between risk factors and outcome.

8. Conclusions

Based on the finding of this study, it can be concluded that the respiratory symptoms were higher among flour factories workers than Pepsi factory workers.

Education level, duration of exposure (service years), work departments and length of working hours are the determinant factors for occurrence of chronic respiratory symptoms. Majority of respondents in flour factory did not have respiratory protective device.

The pulmonary function parameter FVE1/FVC were decreased significantly among flour factory workers relative to Pepsi factory workers.

In general, the results of this study concluded that working in flour factory without proper respiratory protective device has an adverse effect on respiratory health of the workers.

9. Recommendation

Based on study findings, the following important measures are recommended to protect and improving the respiratory health of flour mill factory workers.

For, factory owners

They should implement control measures to reduce the dust and workers should be educated about the health effects and control measures of dust, and workers should be provided with respiratory protective devices during duty hours and rotating workers to low dusty department.

For, factory workers

Workers should have to use personal protective devices which supplied by flour mill factory owners.

For SNNPR labour and social affairs

- ✓ The SNNPR labour and social affairs should develop detailed rules and regulations jointly with health and industry bureaus.
- ✓ There should be regular monitoring to ensure the implementation of these rules and regulations.

Finally, further studies should be conducted for future by using personal and areal dust measurement materials.

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Annex

Annex I Information sheet

My name is _____. I am working as a data collector for the study conducted in this factory by ZemachuAshuro who is studying for his Master's degree at Addis Ababa University, Collage of Health Science, and School of Public Health. I kindly request you to give me your attention to explain you about the study and study participant.

The study title: Assessments of chronic respiratory symptoms and pulmonary function and associated factors among flour and Pepsi factory workers Hawassa city Southern, Ethiopia, 2018.

Purpose of the study: The main aim of this study is to write a thesis as a partial fulfillment of a Master's degree in public health for the principal investigator. After completion of this study, the results used as evidence and input to reduce the potential health risk of exposure to flour dust.

Procedure and duration: I will be assessing chronic respiratory symptoms by using Questionnaires, pulmonary function by using Spirometer that needs your full cooperation and this may take about 30 to 45 minutes, and the procedures will take place in your working environment.

Risks and benefits: Risk of participating in this study is nil since the study does not need collecting any samples. There would have no any direct benefits for being study participant but indirectly the findings from this research will important for improving occupational health safety practice, information for the factory and for scientific knowledge.

Confidentiality: All information forwarded kept confidential and names will not be written.

Rights: Giving permission for this study is voluntary. You have the right to permit or not for this study. If you decide to permit the study, you have the right to terminate the study at any time if you consider something related to the study is wrong.

Contact address: If you have any question, which is not clear to you can contact the investigator

Investigator: Zemachu Ashuro

Mob +251-910 09 54 09

Email zemash65@gmail.com

Addis Ababa University, school of public health

Annex II. Informed consent

Detail information about the study explained to me. I have understood that the objective of this study is to assess chronic respiratory symptoms, pulmonary function, and associated factors in workers of flour factory.

In addition, I understand about how the data collection is proceeding and the time it takes to complete the data collection. I also understand that the research imposes no risk on me. I assured that there would be confidentiality of my response and collected data used only for the study.

It also explained to me that I have the right to stop participation at any time.

In addition, I understood that participating in this study is important for scientific knowledge and base for further study. Therefore, I have now consented to participate in the study by signing this form.

Signature of participants_____ date _____

Name and signature of data collector_____ date _____

Annex III. English Version Questionnaire

Addis Ababa University Health Science Collage, School of Public Health

A questionnaire designed to assess chronic respiratory symptoms and pulmonary function and associated factors among flour factory workers in Hawassa city, Southern Ethiopia, 2017/18

Data collection date: _____

100. Factory code _____

101. Status of workers flour factory = 1 Pepsi factory = 2

102. ID number of subjects_____

Part I. Socio-demographic characteristics of respondents

S/no	Questions	Response	Skip
103	Sex (observe)	1. Male 2. Female	
104	What is your age in completed years?	_____(Years)	
105	What is your marital status?	1. Single 2. Married 3. Separated 4. Divorced 5. Widowed	
106	What is your religion?	1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Others(Specify)_____	
107	What was the highest level of education you attend?	1. Illiterate 2. Can read and write 3. Education Grade_____	
108	How much is your average monthly income in Ethiopia birr?	_____(Complete in Ethiopia birr)	

