



**COLLEGE OF HEALTH SCIENCES  
DEPARTMENT OF PUBLIC HEALTH**

**ASSESSMENT OF UNDERNUTRITION AND ITS INFLUENCING FACTORS  
AMONG PRISONERS IN NORTH SHOA ZONE AMHARA REGION  
ETHIOPIA**

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**DEPARTMENT OF PUBLIC HEALTH**

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FACTORS AMONG PRISONERS IN NORTH SHOA ZONE AMHARA  
REGION ETHIOPIA

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## Table of Contents

ACKNOWLEDGEMENTS .....	i
Table of Contents .....	ii
List of Tables .....	iv
List of Figures .....	v
List of Acronyms .....	vi
Abstract .....	vii
1. INTRODUCTION .....	1
1.1 Background .....	1
1.2 Statement of the problem .....	3
1.3 Significance of the study .....	5
2. Literature Review .....	6
2.1 Magnitude of malnutrition among prison inmates .....	6
2.2. Factors associated with nutritional status of prison inmates .....	9
2.2.1 Socio demographic characteristics .....	9
2.2.2 Medical factors .....	9
2.2.3 Behavioural and Personal related characteristics .....	10
2.2.3.1 Food frequency, individual diet diversity and Feeding pattern .....	10
3. Objective .....	13
3.1 General objective .....	13
3.2 Specific objectives .....	13
4. Methods and material .....	14
4.1 Study area and period .....	14
4.2 Study design .....	14
4.4 Population .....	14
4.4.1 Source population .....	14
4.4.2 Study population .....	14
4.3.3 Study units .....	14

4.4 Eligibility criteria .....	15
4.4.1 Inclusion criteria .....	15
4.4.2 Exclusion criteria .....	15
4.5 Sample size determination .....	15
4.6 Sampling technique and procedure .....	15
4.7 Study variables.....	17
4.7.1 Dependent variable .....	17
4.7.2 Independent variable .....	17
4.8 Operational definition .....	18
4.9 Data collection method .....	19
4.10 Data quality assurance .....	21
4.11 Data processing and analysis .....	22
4.12 Ethical consideration.....	22
4.13 Dissemination and utilization of results.....	22
5. Results.....	23
5.1 Socio-demographic characteristics of the respondents .....	23
5.2 Behavioural and feeding characteristics of prisoners .....	24
5.3 Institutional conditions.....	25
5.4. Medical factors and related characteristics .....	26
5. 5 Prevalence of nutritional status.....	27
5.6 Factors associated with under nutrition among prison inmates in north Shoa .....	28
6. Discussion.....	30
7. Limitation and strength of the study .....	33
8. Conclusion and recommendation.....	34
Reference .....	35
ANNEX I:English Interviewer administer questionnaire .....	38
ANNEX II: Amharic Interviewer administer questionnaire .....	46
ANNEX III: Declaration Sheet Format .....	56

## List of Tables

Table 1: Socio demographic characteristics of male adult prison inmates in north Shoa prison, Ethiopia, 2020. (n= 638) .....	23
Table 2: Behavioural and feeding characteristics of prison inmates in North Shoa prison, Ethiopia, 2020 (n=638) .....	24
Table 3: Institutional conditions among the respondents in North Shoa prison, Ethiopia, 2020 (n=638).....	25
Table 4: Medical factors and related characteristics among the respondents in North Shoa prison, Ethiopia, 2020 (n=638) .....	26
Table 5: Bivariate and Multivariate analysis of factors associated with under nutrition among prison in north Shoa, Amhara region, Ethiopia, 2020, (n=638). .....	29

## **List of Figures**

- Figure 1: Conceptual frame work for factors associated with nutritional status and its influencing factors among north Shoa prison Amhara Region, Ethiopia 2020. .... 12
- Figure 2: Sampling procedure for the study assessment of nutritional status and its influencing factors among prisoners in north Shoa zone Amhara region Ethiopia ..... 16
- Figure 3 Prevalence of under nutrition among prisoner in north Shoa, central Ethiopia 202027

## **List of Acronyms**

AIDS	Acquired Immuno Deficiency Syndrome
AOR	Adjust Odd Ratio
BMI	Body Mass Index
CI	Confidence Interval
COR	Crud Odd Ratio
DC	Data collector
EAR	Estimated Average Requirements
EDTA	Ethylene Diamine Tetra Acetic Acid
Hgb	Haemoglobin
HIV	Human Immuno deficiency Virus
ICPR	Institute for Criminal Policy Research
OIs	Opportunity Infections
OR	Odds Ratio
OSS-3	Oslo-3 Social Support Scale
PCV	Packed cell Volume
PI	Principal Investigator
PLHIV	People Living with Human Immuno Deficiency Virus
PPS	Probability Proportional to Population Size
QoL	Quality of Life
RNA	Ribo Nucleic Acid
RPM	Revolution Per Minute
SPSS	Statistical Package for Social Sciences
UDHR	Universal Declaration of Human Right
WHO	World Health Organization
WPB	World Prison Brief

## **Abstract**

**Background:** - Nutrition status is one of the health problems in developing countries. Prisons typically comprise marginalized sections of society and at high nutritional risk due to lack of diet diversity; And there is a lack of clarity on the dimensions of food security this study was identifying malnutrition and associated factors among prisoners to alleviate the problem.

**Objective:** - This study aimed to assess the nutritional status and influencing factors among prisoners in North Shoa prisons, Ethiopia in 2020.

**Method:** - Institution based cross sectional study design was conducted from Feb 15 to March 15, 2020. Multi-stage sampling technique was employed to recruit a total of 638 study participants. Data has been collected by using interviewer administered questionnaire. Weight and height measured and BMI was calculating as weight/height ( $\text{kg}/\text{m}^2$ ). Haemoglobin measurement has been measured by a simple procedure for determining the amount of iron in blood using Hemo-cue methods. Cleaned data was entered to Epi data version 3.1 and transferred to SPSS version 25 for further analysis, Bivariate and multivariate logistic regression was fitted to identify factors associated with under nutrition (nutritional status). Significance variable was obtained at adjusted odds ratio with 95% CI and  $p < 0.05$ .

**Result:** - The overall prevalence of under nutrition among prisoners estimated as 19.3% (95% CI 16.5-22.4); anaemic respondents were 3.23% times more likely to develop malnutrition than non anaemic respondents and those who were in educational status unable to read and write were eight times more likely to be malnourished with AOR 8.466(1.548-26.295) than college level and above.

**Conclusion and recommendation:** - The prevalence of malnutrition among prisoners in north Shoa zone was high. Anemia, HIV sero status, depression, social support and lack of additional diet like milk and meat were the most significant factors affecting under-nutrition. Therefore regular check-up of hemoglobin concentration among prisoner in general and those taking additional diet in particular is recommended.

**Key words:** - Nutrition status, Prison, Dietary intakes

# **1. INTRODUCTION**

## **1.1 Background**

There are over 10.35 million persons held in prisons and detention centres worldwide(1). Prisons typically comprise marginalized sections of society and at high nutritional risk due to lack of diet diversity. As these prisoners depend on few kinds of food for a long time and in a situation, adequacy of nutritional requirement is a great issue of concern(2).

A prison is an institution where diverse people who have run afoul of the law live. On the other hand, prisoners are people who are being held in an institution such as prison or jail; they have no control over their environment as a result of their incarceration. Prison is not just a mechanism for inflicting punishment on the prisoner, but also a centre of rehabilitation(3).

A major factor influencing nutritional status is decreased consumption of foods with adequate concentrations of nutrients. Many factors play a role in determining dietary intake. Socioeconomic, psychological, ethnic, physiological, and pathological factors all influence dietary intake, interacting in a complex and intertwining manner. For example, financial stress can lead to depression, which in turn adversely affects dietary intake. Inadequate intake can lead to protein-calorie malnutrition, which in itself can cause anorexia, depression, and apathy, ultimately setting up a vicious cycle(4).

Poor nutrition increases the body's vulnerability to infections, and infections aggravate poor nutrition. Inadequate dietary intake leads to poor nutrition and lowers immune system functioning. Poor nutrition reduces the body's ability to fight infections and therefore helps increase the incidence, severity, and length of infections. Symptoms that accompany infections such as loss of appetite, diarrhoea, and fever lead to reduced food intake, poor nutrient absorption, nutrient loss, and altered metabolism. All of these contribute to weight loss and growth faltering, which further weaken the immune system. An adequate nutrient-dense diet, proper hygiene, food safety, and nutrition management of symptoms are critical interventions to break the cycle of infection and poor nutrition(5).

Some studies reported that poor nutrition is significantly associated with severity of pneumococcal pneumonia and risk of acquiring tuberculosis infection(6, 7). Other studies showed that underweight and micronutrient deficiencies were associated with higher odds of respiratory infections(8).

Anemia currently affects 2 billion people throughout the world. It is a major public health problem in Ethiopia. According to the most recent estimates of the World Health Organization (WHO). Although the immediate causes of anemia among prisoner are known (including malnutrition and infections), the importance of contextual determinants and their relationships with individual effects have rarely been explored(9).

In general, in Africa, there is limited evidence on the various health problems of prisoners despite the relevance of such evidence on the health of the prisoners, their inmates, and the general community(10). In the case of Ethiopia, the prison health system seems to be not well integrated with the national health system and health problems of prisoners are mostly marginalized by researchers(11). According to the 2015 report by World Prison Brief (WPB) and Institute for Criminal Policy Research (ICPR), in Ethiopia, the total prison population has grown by 66.9% since 2000, reaching 113,727 in 2013/2014(12).

## **1.2 Statement of the problem**

Every country in the world is facing a demographic challenge due to drastic growth of population(13). The percentage of prisoner is growing rapidly and some study show malnutrition. Adequate diet and nutritional status are important determinants of health in populations (14). According to the report released by International centre for prison studies, prison overcrowding is a central problem in prison management around the globe(15). A lack of sufficient energy in the diet is the major nutritional problem in many low-income countries but also affects some people in the wealthier countries(16).

In low income countries nutrition related issues are often neglected specifically in vulnerable group like prisoners(11). The quality and quantity of food available in a prison has a major influence on the quality of a prisoner's life. The availability of safe and healthy food is essential in maintaining and improving prisoners' health. Supporting and ensuring a safe and healthy food supply in prison will help to prevent diet-related diseases and promote better overall health of prisoners (17).

Nutritional status is one of the health problems in developing countries, and its occurrence is aggravated by poor hygienic condition and little access to health problem(18). Nutrition and its epidemiologic transition has its own impact on changes in diet and activity patterns, leading to the development of a double burden of malnutrition. Changes in nutritional intake combined with increasingly sedentary life styles and failing to meet nutritional needs may lead to decreased immunity and increased susceptibility to infections, which can lead to further malnutrition(19).

