UNDERNUTRITION AND ASSOCIATED FACTORS AMONG ELDERLY POPULATION IN HARAMAYA DISTRICT, OROMIA REGION, EASTERN ETHIOPIA

MPH THESIS

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BIOGRAPHICAL SKETCH

The author was born in 1992 in Sebeta, Oromia Regional State, Ethiopia. I completed my Elementary School in Debel yohannes and Tefki Elementary School. I attended my Secondary and Preparatory school in Sebeta secondary and comprehensive school. After completion of Preparatory School, I joined Madda Walabu University in 2010. At Madda Walabu University I studied Public Health Officer and got my BSc degree in Public Health Officer in June 2013. After graduation I was employed in Oromia regional state on November 9, 2013 and served in Ameya woreda of southwest Shoa until I enjoyed Shashemene Health Science College then to Madda Walabu University in 2017 and left for my graduate study.

In September 2019, I joined Haramaya University Post Graduate Program Directorate as Ministry of Education sponsored student pursues my study in Master of Public Health Nutrition.

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ACRONYMS AND ABBREVIATIONS

6CIT	Six-Item Cognitive Impairment Test
AOR	Adjusted Odds Ratio
BMI	Body Mass Index
BSc	Bachelor Science
CC	Calf Circumference
CI	Confidence Interval
CM	Centimeter
COR	Crude Odds Ratio
ESPEN	European Society for Clinical Nutrition and Metabolism
ETB	Ethiopian Birr
FCS	Food Consumption Score
FMOH	Federal Ministry of Health
GDS	Geriatric Depression Scale
GDS-SF	Geriatric Depression Scale Short Form
HC	Health Center
HHFS	Household Food Security
IHRERC	Institutional Health Research Ethics Review Committee
L	Liter
MNA-SF	Mini Nutrition Assessment Short Form
MUAC	Mid-Upper Arm Circumference
NNP	National Nutritional Program
NRR	Non Response Rate
OPD	Outpatient Department
OR	Odds Ratio
ORHB	Oromia Regional Health Bureau
PV	P-value
PI	Principal Investigation
PPS	Probability Proportion to Size
PR	Prevalence Rate

PUD	Peptic Ulcer Disease
SPSS	Statistical Package for Social Science
SRS	Simple Random Sampling
UN	United Nations
UNICEF	United Nations International Children's Emergency Fund
VIF	Variance Inflation Factors
WFP	World Food Program
WHO	World Health Organization

ABSTRACT

Background: Undernutrition among elderly people is one of the common public health problems causing greater morbidity and mortality in developing countries. It was often poorly recognized and under-diagnosed. Evidence on the nutritional status and its associated factors among elderly population was not well studied in Ethiopia particularly in the study area.

Objective: To assess the prevalence of undernutrition and associated factors among the elderly population living in Haramaya district, Oromia, Eastern Ethiopia.

Methods: Community based cross-sectional study design was used among randomly selected 449 elderly populations living in Haramaya district through probability sampling methods from March 01 to 31, 2020. A full Mini Nutritional Assessment tool was used to assess the nutritional status of the study participants and to classify them as undernourished (MNA score <17). Validated geriatric depression scale short form (15 items) was employed to screen for depression and six-item cognitive impairment test to screen dementia status by trained data collectors.

The collected data were entered and cleaned on to EpiData Version 3.02 statistical software and exported to the SPSS Version 22 statistical package for analysis. Binary and multivariate logistic regressions were used to analyze the data. Odds ratios along with 95% confidence intervals were calculated to measure the strength of the association. Level of statistical significance was declared at p-value less or equal to 0.05.

Results: Of the 449 study participants 51%; 95% CI: (46.3%, 55.5%) were undernourished. Being a housewife [(AOR=2.35; 95% CI: (1.17, 4.70)], having chronic disease comorbidities [(AOR=2.11; 95% CI: (1.27, 3.52)], living in food insecure household [(AOR=4.37; 95% CI: (1.60, 11.93)], not having family/care giver [(AOR=3.19; 95% CI: (1.54, 6.61)] and being in oldest-old age (≥85 years old) [(AOR=6.63; 95% CI: (1.31, 33.60)] were the factors that were significantly associated with elderly undernutrition.