Part II Occupational history

S/no	Question	Response		Skip
109	For how long have you been working in this factory?	_____(Years & months)		
110	For how many working hours per day you have been working in this factory?	_____(Hours/day)		
111	For how many working days 'per a week you have been working in this factory?	_____(Day/week)		
112	How long have you been working in flour industry, summarizing all periods?	_____(Years and months)		
113	Which section are you working now and for how long?	**Working department**	**Service year**	
		Cleaning		
		Milling		
		Machine operating		
		Packaging		
		Loading		
114	Have you ever worked in other sections in the past in the flour factory?	1. Yes 2. No		If No go to 116
115	If Q 114 answer is "Yes" indicate which section and for how long? (in years & months) (Multiple answer is possible)	**Work department**	**Service year**	
		Cleaning		
		Milling		
		Machine operating		
		Packaging		
		Loading		
116	Have you ever worked in other dusty types of work?	1. Yes 2. No		
117	If Q 116 answer is "Yes", for how long have you worked in any of the following types of work? (in years/months)	**Work area**	**Service year**	
		Chip wood factory		
		Textile factory		

	(Multiple answer is possible)	Soap factory		
		Coffee processing		
		Others_____		
118	Are you normally cooking food at home?	1. Yes 2. No		If No go to 121
119	If Q 118 is "Yes" where is cooking normally taking places in your home?	1. Inside house 2. Outside house in open area 3. In a kitchen		
120	What type of fuel do you use in your home for cooking?	1. Charcoal 2. Fire wood 3. Kerosene		

Part III. Respiratory symptoms of respondents

I am going to ask you some questions mainly about your chest. I would like you to answer Yes or No wherever possible

S/no	Questions	Response	Skip
A cough Related Questions **A cough: -** isexperience of a cough for 4 days or more per a week for at least three consecutive months in one year**.**			
121	Do you usually have a cough in the morning?	1. Yes 2. No	If "No" (121 & 122) go to 126
122	Do you usually cough during the day or at night?	1. Yes 2. No	
123	Do you usually cough for 4 days or more per a week?	1. Yes 2.No	
124	Do you usually cough for 3 consecutive months or more during the year?	1. Yes 2. No	
125	For how long have you had this cough?	_____(Year)	
A Cough with sputum production related questions **A Cough with sputum :-** is sputum expectoration on most days of the week (5 days) for at least three 3 consecutive months in one year			
126	Do you usually cough with sputum first thing in	1. Yes 2. No	

	the morning?		
127	Do you usually cough with sputum during the day or at night?	1. Yes 2. No	
128	Do you usually cough with sputum for 4 or more days in a week?	1. Yes 2. No	If "No" to the above questions skip this
129	Do you cough with sputum on most of days for as much as 3 consecutive months or more in a year?	1. Yes 2. No	If ''No" to the above questions skip this
Wheezing Related Questions **Wheezing: -** is a condition of causing a wheezy or whistling sound heard during inhalation or exhalation (at least for three months in a year).			
130	Do you have wheeze/whistling/ sound in your chest?	1. Yes 2. No	If "No" go to 133
131	When you have wheeze/whistling/ sound in your chest?	1. In the daytime 2. In the morning 3. At night	
132	For how long has this wheezy sound persisted?	_____(Years)	
Breathlessness related questions **Breathlessness** :- is a discomfort or difficult to breathe in different activities			
133	Are you troubled with shortness of breath when hurrying or walking uphill?	1. Yes 2. No	If " No" go to 136
134	If Yes Q133 Have, you had trouble of breathlessness while walking with a person of the same age.	1. Yes 2. No	
135	For how long have you been this short of breath?	_____(In years)	
Chest pain Related Questions			
136	In the past three years, have you experienced any chest illness that kept you off duty, or in bed?	1. Yes 2. No	If "No" go to 139
137	If you get a cold, does it usually go to your chest?	1. Yes 2. No	