In central prison of Guinea there was high prevalence of malnutrition and also it is primary cause for the death of seven inmates per month. So prisoners are more susceptible to develop nutritional deficiencies especially micronutrients required for optimum health and prevention of chronic diseases and their complications. Considerable benefits can be achieved when prison services work in a complementary manner to promote healthy lifestyles and facilitate healthy eating. These services include those for catering, education, health care, sports activities, treatment for substance users and activities of outside agencies(20).

The prisons' health system is inadequate in almost all developing countries and, particularly in Sub-Saharan Africa (SSA), like Zimbabwe, and democratic republic of Congo, elsewhere severe malnutrition has been documented. Adequate nutrition should be considered one of prisoners' basic human rights, especially as many have poor health. Healthy, nutritious meals

will enable them to take their medication properly and prevent the development of life-threatening infections such as HIV/AIDS and tuberculosis(21).

Nutritional status includes environmental, economic, biological, educational, and cultural factors, as well as issues pertaining to food security. Nutritional status directly affects the prisoner in terms of physical and mental health development. The main medical conditions for which prisoners are treated include diarrhoea and dysentery (42%), fever, including typhoid fever (25%) skin disease (20%), malnutrition (8%), psychological problems (1.5%) and heart problems (1%). The high frequency of diarrhea and skin disease is due to poor sanitation conditions prevailing inside prisons(22).

Prisoners being a potentially vulnerable group, little information on intakes and food practices are available. Diets need to be supportive of health and well-being, as well as meet financial obligations of the state (e.g. getting value for money)(23). In low-income countries including Ethiopia, undernutrition is common in prisons. More than half of the detainees are seriously undernourished(24).

According to universal declaration of human right (UDHR), one of the basic human right that prisoners, article 25(1), must have access to adequate and healthy food choice to meet their nutritional needs. Additionally, Mandela rule '22' state that every prisoner shall be provide by the prison administration at the usual hours with food of nutritional value adequate for health and strength, of whole some and quality and well prepared and served. Drinking water shall be available to every prisoner whenever she/he needs (25).

There is great gap in the prevalence of malnutrition among prison inmates in Guinea (5%) and in north Tigryi region prison (25.2%) thus this study is needed to identify the factors of the gap between this two study areas on under nutrition and identify prevalence and determinants of under nutrition for specific nutritional intervention. In particular, there is a lack of clarity on the dimensions of food security critical for improving health related quality of life for Prisoners. There is great gap in the prevalence of malnutrition among prison inmates in Guinea (5%) and in north Tigryi region prison (25.2%) thus this study is needed to identify the factors of the gap between this two study areas on under nutrition.

There are limited studies on the adequacy of prisoner diet and food practices, yet understanding these are important to inform food provision and assure duty of care for this group. The aim of this study is to assess the dietary intakes of prisoners to inform food and nutrition policy and attempt to assess the nutritional status of prisoners living in selected prisons in North Shoa Zone Amhara Region Ethiopia.

### **1.3 Significance of the study**

The study will be useful in the following main points. First, the study will contribute a better understanding of the overall nutritional status of prisons and associated factors. Secondly, it give some guide line information to policy makers, prison administration and other stakeholders who seek to improve prison's nutritional status in the study area.

The study is also important in putting baseline information to the next work as springboard for researchers who would like to conduct detailed and comprehensive study either in North Shoa or another study area. Results of this study will be useful in advising the policy makers and in planning nutrition support and intervention programmes for prisoners in Ethiopia.

## **2. Literature Review**

The growth of the world prison population has exceeded the rate of general population growth since 2000, and in many countries, this increase has led to more overcrowded prisons(26). It also pointed out links between overcrowding, inadequate healthcare facilities and inadequate diet, as well as a lack of opportunity to enjoy the right to freedom of religion or belief. While there is a great deal of evidence that the mental health of prisoners is affected(15)

Malnutrition is thus a health outcome as well as a risk factor for disease and aggravated and it can increase the risk of both morbidity and mortality(27). Inadequate diet and disease, in turn, are closely linked to the general standard of living, the environmental conditions, and whether a population is able to meet its basic needs such as food, housing and health care(28).

### **2.1 Magnitude of malnutrition among prison inmates**

A cross sectional study was conducted in Pakistan among “A Health and Nutritional Perspective” 39.7% were under weight and 8.3% were malnourished. Most of the prisoners (>68%) consumed food provided by prison authorities. Beside those prisoners who only eat food provided by the prison, there were more than (24%) prisoners who used both homemade and prison food in their meals, this figure showed that the diet of the prisoners was insufficient and nutritionally imbalanced and has led to malnourished and underweight prisoners(28).

There was a study conducted ‘Tangail’ prison in Bangladesh and the study found that, most of the prisoners are male (89.43%) and About 63.46% well nourished, 22.11% undernourished and 14.42% overweight. Prisoners abused mentally and physically by police (18.26%) and prisoner’s leader (38.46%). Study observed that 88.46% prisoners light activity level whereas 11.54% were sedentary but the rate of higher activity level zero. Each prisoner for food and this was too low to provide 2200 kcal per day(29).

A cross-sectional study was conducted among prisoners in Antanimora prison located in the city of Antananarivo, in Madagascar. The proportion of undernourished prisoners is 38.4%. The factors related to undernutrition of women prisoners are: taking two meals a day instead of three meals ( $p=0.003$ ), insufficient energy intake ( $p < 0.001$ ), incarceration duration of more than 10 months ( $p < 0.001$ ), absence of family visits ( $p = 0.013$ ) and lack of financial assistance from family ( $p = 0.013$ ) This higher prevalence of undernutrition among incarcerated women in Antanimora prison compared to the female population as a

whole confirms the vulnerability of prison populations to undernutrition. This public health issue is widespread in prisons in low-income countries(24).

In Papua New Guinea a cross-sectional study was conducted prison to have a comprehensive dietary assessment; 5% of the prisoners were underweight (BMI<18.5) and to provide blood for biochemical analysis ( $\alpha$ -tocopherol,  $\beta$ -carotene, lutein, thiamin, riboflavin, niacin, folate, homocysteine, zinc, ferritin, and vitamins A, B12 and C) on Prison rations consisted of white rice fortified with thiamin, niacin, and iron, tinned tuna, tinned corned beef, water crackers, and black tea, with occasional intakes of fruit and vegetables. Some prisoners received supplementary food from weekend visitors. From assessment of the prisoners dietary data, median intakes of calcium (137 mg), potassium (677 mg), magnesium (182 mg), riboflavin (0.308 mg), vitamin A (54.1 $\mu$ g), vitamin E (1.68 mg), vitamin C (5.7 mg) and folate (76.4  $\mu$ g). The result show that it is below the estimated average requirements (EAR) but a prisoner get a further higher dietary diversity that were associated with greater intakes of nutrients and biomarker concentrations(30)

A study conducted in Tanzania prisons the nutritional statuses of prisoners were assessed for nutritional status, dietary intake, Hb status and body fat mass; however the results of the study showed that, 75.5% of prisoners had good nutritional status of whom 38.3% were HIV-infected and 37.2% were non-infected inmates. About 6.6% of the inmates were underweight, (2.9% HIV-infected, 3.7% non-HIV infected). The study also revealed that, 62.7% of the prisoners were anaemic (32.2% being HIV-infected and 30.5% non-HIV infected(31).

Inadequate nutrition causes health issues and fatalities among prisoners. Thus, the study assesses dietary intake and factors affecting food service among prisoners at selected prisons in Kenya. A cross sectional analytical study design was adopted. Results showed that 70.5% married, while 14.7% single. Christianity (Catholic and Protestant) was the most common religion, followed by Islam. More than half (61.1%) had attained primary school education, followed by secondary education(20%). A meagre 8.0 and 3.0% had attended vocational training and tertiary education respectively. More than half of the prisoners had some duties assigned (51.6%) to them and 23.6% had no work assigned to them(32).

Study done among Dietary Pattern, Nutritional and Health Status of Inmates in Ibara Prison, Abeokuta, Ogun State, Nigeria more than two third (67%) of the respondents had BMI within the normal range, 21% were underweight and 11% were overweight. The respondents consumed more of root and tubers, legumes and cereals. About 37.5% of the respondents

perceived their health as good. There was a significant relationship between BMI and Health Perception ( $p = 0.001$ ,  $R = 0.057$ ). Poor dietary pattern and nutritional status were some of the major issues faced by inmates(33).

A Cross Sectional study conducted in Harer town in Ethiopia prison by using interviewer administered questionnaire and anthropometric measurements. Four Hundred eight (418) clients interviewed, of them 124 (29.6%) were chronic energy deficient ( $BMI < 18.5 \text{ kg/m}^2$ ); Proportion of mildly, moderately, and severely malnourished participants 64.4%, 19.2%, and 16.4% respectively. Females most affected (56.7%). eating difficulty are predictors associated to malnutrition(34).

Institution based cross sectional study design was conducted in Kality prison, Addis Ababa, Ethiopia. The overall magnitude of malnutrition was found to be 43% among prisoners living with HIV/AIDS. Female respondents were 92% times less likely to develop malnutrition than male respondents and those who were in the age range of  $\geq 50$  were eight times more likely to be malnourished with 47.28% than other age groups. The prevalence of underweight was very high among prisoners(35).

From nine major prison setups in the Tigray region of Ethiopia; the prevalence of underweight is 25.2%, Khat Chewing ( $OR = 2.08$ ; 95%  $CI = 1.17, 3.70$ ) and longer duration of incarceration ( $OR = 1.07$ ; 95%  $CI = 1.01, 1.14$ ) these associated with a significantly increased risk of underweight. Additionally, previous incarceration ( $OR = 1.54$ ; 95%  $CI = 0.99, 2.42$ ) was a relevant determinant of underweight with a borderline significance. In contrast, family support ( $OR = 0.61$ ; 95%  $CI = 0.43, 0.85$ ) and farmer occupation ( $OR = 0.59$ ; 95%  $CI = 0.36, 0.98$ ) compared to those who unemployed and important protective determinants significantly associated with lower risk of underweight(36).

In Arba Minch area public health facilities study conducted among nutritional status and associated factors. Out of all the participants, 18.23% (95%  $CI: 14.52-22.65$ ) were undernourished. The prevalence of undernutrition was significantly lower among those consuming food from five or more food groups per day ( $AOR: 0.33$ ; 95%  $CI: 0.16-0.71$ ) and undergoing for more than a year. On the contrary, the prevalence was significantly higher among those who were currently smoking tobacco ( $AOR: 6.67$ ; 95%  $CI: 1.45-30.76$ )(37).

Another quantitative cross-sectional study conducted by using Body Mass Index (BMI) as an indicator for nutritional status, and additional information on opportunistic infections, collected from medical records demonstrated that, One in five Prisons was found to be

under nourished (BMI <18.5 kg/m<sup>2</sup>). Nutritional status of study participants was assessed based on the anthropometric measurements used to assess the physical development Weight and height will measured by two different measurers and with any variation subjects were weighed with minimum of clothing. Illiteracy, residence in care homes, OIs and illness were found to be significant predictors of under nutrition. BMI was significantly correlated with three domains of quality of life (psychological, social and environmental)(38).