Conclusion: Undernutrition among elderly population is high and hence, it is an important public health problem in the study area. Therefore, all relevant stakeholders should work towards improving the nutritional status of elderly population.

Key-words: Elderly, Undernutrition, Mini nutritional assessment, Eastern Ethiopia

1. INTRODUCTION

1.1. Background

Undernutrition is the outcome of insufficient food caused primarily by an inadequate intake of dietary or food energy and defined as a dietary energy intake below the minimum requirement level to maintain the balance between actual energy intake and acceptable levels of energy expenditure(FAO, 2007). The current definition of malnutrition from the European Society for Clinical Nutrition and Metabolism (ESPEN) is "a state resulting from a lack of uptake or intake of nutrition leading to altered body composition (decreased fat free mass and body cell mass) leading to diminished physical and mental function and impaired outcome from disease"(Cederholm *et al*., 2015).

Undernutrition is a common in older people (aged ≥ 60 years old) and often poorly recognized and under-diagnosed. It is associated with frailty (physical weakness), sarcopenia (decline in muscle mass) and poor health outcomes(Lancet, 2013). Older people are vulnerable to malnutrition for many reasons including physiological and functional changes that occur with age, lack of financial support and inadequate access to food. The functional status of the elderly is their ability to carry out their day to day activities including preparation of food and intake, thereby affecting nutritional status(Agarwalla *et al*., 2015).

The causes of malnutrition in the elderly population are extremely varied, and they can be divided into three main types: medical, social, and psychological. The Medical causes include poor appetite, poor dentition, loss of taste and smell, respiratory disorders, gastrointestinal disorders, endocrine disorders, neurological disorders, infections, physical disability and drug interactions. A lifestyle or social cause of malnutrition includes lack of knowledge about food, cooking, and nutrition, isolation/loneliness, poverty and inability to shop or prepare food. Psychological causes are also an important cause of malnutrition which includes dementia, depression, bereavement and anxiety(Hickson, 2006).

The community-dwelling elderly population is defined as the population aged ≥ 60 years that are living in the community freely on their own as opposed to those are in the institutionalized and hospitalized elderly. There is no United Nations (UN) standard numerical criterion, but the

UN agreed cutoff is 60+ years when referring to the elderly population(United Nations, 2013). The definition of older populations in many developing countries followed the same path as that in more developed countries, that is, the government sets the definition by stating a retirement age(WHO, 2002). This is also applicable in Ethiopian context since the age of retirement is after 60 years old and as result the old age in our context is also greater than or equal to 60 years old as that of others(FMOH, 2019).

The population aged ≥ 60 years old is the fastest growing in number at global level. In the more developed regions, the population aged ≥ 60 is increasing at 1% annually before 2050 and 0.11% annually from 2050 to 2100. In the less developed regions, the population aged ≥ 60 is currently increasing at the fastest pace ever, 3.7% annually in the period 2010-2015 and is projected to increase by 2.9% annually before 2050 and 0.9% annually from 2050 to 2100(United Nations, 2013). Eleven percent of the world population and 5% of Ethiopian population were categorized under elderly population aged ≥60 years(Wondiye *et al*., 2019)

Aging is frequently associated with decreases in several physiological functions that can have impact on nutritional status, including reduced lean body mass and a resultant decrease in basal metabolic rate, decreased gastric secretion of digestive juices and changes in the oral cavity (deteriorating dental health), sensory function deficits (taste acuity and smell), changes in fluid and electrolyte regulation and chronic illness. Medication, hospitalization and other social determinants also can contribute to nutritional inadequacy.

The Mini Nutritional Assessment (MNA) tool, which was published in 1994, is a short, non-invasive, reliable and extensively evaluated nutritional assessment tool for free-living and clinically relevant elderly populations. The tool was first developed by Nestlé Institute geriatricians and tested in a variety of settings(Guigoz, 2006). MNA tool was recommended by the European Society for Nutrition and Metabolism for routine geriatric nutritional assessments.