138	Did you produce phlegm with any of these chest illnesses?	1. Yes 2. No	

Part IV Past respiratory illness

S/no	Questions	Response	Skip
139	Have you experienced any respiratory illness, whichis confirmed by a physician?	1. Yes 2. No	If "No" go to 141
140	Have you ever had any of the following respiratory illness? (Mention all you had)	1. Asthma 2. Tuberculosis (TB) 3. Any other chest illness 4. Chronic bronchitis 5. Lung cancer	

S/no	Questions	Response	Skip
Ever smoker: - a person smoked at least 100 cigarettes in his entire life. **Currently smoker: -** a person who smoke cigarettes every day or some days.			
141	Have you ever-smoke cigarette?	1. Yes 2. No	If "No "go to 146
142	Do you smoke Cigarette Currently?	1. Yes 2. No	
143	How many cigarettes do you normally smoke per day now?	___(No of cigarettes)	
144	For how many times smoke per week?	_____(Times/day)	
145	For how long have you been smoking?	_____(In years)	

Part V Behavioral factors of workers

Part VI. Respiratory protective devices

S/no	Questions	Response	Skip
146	Do you usually wear respiratory protective devices while at work?	1. Yes 2. No	If "No" go to 148

147	Which of the following type of protective devices did you use? (choose all that you apply in your working area)	1 Mask respiratory 1. Full face pieces respiratory 2. Breathing apparatus 3. others_____	
148	If Q146 answer is "No "Select the most appropriate reasons for not using	1. Not available 2. Not comfortable for work 3. Not provided by institution 4. The dust is not harmful 5. Others specify_____	
149	Do you ever had occupational health and safety training?	1. Yes 2. No	
150	Do you ever been supervised at work place on occupational safety issues?	1. Yes 2. No	

Name of data collector: _____ signature_____

Checked by (supervisor name): _____signature_____

Annex IV. Observational checklist for PPE usage and workplace ventilation

S/no	PPE Usage	Response		Comments
		Yes	No	
1	Is required equipment provided,and used?			
2	Is there a written procedure for the selection, use and maintenance of PPE?			
3	Is personal protection utilized only when it is not reasonably practicable to eliminate or control the hazardous substance or process?			
4	Are the areas requiring PPE usage properly identified by warning signs?			
	Workplace ventilation			
1	Is the work place well ventilated /free fresh air movements?			
2	Is the ventilation system appropriate for the work performed?			
3	Is exhaust ventilation required before confined space entry?			
4	Dust absorber			
5	Do you had occupational health and safety training?			Observation documents

Annex V. Information sheet (Amharic version)

የስምምነት ማሳወቂያ ቅጽ

ስሜ.....ይባላል፡፡እዚህ የተገኘሁት የአዲስ አበባዩኒቨርስቲ ጤና ሳይንስ ኮሌጅ የህብረተሰብ ጤና ሳይንስ ትምህርት ቤት የድህረ-ምረቃ ተማሪ የሆኑት ዘማቹ አሹሮ ወክየነው። እሳቸውም ዱቄት ፋብሪካ ውስጥ በሚሰሩ ሰራተኞች የመተንፈሻ አካላት ችግርና መንስኤዎቻቸው ዙርያ ላይ ጥናት በመስራት ላይ ይገኛሉ። ይህንን ጥናት ለማካሄድ ተሳታፊ የሚሆኑትን በሎቶሪ የናሙና አወጣጥ ምልመላ ሲካሄድ እርሶ በዚህ ጥናት እንዲሳተፉ የተመረጡ ስሆን ጥናቱ በሚካሄድበት ወቅት የመተንፈሻ አካላት ችግርመንስኤዎቻቸው ዳሳሳ ለማድረግ