## **2.2. Factors associated with nutritional status of prison inmates**

### **2.2.1 Socio demographic characteristics**

Research done in England by Oxford University among inmates in 2012, found that male prisoners were less likely to be overweight or obese compared with the male population of similar age in that country(39). Educational status is the factor for nutritional status, Prison inmates who malnourished were less educated compared with the general population(40). Duration of stay in the prison Year of stay in the prison has its own impact in nutritional status, inmates in Karachi (Pakistan), among inmates who stay in the prison for at least 6 months the prevalence of under nutrition increase from time of imprisoned to time of study that is from 22.2% to 39.7%(28)

### **2.2.2 Medical factors**

A cross-sectional study design was employed in Jimma town in 2017, 41.9% of participants among prisoners had depression. People in prison frequently have complex health needs. There are high rates of mental health illness, as well as disease resulting from unhygienic prison conditions. The prevalence of depression among prisoners was very high. Having family history of mental illness, having chronic physical illness, having previous incarceration, lifetime alcohol use, thinking life to be difficult one after release from prison, and having poor social support were found to have an impact on the prevalence of depression(41).

The rates for HIV, tuberculosis and other infectious diseases among prisoners remain much higher than in the general community. The Joint United Nations Programme on HIV/AIDS (UNAIDS) estimates that people in prison are on average five times more likely to be living with HIV compared with adults outside prisons(42), although a higher estimate of 15 percent is given by the World Health Organization(26).

The diseases like tuberculosis and HIV/AIDS have the capacity to turn borderline nutritional deficiencies into severe malnutrition(32). Malnutrition independently cause progressive

damage to the immune system and increased susceptibility to infection and infection can also cause malnutrition. Study conducted in north Gondar prison (Ethiopia) on the prevalence of tuberculosis, the odds of TB was 9 times higher than the general population of north Gondar(7). Similarly in North central Ethiopia, Shoarobit prison the prevalence of energy depletion parasitic infectious was about 61.8%(43).

### **2.2.3 Behavioural and Personal related characteristics**

A large majority of people in prison smoke tobacco, with prevalence rates ranging from 64 to 90 per cent. In nearly all countries, smoking is a normal part of prison culture for a variety of reasons, including boredom and the stresses of being detained(44). Smoking is a factor for human health including nutritional status but few know about the effect of smoking on nutritional aspect, it has negative impact on food intake and absorption of nutrients(45).

A cross sectional study was conducted in Pakistan among “A Health and Nutritional Perspective” 11.8% prisoners was having respiratory tract infections at time the study was conducted. Among 433 inmates, 386 were addicted to at least one addiction such as smoking(28).

A study done in new Guinea majority of prison inmates(77%) were smoker and it is significantly associated with under nutrition with P-value <0.001.similarly in Oyo state (Nigeria) 80% of them are current smoker(10, 32).

#### **2.2.3.1 Food frequency, individual diet diversity and Feeding pattern**

A majority (54.8%) Tangail’ prison in Bangladesh, their daily meal pattern was breakfast (bread and jiggery), lunch (rice, pulse and vegetables) and dinner (rice, meat/fish/egg, pulse). Total kcal provided was about 1356 kcal (under trial) and 1425 kcal (trial) which was not sufficient to fulfil their daily calorie demand(26).

A study conducted among Dietary Pattern, Nutritional and Health Status in Abeokuta, Nigeria. The respondents consumed more of root and tubers, legumes and cereals. About 37.5% of the respondents perceived their health as good. There was a significant relationship between BMI and Health Perception ( $p = 0.001$ ,  $R = 0.057$ ). Poor dietary pattern and nutritional status were some of the major issues faced by inmates(33)

#### **2.2.4 Institutional factor**

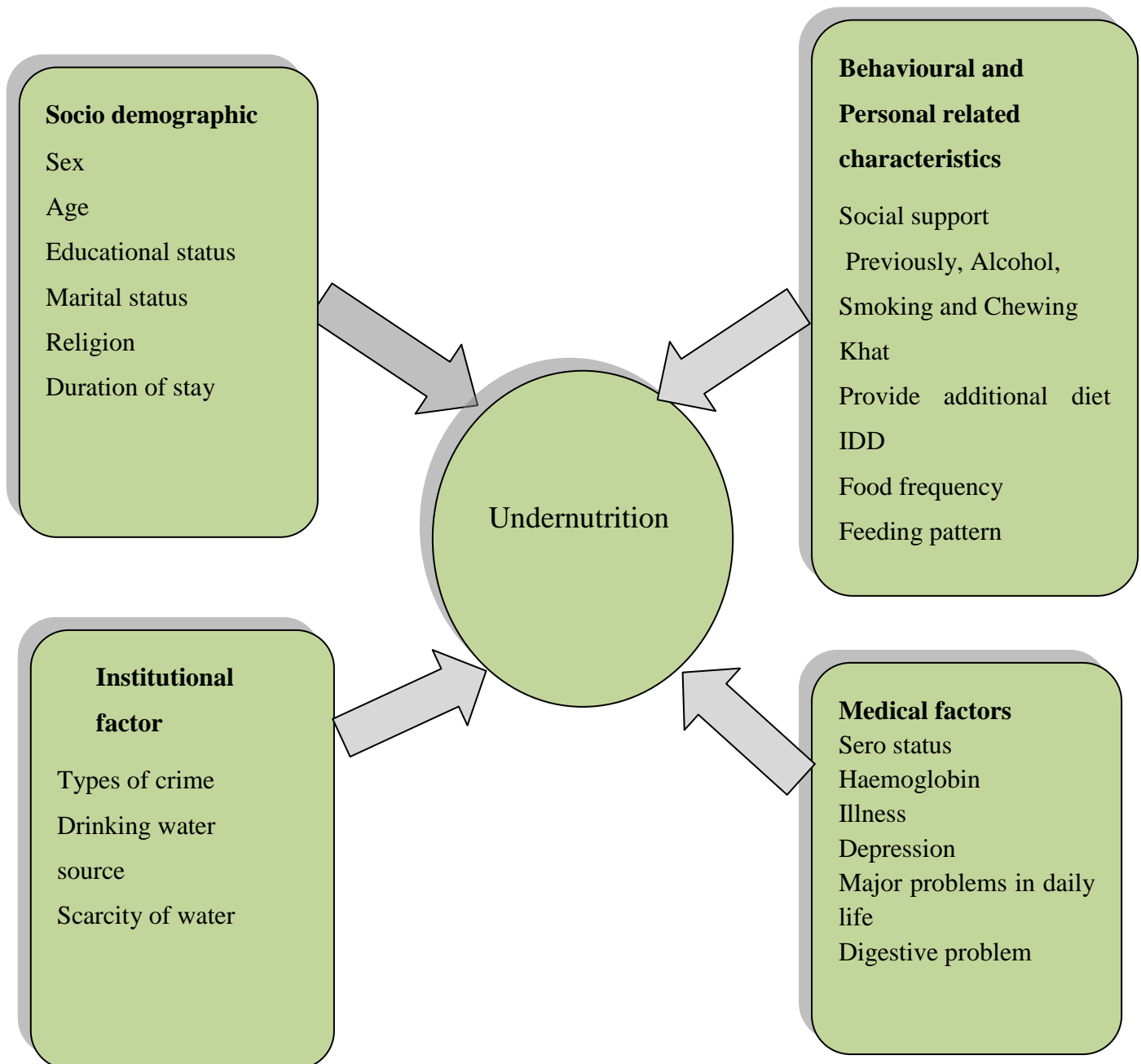
Factor for nutritional status that is if an individual have extra income generating activity, he may get diversified food items , study done in Nigeria, inmates perform different activity

inside the prison, almost 50% of them have job in the prison and also low prevalence of under nutrition among them which is about 4 % (46).

In Ethiopia a number of studies confirmed that there is a severe food insecurity problem in the country. The magnitude and factors associated with nutritional status among prison in Ethiopia are quite limited. By considering these background information there is a need of filling the gap regarding to include atypical days (local feasts or celebrations) in the 24 hour recall. The dependent variable is nutritional status of prisoner. The independent variables derived from socio-demographic and socioeconomic characteristics of the prisoner, and dietary habits of the prisoner. The socio-demographic variables will used to include in this, religion. The socio-economic variables will be included level of education, marital status, water and sanitation among prisoners were asked about their lifestyles that means quality of life, source of income (pocket money) and also measure Haemoglobin; all the above nutritional status among prisoner in our country, which prompt the conduct of this study.

## Conceptual framework

This conceptual frame was constructed after reviewing different literatures for the study nutritional status and its influencing factors among prisoners ( 14,19–21,22-25,26,32,40,45).



**Figure 1:** Conceptual frame work for factors associated with nutritional status and its influencing factors among north Shoa prison Amhara Region, Ethiopia 2020.

### **3. Objective**

#### **3.1 General objective**

- To assess Undernutrition and its influencing factors among prisoners in North Shoa Zone, Amhara Region, Ethiopia 2020 G.C

#### **3.2 Specific objectives**

- To measure undernutrition of prisoners in North Shoa Zone, Amhara Region, Ethiopia 2020.
- To determine factors affecting nutritional status of prisoners in North Shoa Zone, Amhara Region, Ethiopia 2020.

## **4. Methods and material**

### **4.1 Study area and period**

The study was conducted in five prisons found in North Shoa zone, Amhara region, Ethiopia. North Shoa located in Amhara National Regional State of Ethiopia. The selection was based on geographical location. It accommodates thousands of inmates every year and was one of the major prisons in Federal level and regional level. It had 5180 prison inmates at time of data collection. The function of North Shoa Prisons used to accommodate prisoners who are serving long-term sentences, life imprisonment or those who had condemned and remands with difficult cases such as armed robbery, murder cases or raping. The prisons were divided into male and female zones, comprising sentenced prisoners currently, and 5180 of which males 4760 and 420 females.

Debre Brehan prison comprises around 1750 sentenced prisoners currently, of which 1450 males and 300 females, Alemketema prison accommodates 380 to 450 inmates per day, Mehalmeda prison which accommodates male and female inmates also prison accommodates 440 to 460 inmates daily, Ataye Prison accommodates 390 to 440 inmates per day and Shoarobit prison are only male comprising around 2990 sentenced prisoners currently. The prisons have five primary school and health facility with a total of 15 health professional (7 clinical nurses, 3 pharmacy technicians, 4 laboratory technician and 1 environmental health professional). The study was conducted from February 15 – march 15. 2020.

### **4.2 Study design**

Institutional based cross sectional study was conducted.

### **4.4 Population**

#### **4.4.1 Source population**

All prisoners found in north Shoa.

#### **4.4.2 Study population**

Prisoners found in three selected prisons of north Shoa zone.