1.2. Statements of the problem

The nutritional status of older people is an important determinant of quality of life, morbidity and mortality and decreases in physical activity, which may all affect nutrient intake (Brownie, 2006, Gariballa and Sinclair, 1998). Any change in nutrient intake can lead to malnutrition

with its potentially serious consequences, sensory changes, including smell, vision, and taste, affect the appetite in many ways that lead to a diminished dietary intake; these, together with changes in the digestive system that alter absorption and the digestion of food, can lead to malnutrition which leads to a weak immune system, increasing the risk of infections, poor wound healing, and muscle weakness, which further leads to falls and fractures(Amarya *et al*., 2015).

Older people are more vulnerable to inadequate nutrition than younger adults and have a higher risk of nutrient deficiencies. Poor nutritional status is associated with increased demands on health services, lengthier hospital stays and immune dysfunction, and it is recognized as an important predictor of morbidity and mortality (Chernoff, 2005).

The nutritional problems relating to the elderly are commonly overlooked by the primary care physicians and other healthcare workers in our setting due to the assumption that nutritional deficiencies are an inevitable consequence of ageing and disease, and that intervention in correcting these deficiencies has a limited effect(Adebusoye *et al*., 2014, Harris and Haboubi, 2005).

Only few African countries offer social and welfare assistance programs for older adults. In terms of formal economic support, only three countries South Africa, Namibia and Mauritius provide an old-age pension system that is noncontributory and means tested. Furthermore, the elderly populations are not currently viewed as a priority group for nutrition services. Nutrition interventions in African countries, when available, are directed primarily toward infants, young children and pregnant and lactating women. The lack of attention to the elderly in policies and programs is mirrored by the paucity of information from studies on their condition. The older population in Africa is rapidly increasing, researchers and policy makers would do well to focus more attention on this group(Charlton and Rose, 2001).

Worldwide studies revealed that the prevalence of undernutrition among people of old age is high (the average prevalence of elderly undernutrition is about 15% and about 45% at risk of malnutrition from 25 studies that were conducted in different setting of the world). The result of limited studies conducted in Ethiopia reported the prevalence of elderly undernutrition were less than 25% (Adhana *et al*., 2019, Legesse *et al*., 2019, Wondiye *et al*., 2019). However,

irrespective of the high prevalence of the elderly population undernutrition and its harmful consequences all over the globe the issue of elderly nutritional status assessment and intervention did not get attention. In Ethiopian context, the National Nutrition Program II initiative did not consider the issue of elderly nutrition condition in their plan on nutrition assessment and intervention. Generally, it can be said the issue of elderly nutrition conditions was ignored in Ethiopian context. Moreover, only limited studies have been conducted in Ethiopia (Wondiye *et al*., 2019, Adhana *et al*., 2019) regarding elderly nutritional status assessment and the elderly are not currently viewed as a priority group for nutrition services and it is also not a priority area for researchers and policy makers. Information limitation is the major gap in this area and all over the country.

This study has included household food security status as one of study variable which was not included in almost all studies conducted on the similar title conducted in different countries throughout the world, even if food insecurity is one of the challenges in developing countries like our country Ethiopia. There was no study conducted on elderly population nutrition condition in study area and East Hararghe zone as evidenced by literature reviews. Therefore, the aim of this study was to assess the prevalence of undernutrition and associated factors among elderly population in the study area.

1.3. Significance of the study

Firstly, the result of this study will help the elderly population to get attention from all stakeholders including the district's population health planner. The result of this study will also help the Haramaya district health office and East Hararghe zonal health department to draft or rearrange their plan regarding the nutritional condition of the elderly population**.**

The result of this study can also be an input for Oromia Regional Health Bureau (ORHB) and Federal Ministry of Health (FMOH) policy designers to include the nutritional program in their future plan and also for other researchers for future further research on the elderly nutritional conditions and related studies**.** This study result will also filled the existing information gap regarding the elderly population's nutritional condition for all stake holders.

1.4. Objectives

1.4.1. General objective

- To assess the prevalence of undernutrition and its associated factors among elderly population in Haramaya district, Oromia region, Eastern Ethiopia.