1. ለጥናቱ የተዘጋጀ መጠይቅ እጠቀማለው
2. ቀላል ዘዴ በመጠቀም አተነፋፈስዎን እንለካለን ይህም የእርሶን ሙሉ ትብብር የሚጠ ይቅይሆናል፡፡ ስለሂደቱም አጭር ገለጻ ይደረጋል፡፡ልኬቱ የሚካሄደው ሥራ ቦታ ሲሆን የሚወስደው ጊዜ ከ 30-45 ደቂቃ ነው፡፡

የምትሰጡን መረጃ ሁሉም ምስጢራውነቱ የተጠበቀና ቅፅ ላይ ስም አይሰፍርም፡፡ ከጥናቱ በቀጥታ የሚገኙት ጥቅም የለም፡፡ ነገር ግን በተዘዋዋሪም ጥናቱ በዱቄት ፋብሪካ በሚሰሩ ሰራተኞች ላይ የሚታዩ የመተንፈሻ አካላት ችግሮች ለመከላከልና ለመቆጣጠር ትልቅ አስተዋፅኦ ይኖረዋል፡፡ በተጨማሪም ለቀጣይ ምርምር መሰረት በመሆን ያገለግላል፡፡

እንዲሁም ይህንን ጥናት መሰረት በማድረግ መንግስትና የተለያዩ ባለድርሻ አካላት ትኩረት በመስጠት ችግር ላይ የራሳቸው አስተዋፆ እንዲያደርጉ ይረዳል ብዬ አስባለሁ፡፡ስለዚህ የእርሶ ተሳትፎ ለዚህ ምርምር ጠቃሚ ነው፡፡በዚህ ምርምር መሳተፍ ምንም አይነት ጎንዮሽ ጉዳት አይኖረውም፡፡ስለዚህ በጥናቱ መሳተፍምሆነ አለመሳተፍ የእርሶ መብት ነው፡፡ ከጥናትጋር ተያያዥ ጥያቄ ካለዎት ወይም ተጨማሪ መረጃ ከፈለጉ ከአዲስአበባ ዩኒቨርሲቲ ጤና ሳይን ስኮሌጅ የህብረተሰብ ጤናሳይንስ ትምህርት ክፍልን ወይም ጥናት አድራጊውን በሚከተለው አድራሻ ማግኘት ይችላሉ፡፡

ጥናት አድራጊ፡-ዘማቹ አሹሮ
ስልክ+251-910 09 54 09
ኢ-ሜል፡-zemash65@gmail.com

Annex VI. Informed consent (Amharic version)

የስምምነት መዋዋያ ቅጽ

ጥናቱን በሚካሄደው አካል ስለጥናት በቂ መረጃ ተሰጥቶኛል፡፡ የዚህ ጥናት ዓላማም ከዱቄት ፋብሪካ የሚወጣው የዱቄት ብናኝ በአተነፋፈስ ስርዓት ላይ ያለውን ተጽእኖ መለካት መሆኑን ተረድቻለሁ፡፡ ከኔ የሚወሰደው መረጃ በእኔ ላይ ምንም ዓይነት ጉዳት የማያስከትልናመረጃውን ለጥናት ዓላማ ብቻ እንደሚውል ተረድቻለሁ፡፡

ማንኛውም እኔን የተመለከተ መረጃ ሚስጥራዊነቱ የተጠበቀ ነው፡፡ እንደዚሁም በጥናቱ ለመሳተፍ ፍቃደኛ ካልሆንኩ በጥናቱም ለመሳተፍ እንደማልገደድ ነገር ግንበዚህ ጥናትመሳተፌ ለሳይንሳዊ ዕውቀት ጠቃሚ መረጃ የማበርከትና ወደፊት በዚህ ዙሪያ ለሚሰሩስራዎች መሰረት የሚሆኑ ግብዓት መስጠት እንደምችል ተረድቻለሁ፡፡ በመሆኑም በዚህ ጥናት ላይ ለመሳተፍ የተስማማሁ መሆኔን በፊርማዬ አረጋግጣለሁ፡፡

የተሳታፊው ፊርማ…….. ቀን……..

መረጃሰብሳቢ ስምናፊርማ…… ቀን……..