#### **4.3.3 Study units**

Randomly selected prisoners in the selected prisons

#### 4.4 Eligibility criteria

##### 4.4.1 Inclusion criteria

- Stayed in the prison for at least six months
- Adult: aged 18 years or above
- Able to understand the interview

##### 4.4.2 Exclusion criteria

- Prisoners who are severely ill and physically impaired people with severe intellectual disability or dementia

#### 4.5 Sample size determination

Single population proportion formula was used based on prevalence (p) of 25.2% underweight among prisoners in Tigray prison(11). 95% confidence interval ( $Z_{\alpha/2}$ ), 5% marginal error (d) and add 10% non-response rate.

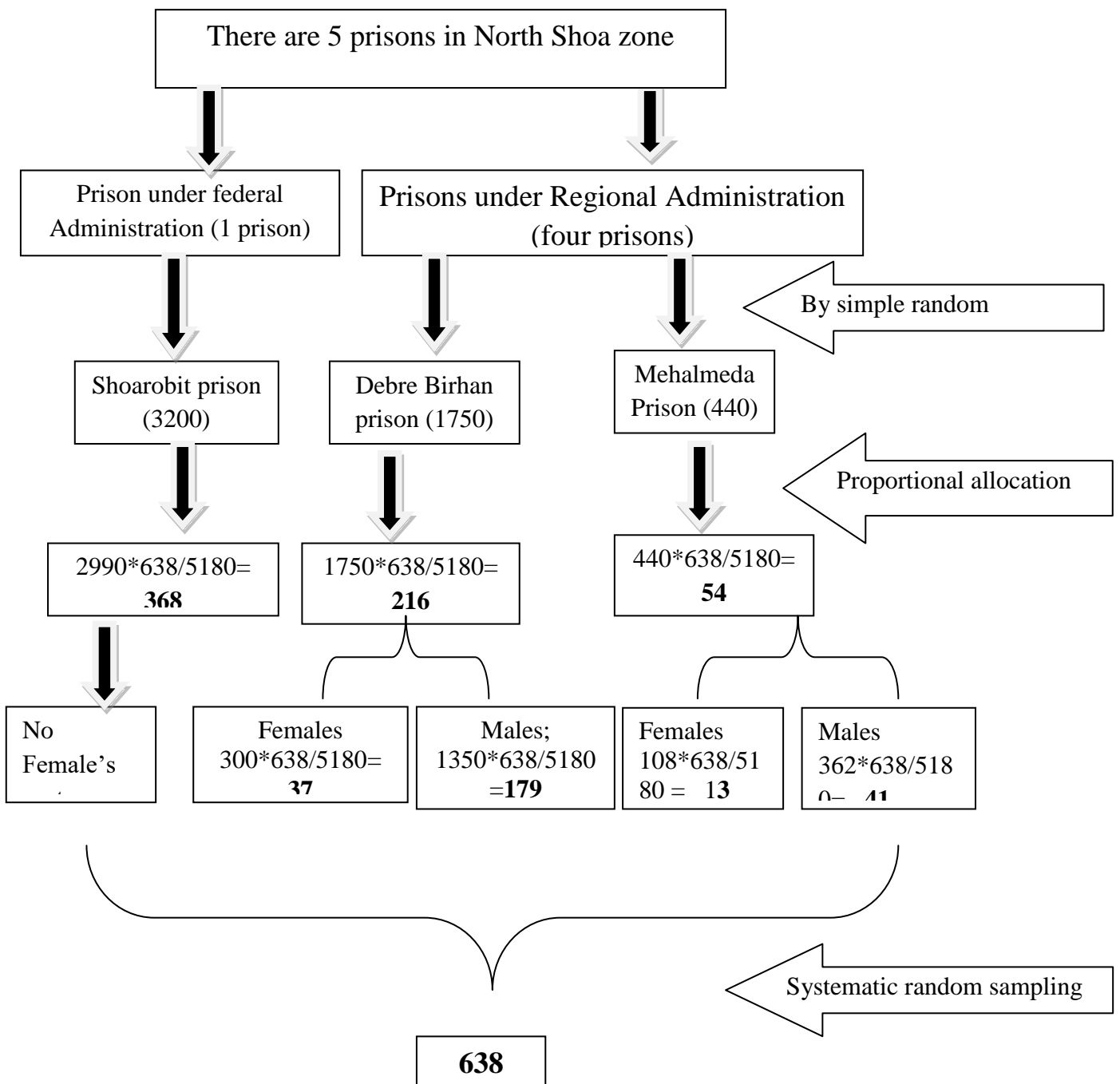
$$\text{Therefore: } n = \frac{(Z_{\alpha/2})^2 p(1-p)}{d^2}$$

$$n = \frac{(1.96)^2 \times 0.252(1-0.252)}{0.05^2}$$

n= 290; by adding design effect 2 and 10% non-response rate the sample size become **638**.

#### 4.6 Sampling technique and procedure

Multi-stage sampling technique was employed. In North Shoa, there are a total of 5 prisons one federal and four regional administration prisons. First each prison is stratified into Federal and regional administration prison. Then one Federal prison had been taken and two regional prisons were randomly select by lottery method to include in this study. There were a total of 5180 prisoner in the selected prisons. Mehalmeda prison (440), Debre Berhan Prison (1750) and Shoarobit prison (2990); Then estimate sample size for each prison was distributed proportionally to each section and final samples was draw using systematic random sampling method from registry identifying a list of prisoners in each prison.



**Figure 2:** Sampling procedure for the study assessment of nutritional status and its influencing factors among prisoners in north Shoa zone Amhara region Ethiopia

## **4.7 Study variables**

### **4.7.1 Dependent variable**

- Under nutrition

### **4.7.2 Independent variable**

#### **Socio demographic characteristics**

- Sex
- Age
- Educational status
- Marital status
- Religion
- Duration of stay in prison (Length of sentence / punishment)

#### **Institutional factor**

- Types of crime
- Drinking water source
- Scarcity of water

#### **Behavioural and Personal related characteristics**

- Social support
- Previous imprisonment history
- Alcohol use before jail
- Smoking before jail
- Chewing Khat before jail
- Provide additional diet
- Individual diet diversity
- Food frequency
- Feeding pattern

#### **Medical factors**

- Sero status
- Haemoglobin
- Any illness in the past 15 days
- Depression
- Major problems in daily life
- Digestive problem

#### **4.8 Operational definition**

**Nutritional status:** - For adults, body weight and height are used to evaluate overall nutrition status and to classify individuals as at healthy or unhealthy weight. BMI regardless of age or population, is normal at 18.5 to 25.0 kg/m<sup>2</sup>, overweight at 25.0 to 29.9 kg/m<sup>2</sup> and obese at Over 30.0 kg/m<sup>2</sup>(47).

**Undernutrition:** - resulting from a reduced supply of food or from inability to digest, assimilate, and use the necessary nutrients. Undernutrition (BMI <18.5 kg/m<sup>2</sup>)

**Prison:-** is a facility also known as a correctional facility, jail goal penitentiary, detention centre, correctional centre(48).

**Prison inmate:** - an individual who stayed in a prison for at least 6 months

**Prisoner diet:** - the term for meals served to prisoner while incarcerated in correctional institutions(49).

**Dietary intakes:-**Foods and drinks which are eaten to supply necessary nutritive elements. A prescribed course of eating and drinking in which the amount and kind of food, as well as the times at which it is to be taken, are regulated for therapeutic purposes.

**Food practices:** - refers to the myriad strategies that actors implement in constituting diet.

**Poor social support** - respondents scoring of 3-8 of the OSS-3(Oslo-3 Social Support Scale) are considered as having poor social support.

**Moderate social support** – respondents scoring of 9-11 of the OSS-3 are considered as having a moderate social support

**Strong social support** – respondents scoring of 12-14 of the OSS-3 are considered as having a strong social support

**Depression Severity:-** is measured by using PHQ-9 with a 5 point severity scale over the last 2 weeks preceding the survey; based on the instrument standard PHQ-9 score  $\geq 10$  is considered as significant for meeting any form of depression diagnosed disorder. 1-4 Minimal depression , 5-9 Mild depression, 10-14 Moderate depression, 15-19 Moderately severe depression, 20-27 Severe depression.

**24hrs recall:** - 24 hour dietary recall is detail information about all foods and beverages consumed by the respondent in the past 24 hours most commonly, from midnight to midnight the previous day

**Dietary diversity score:** - relates to nutrient adequacy in which

≤ 3 food groups: - poor.

4-6 food groups: - medium.

≥ 7 food groups: - Good

**Anaemia** is a decrease of Hgb values as compared to normal reference range for age and sex, physiologic condition, altitude, etc. Thus local normal reference values for female less than 12.5mg/dl and for male 13.5 mg/dl.

#### **4.9 Data collection method**

Data was collected by using interviewer administered pretested structured questionnaire. The questionnaires consist of five sections. Section A, solicited information about socio-demographic information. Section B, solicited information about behavioural characteristics, social support, and feeding practices such as IDD, food frequency and pattern. Section C, contain questions related to institutional factor like types of crime, drinking water source and Scarcity of water. Section D, addressed medical condition of prisoners: HIV-Sero status, depression, major problems in daily life, digestive problem. Section E, consisted anthropometries measurements of weight and height of individuals and hemoglobin level measurement. The questionnaire was prepared first in English language and then translated to Amharic language. 3 data collectors those who have diploma in nursing and 1 /BSc nurse were participate in the data collection process

#### **Oslo-3 Social Support Scale (OSS-3)**

The 3-item Oslo-3 Social Support Scale (OSS-3), which was also recommended for the ECHI according to the explanations of the OSS-3 by Delgard 2008, the OSS-3 can be used to calculate stand-alone indicators for each of the three question items, moreover, to calculate a ‘social support sum score’, applying the score values to the answer categories. Check whether the OSS-3 item sum score comprises valid values from 3 to 14. “A score ranging between 3 and 8 is classified as ‘poor support’, a score between 9 and 11 as ‘intermediate support’, and

a score between 12 and 14 as ‘strong support’” (3). Recode OSS-3 sum score and generate a categorical variable of ‘social support’ in three categories.

## **Depression**

Depression was measured by using PHQ-9, which has 9 items with a 5 point severity scale over last 2 weeks preceding the survey. Those who score  $\geq 10$  were considered as having depression disorder.

## **Anthropometric measurements**

Standing height was measured when the subject was facing directly ahead. Shoes off, feet together and arm's by the sides. Heels, buttocks and upper back should also be in contact with the wall when the measurement was made.

Measuring body weight the person stands with minimal movement with hands by their side. Shoes and excess clothing should be removed.

Weight and height was measure and BMI was calculated as weight/height ( $\text{kg}/\text{m}^2$ ). Body Mass Index (BMI) as the best method of measuring the nutritional status of prisoners was used according to(50).