1.4.2. Specific objectives

- To determine the prevalence of undernutrition among elderly population
- To identify factors associated with undernutrition among elderly population

2. LITERATURE REVIEW

2.1. Prevalence of undernutrition among elderly population

An Institutional based cross-sectional study that was conducted in Diara and Nanda Sub-centers, under Rural Health Unit and Training Centre (RHU and TC), Singur, West Bengal India showed that the prevalence of older undernutrition and risk of undernutrition was 29.4% and 60.4% respectively(Ghosh and Dasgupta, 2017). Similar studies that were conducted in the different areas of India on Assessment of nutritional status among elderly population revealed that 9.1%, 15%, 17.9% and 24.8% elderly were undernourished with the respective of 55%, 58.7%, 32.5% and 58.8% at risk of undernutrition with MNA scoring respectively(Kalaiselvi *et al*., 2016, Konda *et al*., 2018, Krishnamoorthy *et al*., 2018, Lahiri *et al*., 2015) and a study conducted in different area of Spain revealed that the prevalence of older age undernutrition were found between 2.8% and 14.3% with about 25% to 27% at risk of undernutrition(Cuervo *et al*., 2008, Julio *et al*., 2018, Maseda *et al*., 2016, Montejano *et al*., 2017).

The result of the study conducted in Rio Grande do Sula, Brazil came up with the prevalence of undernutrition of older age was 26.6%. This study also reported older age at risk of undernutrition to be 48.1% and in the same study area (Rio Grande do Sula) after one year of the above study had been conducted another study was done and reported 48.4 % of older people at risk of undernutrition of this which 45.1% was at risk of malnutrition and 3.1% was malnourished. Another study that was conducted in the southern part of Brazil revealed that older age at risk of undernutrition was 28.3%. In addition to this, another study conducted in two area of Brazil in 2012 also came with 8.2% underweight and 28.9% at risk of underweight (Damião *et al*., 2017, Damo *et al*., 2018, Fares *et al*., 2012, Ghosh and Dasgupta, 2017).

According to a study conducted in Amsterdam, Netherlands on geriatric outpatients at geriatrics OPD that screened for malnutrition by using MNA showed that prevalence of malnutrition and risk for malnutrition were 17% and 58% respectively(M.A.E. van Bokhorst-de van der Schueren *et al*., 2013). Another observational study that was done on community-dwelling older individuals using data from various settings showed that the prevalence of undernutrition was highest in the home care sample (35%), followed by the general practice (12%) and LASA (11%) samples(Schilp *et al*., 2012). In addition to these, the result of a study

conducted in the Dutch community-dwelling older adults of the country revealed that 56.8% of older people were at the high risk of undernutrition and 84.1% prevalence of nutritional risk factors(Dent *et al*., 2019).

The findings of two study conducted in China reported that the prevalence of older undernutrition were 8% with 36.4% at risk of undernutrition using MNA tool (Han *et al*., 2009) and 12.6% ESPEN criteria respectively (Wei *et al*., 2018). Moreover, a community based cross-sectional household survey study that was done in rural Nepal identified the magnitude of undernutrition as it was about 25% and the risk of undernutrition as it was found between 50-65% (Ghimire *et al*., 2017). In addition to this, in a similar setting with a similar study design another study was conducted and came up with the finding of 24.8% of malnutrition and 49.6% at risk of malnutrition by the MNA score(Tamang *et al*., 2019).

The result of research conducted in New Zealand(Wham *et al*., 2017), Sri Lanka(Damayanthi *et al*., 2018), Sweden(Soderstrom *et al*., 2017), Czech Republic(Slavikova *et al*., 2018), Istanbul Turkey(Soysal *et al*., 2019), and France(Torres *et al*., 2014) showed that the prevalence of older undernutrition ranged from 6.8% to 23% and risk of undernutrition ranged from 33% to 55.1%(Wham *et al*., 2017, Damayanthi *et al*., 2018).

A cross-sectional study that was conducted on prevalence of malnutrition among hospitalized elderly patients and associated factors in Saudi Arabia revealed that 76.6% of patients were either malnourished or at risk of malnutrition. Similar to this a study conducted in Norway also showed that 75% of elderly were undernourished or at risk of undernutrition(Jacobsen *et al*., 2016).