Annex VII. Amharic version questionnaire

አዲስ አበባ ዩኒቨርሲቲ ጤና ሳይንስ ኮሌጅ የሕብረተሰብ ጤና ትምህርት ቤት

ቃለ-መጠይቅ የተደረገበት ቀን_____

100. የፋብሪካ ኮድ_____

101. የተሳታፊ ሁኔታ ዱቄት ፋብሪካ ዉስጥ የሚሰሩ = 1፣በዱቄት ፋብሪካ ዉስጥ የማይሰሩ= 2

102. መለያ ቁጥር _____

ክፍልአንድ፡- ማህበራዊ ሁኔታ መስፈርት

ተ.ቁ	ጥያቄ	ምላሽ	ይለፉ
103	የተሳታፊየታምንድንነዉ?	1. ወንድ2. ሴት	
104	እድሜዎት ስንት ነዉ?	_____(በሙሉዓመት)	
105	የጋብቻ ሁኔታ እንዴት ነዉ?	1. ያላገባ(ች) 2. ያገባ(ች) 3. ተለያይተው የሚኖሩ 4. የፈታ(ች) 5. የሞተበት(ባት)	
106	ሐይማኖትዎ ምንድን ነዉ?	1. ኦርቶዶክስ 2. ሙስሊም 3. ፕሮቴስታንት 4. ካቶሊክ 5. ሌላካለይግለፅ_____	
107	ከፍተኛዉ የተከታተሉት የትምህርት ደረጃ?	1. ያልተማረ/ች 2. ማንበብናመፃፍመቻል 3. የክፍልደረጃ_____	
108	አማካይ ወርሃዊ ገቢ በብርምን ያህል ይሆናል?	_____(በኢትዮጵያ ብርይግለፁ)	

ክፍል ሁለት፡- የሥራ ሁኔታ

ተ.ቁ	ጥያቄ	ምላሽ		ይለፉ
109	ከዚህ በፊት ለብናኝ ሊያጋልጥ የሚችል ሌላ ሥራ ሰረተዉ ያዉቃሉ?	1. አዎ2. ተጋልጨ አላዉቅም		መልስዎ ተጋልጨ አላዉቅም ከሆነ ወደ ጥያቄ 111 ይለፉ
110	መልስዎ ለጥያቄ ነ09 አዎን ከሆነ የስራ ቦታና ለምን ያክል ጊዜ ሰርተዉ ነበር? (ከአንድ በላይ መልስ መስጣት ይቻላል)	**የስራቦታ**	**ለምንያክልጊዜ**	
		ብረትማቅለጫፋብሪካ		
		ቄንጠኛ የድንጋይ ስራ		
		በጥጥፋብሪካ		
		በማዕድንቁፋሮ		
		ቡናመፈልፈያ /ማበጠሪያ		
		ሌላካለይግለፅ_____		
111	አሁን በሚሰሩበት ፋብሪካ ስንት ዓመት ሰርተዋል?	_____(በዓመት/ወር ይግለፁ)		
112	አሁን በሚሰሩበት ፋብሪካ በቀን ምን ያክልሰዓት ይሰራሉ?	_____(በሰዓት)		
113	አሁን በሚሰሩበት ፋብሪካ በሳምንት ስንት ቀን ይሳራሉ?	_____(በቀን)		
114	በዱቄት ፋብሪካ ለምን ያክል ጊዜ ሰርተዉ ነበር?	_____(በዓመት/ወርይግለፁ)		
115	አሁን የሚሰሩበት በየተኛዉ የሥራ ክፍል ለምን ያክል ጊዜ ሰሩ?	**የሥራክፍል**	**ለምን ያክል ጊዜ**	
		ጽዳት		
		እህል መፍጨት		
		ጥላል		
		ዱቄት ማሸግ		
		ዱቄት መጫን		
116	ከአሁን በፊት ዱቄት ፋብሪከ ሌላስራክፍል ለዓመት ወይም ከዓመት በላይ ሰርተው ያውቃሉ?	1. አዎን2.አልሰራሁም		መልስዎ አልሰራሁም ከሆነ ወደጥያቄ 118 ይለፉ