## **Haemoglobin measurements**

Haemoglobin measurement was measured by using hemo-cue from periphery (capillary) blood collected clean the fingertip with 70% alcohol and allow to dry puncture the fingertip (middle or ring finger) with a sterile lancet wipe away first 2 - 3 drops of blood put the tip of the micro cuvette in the drop of blood Fill the micro cuvette in one continuous process. The correct amount of blood (10  $\mu\text{l}$ ) is drawn into the micro cuvette. The micro cuvette should be completely filled then Switch on the machine press and hold left button. The display is activated. Optronic unit is automatically checked. The display shows 3 flashing dashes the analyser is ready to use. Pull out the cuvette holder Wipe away any excess of blood on the outside of the micro cuvette tip check for air bubbles in the filled micro cuvette. If present, use a new micro cuvette. Place the filled micro cuvette in the cuvette holder. Push the cuvette holder to the measuring position after 15 - 60 seconds the result is displayed, read and record the result. Remove and discard the micro cuvette in the appropriate bio-hazard container. Push the cuvette holder back into the instrument.



### **Dietary diversity score**

Diet diversity collected by questionnaire at the individual level according to the purpose of the survey. It has been adapted for ease of data collection from the FANTA Individual Dietary Diversity Score Indicator Guide.

Data was collected by trained data collectors after attending two days training on the aim of the study, content, objective, data collection and interviewing technique and issue on confidentiality. During the data collection, regular supportive supervision and discussion with data collectors and supervisors was done.

#### **4.10 Data quality assurance**

Data quality was insured by translating the questionnaire from English to Amharic then back to English to see consistency. Pre-test was conducted on 5% of the study participants [32] in Ataye prison inmates. Training of data collectors was conducted for about 2 day to have consensus and the same understanding about the objective of the study, how to take measurement and how to approach participants ethically. The completeness, accuracy and consistency of the collected data were checked daily by responsible supervisor and principal investigator. Discussion was held based on the result of the pre-test and accordingly, some modifications were made. The validity and reliability of the tool was measured by Cronbach alpha test the statistic indicate 0.78.

#### **4.11 Data processing and analysis**

Data was cleaned, coded and entered into Epi-data Version 3.1 and then transferred to SPSS version 25.0 for further analysis. Anthropometric measurements were converted to BMI to assess the nutritional status of the study subject then compared with the WHO standard, BMI was computed by weight in kilogram divided by height in meter square ( $\text{kg}/\text{m}^2$ ). Descriptive statistics were presented with graphs and tables. The association between dependent and independent variables were analysed using Odds ratio with 95% confidence interval. The relative contribution of each variable to outcome of interest was assessed by logistic regression analysis to determine the effect of numerous factors on the outcome variable and to control confounding effect logistic regression methods was used. Variables with a  $P$  value  $< 0.05$  in bivariate analysis was transferred to multivariate analysis those variables with  $p$ -value of less than 0.05 in multivariate analysis were considered as significant. Hosmer-Lemeshow goodness-of-fit statistics was conducted to determine whether the model adequately describes the data. The statistic indicates a good fit the significance value is 0.97.

#### **4.12 Ethical consideration**

Ethical clearance was obtained from the Ethical Review Board of Debre Berhan University College of health Science. Written letter for the next steps was secured from North Shoa prison administration office. Consent was obtained from each study participants after informing them all the purpose, benefit, risk, the confidentiality of the information and the voluntary nature of the participation in the study. They were also being informed about their right not to respond for questions they did not want to answer. To assure the confidentiality of the response, nameless interview was conducted.

#### **4.13 Dissemination and utilization of results**

The result of this study will be presented to Debre Berhan University then it will be summated to the research directorate of DBU as partial fulfilment of the degree of Master of Science in General MPH and It will be submitted to all north Shoa prisons administrative office and other who are concerned at regional or federal level. It will be also presented at seminar and workshops, and submitted to different journal for publications.

## 5. Results

### 5.1 Socio-demographic characteristics of the respondents

A total of 638 prison inmates were interviewed in the study, with response rate of 100%. The mean  $\pm$  standard deviation, age of the respondents was 39.08 ( $\pm$ 11.54) years, ranging from 19 to 71 years. Two hundred four (32%) of the participants were in the age group of 26 to 36 years. About 282(44.2%) prison inmates were married and most of them 440(69.0 %) were Christians Orthodox. Nearly one third of the participants 252(39.5%) had informal education. Three hundred thirty one participants (51.9%) were living in prison for duration of 25 -60 months. (Table1).

**Table 1:** Socio demographic characteristics of prisoner in north Shoa prison, Ethiopia, 2020. (n= 638)

Variables	Frequency	Present (%)
Sex	Male	588
	Female	50
Age	<25 Years	152
	26-36	204
	37-47	153
	48-60	129
Religion	Orthodox	440
	Muslim	108
	Protestant	73
	Others	17
Marital status	Single	199
	Married	282
	Divorced	121
	Windowed	36
Educational status	Unable to read and write	126
	Can read and write	252
	Primary education	157
	Secondary education	79
	College level and above	24
Duration of jail	6 months -12 months	48
	13 months -24 months	102
	25 months -60 months	331
	$\geq$ 61 months	157

## 5.2 Behavioural and feeding characteristics of prisoners

Out of the total respondents, 66 (10.3%) were cigarette smoker before jail, 150(23.5%) had history of chewing Khat, 282(44.2%) were alcohol users. Majority of respondents 463(72.6%) had poor social support and 536(84%) didn't get additional diet. Most of the respondents 453(71.0%) ate three times per day. The average individual diet diversity score of study participants was  $2.83 \pm 1.24$  SD (Table 2).

**Table 2:** Behavioural and feeding characteristics of prison inmates in North Shoa prison, Ethiopia, 2020 (n=638)

Variables	Characteristics	Frequency	Present (%)
Smoking status before jail	No	572	89.7
	Yes	66	10.3
Chewing Khat before jail	No	488	76.5
	Yes	150	23.5
Alcohol use before jail	No	356	55.8
	Yes	282	44.2
Social support	Poor social support	463	72.6
	Moderate social support	121	19.0
	Strong social support	54	8.5
Previous jail history	No	500	78.4
	Yes	138	21.6
Provide additional diet	Yes	102	16.0
	No	536	84.0
Frequency of fruit	Three times or more/week	35	5.5
	Two times/week	52	8.2
	One times/week	67	10.5
	Nothing/week	484	75.9
Frequency of Milk & milk products	One or more times/week	34	5.3
	Nothing/week	604	94.7
Frequency of Meat	Three times or more/week	45	7.1
	Two times/week	59	9.2
	One times/week	58	9.1
	Nothing/week	476	74.6
Feeding pattern per day	Once	9	1.4
	Twice	128	20.1
	Three times	453	71.0
	Four times or more	48	7.5
Number of food items used in the last 24 hours	≤ 3 food items	519	81.3
	4-5 food items	92	14.4
	≥ 6 food items	27	4.2

### 5.3 Institutional conditions

From the respondents 259(40.6%) were murderers, but less than half of the respondents did not get sufficient food 240(37.6%) and one hundred two of respondent 16.0% were gets scarcity of water (Table 3).

**Table 3:** Institutional conditions among the respondents in North Shoa prison, Ethiopia, 2020 (n=638)

Variable	Characteristics	Frequency	Precent
Type of crime	Murder	259	40.6
	Theft	162	25.4
	Physical harm	138	21.6
	Political issue	79	12.4
Food shortage	Yes	240	37.6
	No	398	62.4
Scarcity of water	Yes	102	16.0
	No	536	84.0

#### 5.4. Medical factors and related characteristics

Most of the respondents 247(38.7%) of a major problem in daily life were frequently ill, According to the responses of the study groups majority of the respondents one hundred thirty nine (21.8%) were Severely depressed based on PHQ-9, 119 (18.7%) have minor depression disorder but greater than half of the respondents had Anaemia 67.1% (Table)

**Table 4:** Medical factors and related characteristics among the respondents in North Shoa prison, Ethiopia, 2020 (n=638)

Variable	characteristic	Frequency	Present
Self report illness	Yes	187	29.3
	No	451	70.7
Major problems in daily life	Frequent ill	247	38.7
	Little food	114	17.9
	Poor or inadequate water supply	156	24.5
	None	121	19.0
HIV Sero-status	HIV Positive	19	3.0
	HIV Negative	619	97.0
Haemoglobin	Anaemic	428	67.1
	Non anaemic	210	32.9
Depression	Minimal depression	119	18.7
	Mild depression	125	19.6
	Moderate depression	126	19.7
	Moderately severe depression	129	20.2
Digestion problems	Severe depression	139	21.8
	Yes	78	12.2
	No	560	87.8

### 5. 5 Prevalence of nutritional status

The mean body mass index of the participants were 21.135kg/m<sup>2</sup> with (SD=±2.795). Among the total participants 123(19.3%) were under nourished (BMI <18.5kg/m<sup>2</sup>)

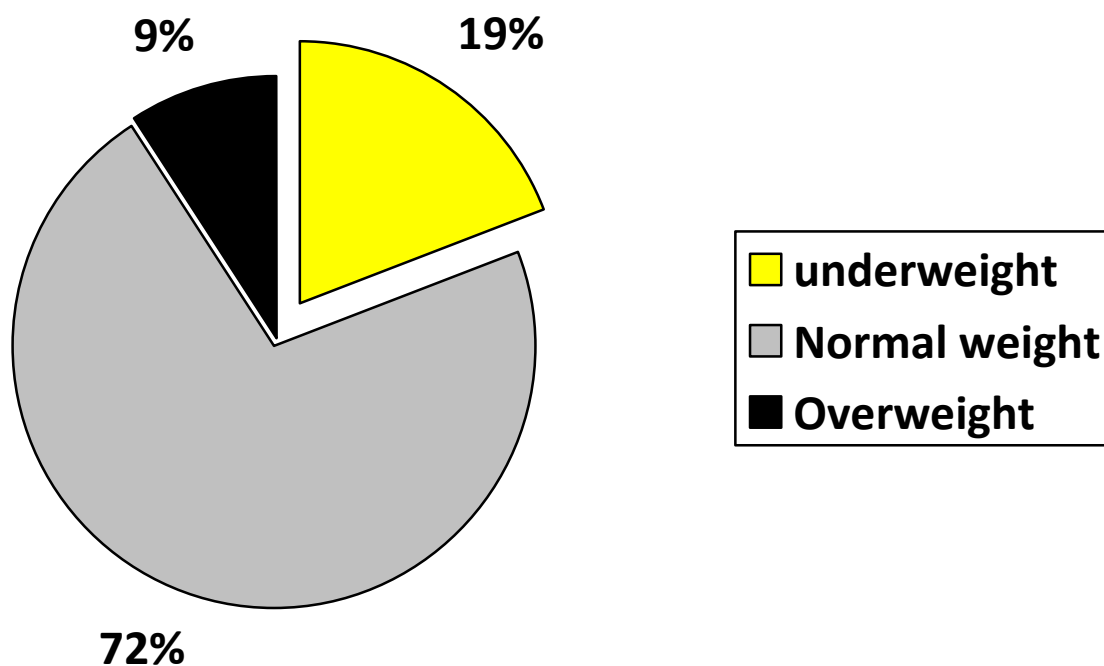


Figure 3 Prevalence of under nutrition among prisoner in north Shoa, central Ethiopia 2020

## **5.6 Factors associated with under nutrition among prison inmates in north Shoa**

The result of bivariate analysis showed that there was significant association between marital status, educational status, HIV Sero status, smoking, any illness in the past 15 days, and major problems in daily life, depression, social support, meal frequency, meat eating per week, frequency of milk and haemoglobin. But after controlling for possible confounders the result of multivariate analysis reveal that haemoglobin, marital status, frequency of food intake like milk, and milk product and Social Support, were significantly associated with under nutrition.