A cross-sectional study conducted in Nigeria, Colombia, and Italy on older age people nutritional status assessment showed that the prevalence of older age undernutrition were 7.8%, 4.58%, and 10% with the respective prevalence of at risk of undernutrition 11.8%, 34.27 %, and 65% respectively(Adebusoye *et al*., 2014, Chavarro-Carvajal *et al*., 2015, Valentini *et al*., 2018).

A study conducted in Aykel and Debra Markos towns which found in the northern part of Ethiopia showed the prevalence of undernutrition among elderly people were 17.6% and 22.7% respectively(Adhana *et al*., 2019, Legesse *et al*., 2019). A community based cross-

sectional study that was conducted in Sodo district of southern part of Ethiopia also reported the overall prevalence of undernutrition among the geriatric age group was 17.1%(Wondiye *et al*., 2019).

2.2. Factors associated with undernutrition among elderly population

2.2.1. Socio-demographic factors

A community based household survey study that was done in Rural Nepal revealed a significant greater proportion of females scored in the malnourished range than males(Ghimire *et al*., 2017) and a study conducted on Nutritional status in the oldest-elderly and associated factors in Southern Brazil also showed that the prevalence of underweight was 27.3% in men and 12.8% in women(Boscatto *et al*., 2013).

A community based cross-sectional study that was done on the Prevalence and predictors of malnutrition in elderly Chinese in the different study areas in China reported that age was positively associated with the nutritional status of the elderly. For every 1-year increase in age, the odds of being malnourished increased by 8.5% (Han *et al*., 2009, Wei *et al*., 2018). According to the study finding that was conducted in Pondicherry, South of India age more than 70 years was found to be significantly associated with undernutrition(Kalaiselvi *et al*., 2016). In addition to these, study findings conducted in the Northern part of Ethiopia also showed that increasing age was significantly associated with the risk of older undernutrition. Being in the Oldest-old age (85+years old) was about four times more likely to be undernourished when compared to that of being in middle-older age (75-84 years old) to be undernourished(Adhana *et al*., 2019).

A study conducted in Debra Markos town, the northwest part of Ethiopia showed that being female is about eight times more likely to suffer from undernutrition when compared to males(Adhana et al., 2019). In addition to this, the study conducted in Aykel town of northwest Ethiopia showed that being female was about 1.6 times more likely to be undernourished when compared to that of being male(Legesse *et al*., 2019). Similarly, the study done in the rural area of West Bengal of India showed that being female is about four times to be malnourished than being male(Ghosh and Dasgupta, 2017). Another study that was conducted in a similar setting also showed that being female (59.4%) was significantly more malnourished than being male

(40.6%) (Lahiri *et al*., 2015). A study conducted in France also reported being female is independently associated with poor nutritional status (Torres *et al*., 2014).

However, in opposite to the above findings concerning the association between older age undernutrition and sex of the participants of the study, the research conducted on Nutritional assessment interpretation on 22007 Spanish community-dwelling elderly population using the Mini Nutritional Assessment test showed that MNA total score was significantly higher in men than in women(Cuervo *et al*., 2008). Similarly, the result of a study done on prevalence and predictors of malnutrition among elderly Chinese adults revealed that the odds of being malnourished was 41 % higher for males than for females(Wei *et al*., 2018).

Concerning the issue of association between elderly age and undernutrition different studies conducted in the different countries reported as there was an association between them. As a result of a study conducted in France, the elderly age appeared to be independently associated with poor nutritional status (Torres *et al.*, 2014). According to the result of a study conducted in Debra Markos town of Ethiopia being in advanced age increases the risk of being undernourished; being in middle-old age group(75-84 years old) and Oldest-Old (85^{+} years old) with 3.45 times and 5.25 times strength of association respectively(Adhana *et al*., 2019). A community-dwelling cross-sectional study that was conducted in Spanish with MNA total score showed that malnutrition was significantly higher in men than in women (Cuervo *et al*., 2008). A study conducted in Sri Lanka also showed that increased age was positively associated with malnutrition (Damayanthi *et al*., 2018).

A study conducted on Factors associated with risk of malnutrition among elderly in south-eastern Brazil revealed that the risk of malnutrition was significantly higher in women without formal education with older age undernutrition when compared with that who have formal education(Damião *et al*., 2017) and another study that was done in South India and France showed having low educational level or have not formal education was significantly associated with older age undernutrition(Konda *et al*., 2018, Torres *et al*., 2014).