117	ለጥያቄ 116 መልስዎአዎን ከሆነ በየተኛዉ የሥራ ክፍል ለምን ያክልጊዜ ሰርተዉ ነበር? (ከአንድ በላይ መልስ መስጣት ይቻላል)	**የሥራክፍል**	**ለምን ያክል ጊዜ**	
		ቅድመ ጽዳት		
		ጽዳት		
		ዱቄት መፍጨት		
		ጥላል		
		ዱቄት ማሸግ		
		ዱቄት መጫን		
118	ምግብ እቤት አብስለዉ ነዉ የሚጠቃሙት?	1. አዎ2. አይደለም		መልስዎ አይደለም ከሆነ ወደ ጥያቄ 121 ይለፉ
119	መልስዎ ለጥያቄ 118 አዎን ከሆነ ምግብ የሚሰሩበት ቦታ የት ነዉ?	ı. እቤትዉስጥ 2. እደጅ ክፍት ቦታ ላይ 3. ኮሽና ወስጥ		
120	ምግብ የሚያበስሉት ምን በመጠቀም ነዉ ?	1. ከሰል 2. እንጨት 3. ነጭ ጋዝ		

ክፍል ሶስት፡-የአተነፋፋስ ስርዓት ምልክቶችን የተመለከቱ ጥያቄዎች

ተ.ቁ	**ጥያቄ**	**ምላሽ**	**ይለፉ**
ሳልን በተመለከተ			
121	አብዛኛው ጊዜ ጧት ያስለዎታል?	1. አዎ2. አያስለኝም	አዎ ከሆነ ላንዳቸው (121, 122) ጥያቄ 123 ፣124 ና 125 መልስ
122	አብዛኛው ጊዜ ቀን ወይም ሌሊት ያስለዎታል?	1. አዎ2. አያስለኝም	
123	አብዛኛው ጊዜ በሳምንት 4 ቀን ወይም ከዛ በላይ ያስለዎታል?	1. አዎ2. አያስለኝም	
124	አብዛኛው ጊዜ ለተከታታይ 3 ወርናከዛ በላይበ 1 አመት አስሎዎት ያውቃል?	1. አዎ2. አያዉቅም	
125	ይህ ሳልለምን ያክል ዓመት ነበረብዎት?	_____ዓመት	

አክታ ያለበት ሳልን በተመለከተ			
126	አብዛኛው ጊዜ ጧት ከመኝዎታዎት ሲነሱ አክታያለበትሳልነበረብዎት?	1. አዎ 2 የለብኝም	
127	በአብዛኛው ጊዜ አክታያለበትሳል በቀን ወይም በማታ ጊዜ ነበረብዎት?	1. አዎ 2 የለብኝም	
128	አብዛኛው ጊዜ 4 ቀን ወይም ከዛ በላይ በሳምንት አክታያለበትሳል ነበረብዎት?	1. አዎ 2 የለብኝም	ለጥያቄ 126 ና 127 መልስ የለብኝም ካሉወደጥያቄ 130 ይለፉ
129	በአመት እንደዚህ አይነት አክታያለበትሳል በአብዛኛው ቀናት ለተከታታይ ሶስት ወር ነበረብዎት?	1. አዎ 2 የለብኝም	
የማንኮራፉት ድምፅ በተመለከተ			
130	ከደረት የማንኮራፉት ወይም የማ□ጨት ድምፅ ያሰማሉወይ?	1. አዎ2. የለብኝም	የለብኝምካሉወደ ጥያቄ 133 ይለፉ
131	ከደረት የማንኮራፉት ወይም የማ□ጨት ድምፅ የሚሰማዉመቼ ነዉ?	1. ጠዋት 2. ቀን 3. ሌሊት	
132	የማ□ጨት ማሰማትከጀመሩምንያክልዓመትሆነዎት?	_____ዓመት	
ትንፋሽ ማጠርን በተመለከተ			
133	ደረጃ ወደ ላይ ወይም ተራራ ሲወጡ ትንፋሽ ያጥሮታል?	1. አዎ 2. አያጥረኝም	አያጥረኝም ካሉ ወደ ጥያቄ 135 ይለፉ
134	ከዕድሜ አቻ ከሆኑ ጓደኞችዎ ጋር ሲሄዱ ትንፋሽ የማጠር ስሜት ይሰማዎታል ?	1. አዎ 2. አያጥረኝም	
135	ትንፋሽ ማጠር ከጀረዎት ምን ያክል ዓመት ሆነዎት?	_____ዓመት	
የደረት ህመምን በተመለከተ			
136	ባለፉት ሦስት አመታት በደረት ህመም ምክንያት ስራ ቀርተዉ (ተኝተዉ) ያዉቃሉ?	1. አዎ 2. አላዉቅም	አላዉቅምካሉወደጥያቄ 139 ይለፉ