In this study, the age group  $\geq 50$  were five times more likely to develop malnutrition (AOR 5.28[95 % CI 2.086-13.366]) than age group 18-29, respondents who had anaemia were 3 times more likely to develop malnutrition (AOR 3.04 [95 % CI 1.67-5.54]) than who had no anaemia, participants who had depression were 5 times more likely to develop malnutrition (AOR 5.04 [95 % CI (2.59-9.83)]) than who had no depression. Divorced participants were 48% times less likely to develop malnutrition (AOR 0.52 [95 % CI 0.007, 0.369]) than windowed ones. Educational status unable to read and write was eight times more likely to be malnourished with AOR 8.466(1.548-46.295) than college and above educational status.

Prisoners who were reached poor social support had two times more likely to develop malnutrition AOR = 2.83 [95% CI = (1.10-7.29)] than compared to those prisoners who were getting strong social support, participants who were HIV sero positive were 10 times more likely to be malnourished with AOR 10.493 [95% CI (2.516-43.757)] than HIV sero negative. Prisoners who didn't get milk and milk product were 3 times more likely to develop under nutrition compared with prisoners who gets milk and milk product (AOR=3.860 [95 % CI (1.12-13.23)]), and respondents who didn't eat meat eating per week were 19 times more likely to develop malnutrition (AOR 19.03 [95 % CI (6.842-52.975)]) than who gets three times or more.(Table 5)

Table 5: Bivariate and Multivariate analysis of factors associated with under nutrition among prison in north Shoa, Amhara region, Ethiopia, 2020, (n=638).

Variables	Categories	Undernutrition		COR(95%CI)	AOR(95%CI)
		Yes	No		
Age	18-29	35	117	1	1
	30-39	27	177	0.782(0.450-1.359)	1.284(0.560-2.945)
	40-49	29	124	1.103(0.636-1.911)	3.014(1.182-7.688)**
	>50	32	97	0.510(.293-.887)	5.280(2.086-13.366)**
Marital status	Single	58	141	2.194(.871-5.527)	0.593(0.106-3.310)
	Married	33	249	0.707(.275-1.818)	0.721(0.141-3.700)
	Divorced	26	93	1.491(.563-3.95)	0.052(0.007-0.369)**
	Windowed	6	32	1	1
Educational status	Unable to read and write	15	111	0.405(0.139-1.182)	8.466(1.548-26.295)**
	Can read and write	46	206	0.670(0.252-1.781)	2.179(0.538-8.820)
	Primary education	51	106	1.443(0.540-3.855)	0.979(0.213-4.485)
	Secondary education	5	74	0.203(.056-.739)	1.24(0.97-8.6748)
Type of crime	College level& above	6	18	1	1
	Murder	47	212	0.873(0.463-1.644)	.696(0.257-1.885)
	Theft	47	115	1.609(0.844-3.068)	1.373(0.555-3.394)
	Physical harm	13	125	0.410(0.185-0.904)	0.214(0.067-0.683)
Depression	Political issue	16	63	1	1
	No	26	65	1	1
Social Support	Yes	97	450	0.539(0.325-0.893)	5.04(2.59-9.83)**
	Poor social support	60	403	0.437(0.229-0.833)	2.83(1.10-7.29) **
	Moderate social support	48	68	2.071(1.036-4.140)	1.251(0.469-3.339)
Hemoglobin	Strong social support	15	44	1	1
	Non anaemic	52	158	1	1
Sero-status	Anaemic	71	357	0.604(0.404-.905)	3.04(1.67-5.54) **
	HIV negative	109	510	1	1
Meat Eating per Week	HIV positive	14	5	13.101(4.622-37.134)	10.493(2.52- 43.757)**
	Three times or more	25	20	1	1
	Two times	20	39	0.410(0.185-0.911)	6.913(2.054-23.263)**
	One times	14	44	0.255(0.110-0.590)	9.423(2.759-32.191)**
Frequency of Milk/week	Nothing	64	412	0.124(0.065-0.237)	19.038(6.842-52.975)**
	One or more times	22	12	1	1
	Nothing/week	101	503	0.110(0.053-0.228)	3.860(1.12-13.23)**

NB \*\*= P-value <0.05

## 6. Discussion

This study revealed the overall prevalence of under nutrition among prisoners to be 19.3%. 95% CI (16.5-22.4) The result is lined with study carried out in Nigeria 21%(33). Lower than other reports conducted in Pakistan(39.7%) (28), and Tigray region of Ethiopia from nine major prison setups the prevalence of underweight was 25.2%(11). However, it was higher than the studies done in New Guinea (5%)(10). And about 6.6% of the inmates were underweight in Tanzania prisons (2). The discrepancy of malnutrition status might be due to the existence of different socioeconomic factors of the study areas, methodology what they used, partly due to the country's limited resources and feeding habits of the prisoners. Age, marital status, educational status, social support, hemoglobin, smoking status, meat eats per week, getting milk per week and depression has significant association with undernutrition.

Results of this study revealed that participant's age group  $\geq 50$  were five times more likely to develop malnutrition (AOR 5.280 [95 % CI (2.086-13.366)]) than age group 18-29. Previous study done in kality (34) is in line with this result. This might be due to older adults were prone to age related diseases, basal metabolic rate decline with age, an older person's energy requirement per kilogram of body weight is also reduced, functional impairment and physical inability that may interfere with the maintenance of a good nutritional status.

In this study, one of the determinant factors for prisoner malnutrition was lower level of hemoglobin in their blood. Prisoners who had anemia were 3 times more likely to develop malnutrition than normal prisoners (AOR = 3.04; 95% CI: 1.67-5.54). Most of the respondents (67.1% n=428) were anaemic, with Hgb <13.5 g/dl for males and <12.5 g/dl for females. Only 32.9% of the respondents had normal iron status (Hgb 13.5 -18 g/dl for males and 12.5-16g/dl for females). This finding is in accordance with the results of former studies conducted similar reports were documented in a studies conducted in Tigray and Tanzania(2, 11). This might be due to a lack of eating more iron-rich foods such as animal products, green leafy vegetables, fruits, taking iron supplements, de-worming, sleeping under insecticide treated nets and by clearing around prison room, and the association of anemia with malnutrition might be due to alterations in bone marrow (aplastic anaemia) as a result of protein-energy malnutrition. Haemopoietic tissue has a high rate of regeneration, and cellular proliferation presents a high demand for protein for the process of haemopoiesis.

Prisoners who gets poor social support had two times more likely to develop malnutrition AOR = 2.83 [95% CI = (1.10-7.29)] than compared to those prisoners who were getting

strong social support. A Study done in Kality prison prisoner had source of support were 97% times less likely to develop malnutrition than who had no source of support (34). This could be due to people who are socially isolated and that cannot attain nutritious foods due to low income and no nutritional social support are most associated with inadequate diet and disease that leads to malnutrition.

Divorced participants were 48% times less likely to develop malnutrition (AOR 0.52 [95 % CI 0.007, 0.369]) than windowed ones. This result was in line with a study done in New Guinea, Kenya and Pakistan (10, 28, 32) This may be due to the fact that having additional food from relatives might increase chance for improved dietary diversification and meal frequency in addition to what is served in the prison which may create opportunity to insure energy and micronutrient adequacy.

In this study, prisoners whose educational status were unable to read and write was eight times more likely to be malnourished with AOR 8.466(1.548-26.295) than college level educational status. This result was an agreement with the finding of other study in Pakistan(28). This indicates that unable to read and write educational status negatively affects nutritional status and it may be educated prisoner can easily read and understand information regarding to malnutrition.

Participants who were HIV sero positive were 10 times more likely to be malnourished than HIV sero negative. This might be due to their weakened immune systems further increase their vulnerability to opportunistic infections. Symptoms that accompany infections such as loss of appetite, diarrhea and fever lead to further reduced food intake, poor nutrition absorption, nutrient loss and altered metabolism; all of these contribute to malnutrition which in turn further weaken the immune system.

Prisoners who didn't get milk and milk product were 3 times more likely to develop under nutrition compared with prisoners who did gets milk and milk product (AOR=3.860 [95 % CI: 1.12-13.23]. it is in lined with study done in New Guinea. This may be due to individual who use animal product like milk can improve food diversification and prevent protein energy deficiency.

Eating meat was another significantly associated variable with malnutrition among prisoners. Those who didn't gets meat eating per week were 19 times more likely to develop malnutrition (AOR 19.03 [95 % CI (6.842-52.975)]) than who gets three times or more, this finding is in accordance with the results of former studies conducted in Gondar(7). This

might be due to the fact that prisoner who didn't get eat meat increase chance for improved malnutrition. However dietary diversification and meat meal frequency in addition to what is served in the prison which may create opportunity to insure energy and micronutrient adequacy.

In this study, prisoners who had depression were 5 times more likely to develop malnutrition than who hadn't depression. This variable was not assessed by another similar research before among prisoners; while the variable was essential for measure mental disorder. This finding may be explained by the fact that most of the inmates in this study were of low socioeconomic status and may not have the opportunity to access additional diet, feeling tired or having little energy and poor appetite or overeating were found to have an impact on the prevalence of undernutrition.

## **7. Limitation and strength of the study**

### **7.1 Strength**

Strength of this study was that the tool used to assess BMI, depression, social support and Anaemia were standardized and internationally recognized screening tools.

### **7.2 Limitation**

This investigation represents the prevalence of under nutrition among prisoners but the result could not describe whether the loss of weight was actually occurred in the prison because there was no documented anthropometric characteristics at time of incarceration and the time of data collection was fasting period for dietary assessment.

The other limitation of this study was using a cross-sectional study design; that did not allow establishing a temporal relationship between nutritional status and associated factors. The study was institution based which could limit its generalizability to normal population and clinical setting.

## **8. Conclusion and recommendation**

### **8.1 Conclusion**

This study revealed that the prevalence of malnutrition among prisoners in north Shoa zone was high. Anaemia, age, HIV sero status, social support, depression and lack of additional diet were the most significant factors affecting undernutrition.

Older prisoners were more affected than younger with the maintenance of a good nutritional status. Prisoners who had strong social support were less likely to have Undernutrition while those who had depression were more likely to have malnutrition, individual who use animal product like milk and meat can improve food diversification and prevent protein energy deficiency: However this study was able to demonstrate that Anaemia and HIV sero-positivity were also associated with higher risk of underweight.

### **8.2 Recommendation**

Base on the major finding the following recommendations are forwarded.

1. Governmental and nongovernmental organizations (NGOs) come together to integrate full nutritional interventions to address undernutrition and reform the environmental health conditions to address underweight and promote overall health status of prisoners.
2. To North Shoa prison administrative office
  - Take an action on nutritional intervention especially for food diversity, food quality and improve the health status of the inmates specifically for prisoner who hadn't social support and older age.
  - The results of this study indicated that depression as one of the factors which affect the nutritional status of prisoner. Thus, initiating mental health service program in the prison is paramount importance.
  - Regular check-up of haemoglobin concentration among prisoner in general and those taking additional diet in particular is recommended

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## **ANNEX I:English Interviewer administer questionnaire**

Good morning/Good afternoon. My name is \_\_\_\_\_. This questioner is developed to gather information on assessment of nutritional status and its influencing factors among prisoners. The information collect will be informed the prisoner's nutritional status and its related problems. The interview takes 15-30 minutes.

All of the answers you give will be confidential and will not be shared with anyone. You have the right to refuse participation in this study, but I hope you will agree to answer the questions since your views are important. Your name will not be recorded on the questionnaire. The questionnaire will be kept in a locked cabinet for safe keeping at Debre Berhan University. Everything will be kept private.

If I ask you any question you don't want to answer, just let me know and we will go on to the next question or you can stop the interview at any time without any consequences.

Questionnaire code: - \_\_\_\_\_

Do you have any question? \_\_\_\_\_

### Socio demographic characteristics

<b>Section A.</b> Background information Socio-demographic characteristics of study participants			
S.No	Question	Answer	
101	Name of Prison	_____	
102	How old are you?	_____	
103	Sex	1. Male 2. Female	
104	What is your religion?	1. Orthodox 2. Muslim 3. Protestant 4. Others	
105	What is your marital status?	1. Single 2. Married 3. Divorced 4. Widowed	
106	What is your educational status?	1.unable to read and write 2. Informal education 3.Primary education 4.Secondary education 5.College level and above	
107	Duration of jail	1. _____ year 2. _____ month	

### 2. Institutional factor

S.No,	Question	Answer	Skip
<b>201</b>	Type of crime	1. Murder 2. Theft 3. Physical harm 4. Other	
<b>202</b>	Are there times when water is scarce?	1. Yes 2. No	
<b>203</b>	Where does the prison get water?	1. Public water supply 2. wells/springs 3. river/canals	
<b>204</b>	Are there food shortage times in prison?	1. Yes 2. No	
<b>205</b>	How many times do you eat per day?	1. _____	

### 3. Behavioural and Personal related characteristics

S.No,	Question	Answer	Skip
<b>301</b>	Social support		
	How many people are so close to you that you can count on them if you have serious problems?	1. none 2. one or two 3. three to five 4. six or more	
	How much concern do	1. A lot of concern	

	people show in what you are doing?	and interest 2. Some concern and interest 3. Uncertain 4. Little concern and interest 5. No concern and interest	
	How easy can you get practical help from friends if you should need it?	1. Very easy 2. Easy 3. Possible 4. Difficult 5. Very difficult	
Total			
<b>302</b>	Do you Smoke cigarettes before jail	1. No 2. Yes	
<b>303</b>	Do you Chewing khat before jail?	1. No 2. Yes	
<b>304</b>	Do you drank alcohol before jail	1. No 2. Yes	
<b>305</b>	Previous jail history	1. No 2. Yes	
<b>306</b>	Are you provided with special diet?	1. Yes 2. No	If No skip
<b>307</b>	Mention the special diet you are given?	1. _____ 2. _____ 3. _____	

		4. _____	
<b>308</b>	How frequently do you use fruit like orange papaya mango banana/week?	<ol style="list-style-type: none"> <li>1. Three times or more /week</li> <li>2. Two times/week</li> <li>3. One times/week</li> <li>4. Nothing/week</li> </ol>	
<b>309</b>	How frequently do you use milk and milk product/week	<ol style="list-style-type: none"> <li>1. One or more times/week</li> <li>2. Nothing/week</li> </ol>	
<b>310</b>	How frequently do you use meat or meat product/week?	<ol style="list-style-type: none"> <li>1. Three times or more/week</li> <li>2. Two times/week</li> <li>3. One times/week</li> <li>4. Nothing/week</li> </ol>	
<b>311</b>	Number of food items using in the last 24 hours	<ol style="list-style-type: none"> <li>1. <math>\leq 3</math> food items</li> <li>2. 4-5 food items</li> <li>3. <math>\geq 6</math> food items</li> </ol>	

#### 4. Medical factors

S.No,	Question	Answer	Skip
401	Sero-status	1. HIV Positive 2. HIV Negative	
402	Do you get any illness in the past 15 days?	1. Yes 2. No	
403	Do you have digestive problem	1. Yes 2. No	
405	Major problems in daily life	1. frequently ill 2. food shortage 3. Poor or inadequate water supply none 4. None	
406	Which one of the following foods did you ate in the last 24 hours (during day and night)	1. _____cereals(bread , Enjera. Biscuits, any foods made from maize sorghum, rice or wheat 2. _____Vegetable (sweet potatoes, green paper, Tomatoes, Cabbage etc) 3. _____Fruits;- orange papaya, Mango, banana etc) 4. _____Organ meat(Kidney ,liver, heart etc) 5. _____Eggs 6. _____Fish	

		<p>7. _____Flesh meat (Beef, lamb, Goat, Chicken)</p> <p>8. _____Legumes, nuts, and seeds(bean, peas, nuts)</p> <p>9. _____Milk and milk products (milk, cheese, yoghurt, and other milk products</p> <p>10. _____Oils and fats (oil, butter, fats or added to cooked foods</p> <p>11. _____Sweets(Sug, honey, Sweetened soda, chocolates, candies</p> <p>12. _____Spices (beverages, tea, coffee etc)</p>	
<b>407</b>	Haemoglobin concentration	1. _____ mg/dl	

<b>Over the last 2 weeks, how often have you been bothered by any of the following problems? (Use "x" to indicate your answer)</b>					
S. no,		Not at all	Sever al	More than	Nearl y every
	Little interest or pleasure in doing things	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>

<b>407 Depression</b>	Feeling down, depressed, or hopeless	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
	Trouble falling or staying asleep, or sleeping too much	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
	Feeling tired or having little energy	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
	Poor appetite or overeating	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
	Feeling bad about yourself or that you are a failure or have let yourself or your family down	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
	Trouble concentrating on things, such as reading the newspaper or watching television	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
	Moving or speaking so slowly that other people could have noticed. Or the opposite being so figety or restless that you have been moving around a lot more than usual	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
	Thoughts that you would be better off dead, or ofhurting yourself	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
Sum of total		<b>0</b>			
Sum of total /27					

<b>Anthropometric measurements</b>			
S.No,	Question	Answer	
	Weight (kg)	_____	
	Height (meter)	_____	

**ANNEX II: Amharic Interviewer administer questionnaire**

**ቃለ መጠይቅ**

እንደምን አደሩ/ እንደምን ዋሉ። ስሜ አቶ/ወ/ሮ/ወ/ሪት----- እባላላሁ።

ይህ ቃለ መጠይቅ የተዘጋጀው በ ሰሜን ሸዋ ዞን የሚኖሩ ታራሚዎች በስነ- ምግብ እና ተዛማች ጉዳዮችን በተመለከተ መረጃ ለመሰብሰብ ነው። የጥናቱ ውጤት በታራሚዎች ስነ- ምግብ እና የተያያዙ ችግሮች በተመለከተ ግንዛቤ ለመፍጠር እና መንግስት ተስማሚና ምቹ በሆነ መልኩ አገልግሎት መስጠት እንዲችል ይረዳል። አሁን ምናደርገው ቃለ ምልልስ 15 እስከ 30 ደቂቃ ይወስዳል።

እርስዎ የሚሰጡት ማንኛውም መረጃ በሚስጥር የሚያዝ ሲሆን መረጃዎ ስምዎን በማይገልጽ ሁኔታ ተቀብሎ ጥቅም ላይ ይውላል። ከጥናቱ አባላት በስተቀር ማንም ሰስተኛ ወገን የእርስዎን መረጃ ማግኘት አይችልም። በዚህ ጥናት ያለመሳተፍ ወይም በማንኛውም ግዜ ተሳትፎዎን የማቁዋረጥ ሙሉ መብት አለዎት። ሆኖም ግን ከእርስዎ የምናገኘው መረጃ ለጥናቱ በጣም ጠቃሚ ስለሆነ በጥናቱ እንዲሳተፍና መረጃዎን እንዲሰጡን እናበረታተለን። መመለስ የማይፈልጉትን ማንኛውንም ጥያቄ ከጠየኩዎት ይንገሩኝ እና ወደ ቀጣዩ ጥያቄ እንሸጋገራለን ወይም በፈለጉት ሰዓት ቃለ ምልልሱን ማቆም ይችላሉ። ይህን ሲያደርጉ ግን አሁንም ሆነ ወደፊት ከዚህም ሆነ ከየትኛውም ተቋም በሚያገኙት አገልግሎት ላይ ተጽእኖ ይኖረዋል ብለው አይስጉ። ጥናቱን በተመለከተ ማንኛውም ጥያቄ ካለዎት አሁን ሊጠይቁኝ ይችላሉ።

- ጥያቄ አለዎት?

የተጠያቂ ቃል

የኔን በዚህ ጥናት መሳተፍ በተመለከተ ከላይ የቀረበልኝ መረጃ ግልጽ ሆኖልኛል። የጥናቱ አላማ በምረዳው ቋንቋ ተገልጿል። ከዚህም በተጨማሪ ጥያቄ እንድጠይቅ አጋጣሚ የተሰጠኝ ከመሆኑም በላይ ጥያቄዎቼ በተገቢው መንገድ መልስ አገኝተዋል። የኔ በዚህ ጥናት መሳተፍ ሙሉ በሙሉ በፈቃደኝነት ላይ የተመሰረተ ነው። እኔ የምሰጠው መረጃ በሚስጥር እንደሚያዝና በፈለኩት ሰዓት ቃለ ምልልሱን ማቆም እንደምችል ገብቶኛል። የኔ በዚህ ጥናት

መሳተፍም ሆነ አለመሳተፍ ከዚህም ሆነ ከሌላ ተቋም በማገኘው አገልግሎት ላይ ምንም ተጽዕኖ እንደማይነኛረው ተገንዝቤለሁ።

የመለያ ቁጥር.....