137	በአብዛኛዉ ለቅዝቀዜ በሚጋለጡበት ጊዜ የደረት ህመም ይሰማዎታል?	1. አዎ 2. የለም	
138	የደረት ህመሙ አክታ ኑሮት ያዉቃል?	1. አዎ 2. የለም	

ክፍል አራት ፡- ከዚህ በፊት የነበረ ህመምን የተመለከቱ ጥያቄዎች

ተ.ቁ	**ጥያቄ**	**ምላሽ**	**ይለፉ**
139	በሀኪም የተረጋገጠ የመተንፈሻ ህመምነበረብዎት?	1. አዎ2. የለብኝም	የለብኝም ካሉወደጥያቄ 141 ይለፉ
140	ከተዘረዘሩት ህመሞች ዉስጥ የትኞቹን ታመዉ ነበር?	1. አስም 2. የሳንባነቀርሳ(ቲቢ) 3. ብሮንካይተስ 4. የልብችግር 5. *የደረት አካባቢ ችግር*	

ክፍል አምስት ፡- የአኗኗር ዘይቤጋር የተያያዙ ጥያቄዎች

ተ.ቁ	**ጥያቄ**	**ምላሽ**	**ይለፉ**
141	በህይወተዎ ሲጋራ አጭሰዉ ያቃሉ?	1. አዎ2. አላዉቅም	አላዉቅምካሉወደ ጥያቄ 146 ይለፉ
142	በአሁኑ ጊዜ ሲጋራ ያጨሳሉ?	1. አዎ2. አላጨስም	
143	በቀን ስንት ስጋራ ያጨሳሉ?	_____(በቁጥር)	
144	በሳምንት ስንት ጊዜ ሲጃራ ያጨሳሉ?	_____ (በጊዜ)	

145	ለምን ያህል ዓመት ነዉ ሲጃራ ያጫሱት?	_____(በዓመት)	

ክፍል ስድስት :- የመተንፈሻ አካል አዳጋ መከላከያ መሳሪያ

ተ.ቁ	ጥያቄ	ምላሽ	ይለፉ
146	በስራ ላይ የብናኝ መከላከያ ልብስ ይለብሳሉ?	1. አዎ2. አለብስም	አለብስም ካሉ ወደ ጥያቄ 148 ይለፉ
147	ከሚከተሉት ዉስጥ የትኛዉን መከላከያ ይጠቀማሉ? (ከአንድ በላይ መልስ ይችላል)	1. የአፍ/አፍንጫመሸፈኛ 2. ጭምብል (የፊትመሸፈኛ) 3. የአየርማጣሪ ያመሳሪያ 4. ሌላ ካለ ይጥቀሱ_____	
148	የብናኝ መከላከያ ልብስ የማይለብሱበት ምክንያቱ ምንድን ነዉ?	ı. ጭራሽ ስለሌለ 2. ለመልበስ ስለማይመች 3. በማስሪያ ቤት ስለማይቀረብ 4. ጎጅ ብናኝ ስለሌለ 5. ሌላካለይጥቀሱ_____	
149	የሥራ ደህንነት ስልጠና ወስደዋል?	1. አዎ 2. አልወሰድኩም	
150	በስራ ደህንነት ጤና ጉዳዮች ላይ ክትትልና ድጋፍ ተደርጎሎት ያውቃል?	1. አዎ 2. አያዉቅም	

መረጃ ሰብሳቢዉ ባለሙያ ስም _____