1. ግለ ታሪክን በተመለከተ			
ተ.ቁ	ጥያቄ	መልስ	ምርመራ
101	የማረጋገጫ ቤቱ ስም	_____	
102	እድሜ	_____	
103	ጾታ	1. ወንድ 2. ሴት	
104	ሐይማኖት	1. ኦርቶዶክስ 2. ሙስሊም 3. ፕሮቴስታንት 4. ሌላ	
105	የትዳር ሁኔታ	1. ያላገባ 2. ያገባ 3. የፈታ 4. በሞት የሙ	
106	የትምህርት ደረጃ	1. ኢ -መደበኛ ትምህርት 2. የመጀመሪያ ደረጃ ት/ት 3. ሁለተኛ ደረጃ ት/ት 4. ኮሌጅ 5. ሌላ	
107	የቆይታ ግዜ	1. _____	

2. ከተቋሙ ጋር የተያያዘ ጥያቄ

ተ.ቁ	ጥያቄ	መልስ	
201	የወንጀል አይነት	3. ግድያ 4. ስርቆሽ 5. የአካል ጉዳት ጥቃት 6. ሌላ	
202	ማረሚያ ቤቱ ውሃ ከየት ያገኛል?	1. ከማህበረሰቡ ውሃ የተጠለፈ 2. ከምንጭ 3. ከወንዝ/ከግድብ 4. ከሌላ	
203	የውሃ ችግር የገጠማቹ ግዜ ነበር?	1. አዎ 2. የለም	
204	የምግብ እጥረት በማረሚያ ቤቱ ገጥሞ ያቃል?	1. አዎ 2. የለም	
205	ለምን ያክል ግዜ በቀን ትመገባላች?	1. _____	

3. መሐበራዊ ርዳታን በተመለከተ እና የተለያዩ ምግብ አይነቶችና ድግግሞ

ተ.ቁ	ጥያቄ	መልስ	
301 መሐበራዊ ርዳታን በተመለከተ	ለእርሶ ቅርብ ከሆኑ ሰዎች መካከል ምን ያህሉ ችግር ቢያጋጥምዎ ይደርሱልኛል ብለው ያስባሉ	1. ምንም 2. 1-2 3. 3-5	

		4. 6 እና ከዚያ በላይ	
	እርስዎ በሚያረጉት ድርጊት ሰዎች ምን ያህል ያስብልዎታል	1. ብዙ ያሰቡልኛል 2. በመጠኑ ያስቡልኛል 3. እርግጠኛ መሆን አልቻልኩም 4. በትንሹ ያስቡልኛል 5. ማንም ሰው አያስብልኝም	
	ችግር አጋጥሞዎት እርዳታ ቢያስፈልግዎት ከጓደኛዎ በምን ያህል ፍጥነት ሊያገኙ ይችላሉ	1. በጣም በቀላሉ 2. ላገኝ የምችል ይመስለኛል 3. ከባድነዉ 4. በጣም ከባድ ነዉ	
<b>ድምር</b>			
302	የትምህርት ተጠቃሚ ኖት	1. አይደለሁም 2. አዎ	
303	ጫት ይጠቀማሉ ነበር	1. አይደለም 2. አዎ	
304	እዚህ ከመምጣቶ በፊት አልኮል ይጠቀሙ ነበር	1. አይደለም 2. አዎ	
305	ከዚህ በፊት ታስረዉ ያዉቃሉ	1. አላቅም 2. አዎ	
306	ለየት ያለ እስቴሻል ምግብ ትመገባላቸው?	1. አዎ 2. የለም	
307	ለየት ያለዉን እስቴሻል	1. _____	

	ምግብ ዘርዘር/ ዘርዘሪ?	2. _____ 3. _____ 4. _____	
307	በሰምንት ምንደህል ግዜ ፍራፍሬ ተምገባለህ ? (ማለትም ሙዝ፣ ብርቱካን ፓፓያ ወዘተ...)	1. በሰምንት አንድ ግዜ 2. በሰምንት ሁለት ግዜ 3. በሰምንት ከሁለት ግዜ በላይ 4. አልመገብም	
308	በሰምንት ምንደህል ግዜ ወተትና የወተት ተዋዕዖ ተምገባለህ ?	1. በሰምንት አንድ ግዜ 2. በሰምንት ሁለት ግዜ 3. በሰምንት ከሁለት ግዜ በላይ 4. አልመገብም	
309	በሰምንት ምንደህል ግዜ ሲጋ አናዩስ ጋ ተዋዖ ትምገባለህ ?	1. በሰምንት አንድ ግዜ 2. በሰምንት ሁለት ግዜ 3. በሰምንት ከሁለት ግዜ በላይ 4. አልመገብም	
310	በ24 ሰዓት የተመገቡት የምግብ አይነት	4. $\leq 3$ 5. 4-5 6. $\geq 6$	

5. የመጨረሻ(ድጥፊሽ) ፤ የባህሪና የህክምና ሁኔታ

ተ.ቁ	ጥያቄ	መልስ	
401	የደም እክል ሁኔታ	1. የኤች አይ ቪ ተጠቂ 2. ከኤች አይ ቪ ነፃ	
402	ያጋጠሞት የጤና እክል በ 15 ቀናት ውስጥ? ዘርዘሩት	1. _____ 2. _____ 3. _____ 4. _____	

403	በእርሶ እለት ተእለት ኑሮ የሚያጋጥሞ ችግር?	<ol style="list-style-type: none"> <li>1. በተደጋጋሚ መታመም</li> <li>2. የምግብ እጥረት</li> <li>3. በቂ ያልሆነ የዉሃ እጥረት</li> </ol>	
404	ምግብ የመለም /የመፈጨት ችግር አለቦዎ?	<ol style="list-style-type: none"> <li>1. አዎ</li> <li>2. የለም</li> </ol>	
405	መልሶዎ አዎ ከሆነ ችግሮዎን ያብራሩ...	<ol style="list-style-type: none"> <li>1. _____</li> <li>2. _____</li> <li>3. _____</li> <li>4. _____</li> <li>5. _____</li> <li>6. _____</li> </ol>	
406	የትኛዉን የምግብ አይነት በ24 ሰዓት ዉስጥ ተመግቦ (ቀን እና ለሊትን ያጠቃልላል)	<ol style="list-style-type: none"> <li>1. _____ ከብዕርና አገዳ እህል (ዳቦ: እንጀራ፣ ብስኩት፣ ሌሎች ከማሽላ ከስንዴ ከሩዝ ከበቆሎ)</li> <li>2. _____ አትክልት (ስኳር ድንች, ጎሙን, ቲማቲም, ወ.ዘ.ተ)</li> <li>3. _____ አትክልት (ብርቱካን: ፓፓዬ፣ ማንጎ፣ ሙዝ...)</li> <li>4. የስጋ ብልቶች (ጉቦት ፣ ኩላሊት፣ ልብ)</li> <li>5. _____ እንቁላል</li> <li>6. _____ አሳ</li> <li>7. _____ ሙዳ (ትኩስ)</li> </ol>	

		<p>ስጋ</p> <p>(የበሬ ስጋ:የፍየል ስጋ:የበግ ስጋ: ችክን)</p> <p>8. _____ ባቄላ መሰል ጥራጥሬ (አቸሎኒ: ባቄላ: አተር ወ.ዘ.ተ)</p> <p>9. _____ የወተት ተዋጽዖ (ወተት፤እርጎ፤ አይብ ወ.ዘ.ተ)</p> <p>10. _____ ቅባት ነክ ምግቦች (ዘይት ለማብሰያ የምንጠቀማቸው ቅባቶች)</p> <p>11. _____ ጣፋጭ ምግቦች (ስኳር፤ማር፤ቸኮሌት፤)</p> <p>12. _____ ቅመም ነክ (መጠጦች፤ቡና፤ ሻይ...ወ.ዘ.ተ)</p>	
407	የደም ይዘት ልኬታ በ ግራም/ዴሲ ሊትር Hgb level (g/dl)	1. _____	

**407 : -ከሚከተሉት ውስጥ ከሁለት ሳምንታት በላይ በተደጋጋሚ የተጨነቁበት ካለ ምን የህል አስጨንቅዎታል? ("x" ይህን ምልክት ይጠቀሙ)**

ተ.ቁ		በጭራ ሽ (0)	ጥቂት ቀናት (1)	ለብዙቀ ናት (2)	በየቀኑ (3)
የመጫጫን (ድጥፊሽን)	ከሚሠሩ ስራ የሚያገኙት ደስታ አንሶ ወይም ቀንሶ ነበር	0	1	2	3
	የመደበኛ ወይም ተስፋ ማጣት እና፣ መጨነቅ	0	1	2	3
	የእንቅፍ ማጣት ወይም ከበቂ በላይ ማንቀላፋት ይታይበታል	0	1	2	3
	የድካም ስሜት ወይም የአቅም ማነስ	0	1	2	3
	የምግብ ፍላጎት መቀነስ ወይም መጨመር	0	1	2	3
	ስለ እራሳዎ መጥፎ ስሜት ይሰሞዎታል ወይም ለራሳዎ እና ለቤተሰቦዎ የሚሰጡት ግምት ዝቅተኛ ነዉ	0	1	2	3
	ለነገሮች ትኩረት የሰጣሉ ለምሳሌ ጋዜጣ ለማንበብ ፣ ቴሌቭዥን ለማየት	0	1	2	3
	በእንቅስቃሴዎ ወይም በንግግሮዎ ለዘብተኝነት ሰዎች ይተችዎታሉ	0	1	2	3

	ወይም በተቃራኒው ሳያቋርጡ በማዉራቶዎ እና በመንቀሳቀሶዎ				
	እራስን መጉዳት ወይም ሞት ይሻላል ብለው ያሳሰቡትግዜ ነበር	0	1	2	3
ድምር		0			
ጠቅላላ ድምር					

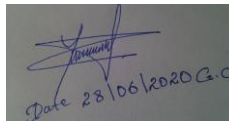
6. የተክለ ሰውነት ይዘት ጥያቄ			
ተ.ቁ	ጥያቄ	መልስ	
501	ክብደት(ኪ.ግ)	_____	
502	ቁመት	_____	

**ANNEX III: Declaration Sheet Format**

I the undersigned on behalf of all investigation, declare that this is our original work and has never been presented in this or any other University and that all source of materials used for the thesis and individual contributed for it have been fully acknowledged.

**Name of investigator: -**

Yohannes Yilma



July **07/2020 G.C**

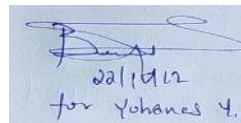
Principal Investigator Name

Signature

**Date**

After I make essential revisions and correction, I assured that this Thesis is technically and methodologically legible for ethical review and submitted with my approval as an advisor:

**Name: - Behailu Tariku**



**July 07 /2012 E.C**

Principal Advisor Name

Signature

Date