A research conducted in Pondicherry south India and another part of south India came up with low and middle family income was significantly associated with older age undernutrition. Another study conducted in Assam India, France west Bengal and different areas of Spain

share these findings (Kalaiselvi *et al*., 2016, Konda *et al*., 2018). The risk of malnutrition was twice as high in individuals with no family income compared to those who earned at least three times a minimum wage (Damião *et al*., 2017).

According to a result of study conducted in Saudi Arabia, France, south-eastern India, and Spain being alone/living alone and being widowed were significantly associated with elderly undernutrition of their particular country (Alzahrani and Alamri, 2017, Torres *et al*., 2014, Damião *et al*., 2017, Julio *et al*., 2018). Concerning the correlation between family size and undernutrition, the study done in Sri Lanka revealed that an increased number of people living with the older person decreased the risk of being undernourished by about 91 %(Damayanthi *et al*., 2018).

Household Food security status is also one of the factors that are associated with undernutrition in the case of elderly age group. According to the finding of the study conducted in northern part of Ethiopia, the odds of elderly undernutrition was about two times higher among those household food insecure participants when compared with that of food secured participants(Legesse *et al*., 2019).

2.2.2. Lifestyle factors

The result of the study conducted in Brazil showed that Smokers were 1.63 times more likely to be at risk of malnutrition than individuals who had never smoked(Damião *et al*., 2017). However, another study conducted on Factors associated with the nutritional status of the elderly in two regions of Brazil, smoking was one of the factors that affect the older nutritional status negatively(Fares *et al*., 2012). A study conducted in the Netherlands and Ethiopia also showed that smoking was significantly associated with older age undernutrition (M.A.E. van Bokhorst-de van der Schueren *et al*., 2013, Wondiye *et al*., 2019).

According to a study conducted in Sri Lanka being alcohol consumer was about four times more likely to be undernourished to that of not alcohol consumers(Damayanthi *et al*., 2018). In addition to this, another study that was done in two regions of Brazil revealed that alcohol consumption was significantly associated with the risk of undernutrition in the elderly age group(Fares *et al*., 2012).

Concerning meal frequency study conducted in the Netherlands, south India and Ethiopia reported that eating ≤ 2 or 3 times daily and skipping meal significantly affect the risk of undernutrition(Adhana *et al*., 2019, Dent *et al*., 2019, Konda *et al*., 2018). The study conducted in two regions of Brazil revealed that sitting much time positively affects the prevalence of undernutrition(Fares *et al*., 2012).

Regarding Chewing *khat* and nutritional status the study done at Gulalle sub city, Addis Ababa revealed *khat* chewers were almost about 2 times more likely to be underweight compared to those non *khat* chewers on two study conducted in different time period(Legesse and Bedane, 2016, Tesfaye Girma Legesse *et al*., 2017).

2.2.3. Health status factors

A cross-sectional study conducted in Colombia reported that comorbidities was increased the chance of being undernutrition by about 1.2 times than that of free of comorbidities and perceived poor health was increase the risk of being undernourished by about 1.5 folds(Chavarro-Carvajal *et al*., 2015).

According to the study result that was conducted in a rural area of West Bengal, chronic comorbidities was significantly associated with elderly malnutrition, individuals that had comorbidities was about four times suffer to malnutrition when compared to that who had no comorbidities(Ghosh and Dasgupta, 2017).

A study finding that was conducted in Nigeria showed that previous hospital admission increased the risk of undernutrition by about two times when compared with that who have no previous hospital admission and chronic morbidities like hypertension were significantly associated with the development of undernutrition(Adebusoye *et al*., 2014).

According to the result of research conducted in Debra Markos town, northwest Ethiopia individuals with eating difficulty and poor appetite were increased the chance of being undernourished by about eleven times greater than that who had a good appetite and free of eating difficulty(Adhana *et al*., 2019).

2.3. Conceptual framework

This conceptual framework was developed after reviewing different related literatures. The figure below shows the factors associated with undernutrition among elderly population. These independent variables have direct and indirect contribution to undernutrition (Figure 1).

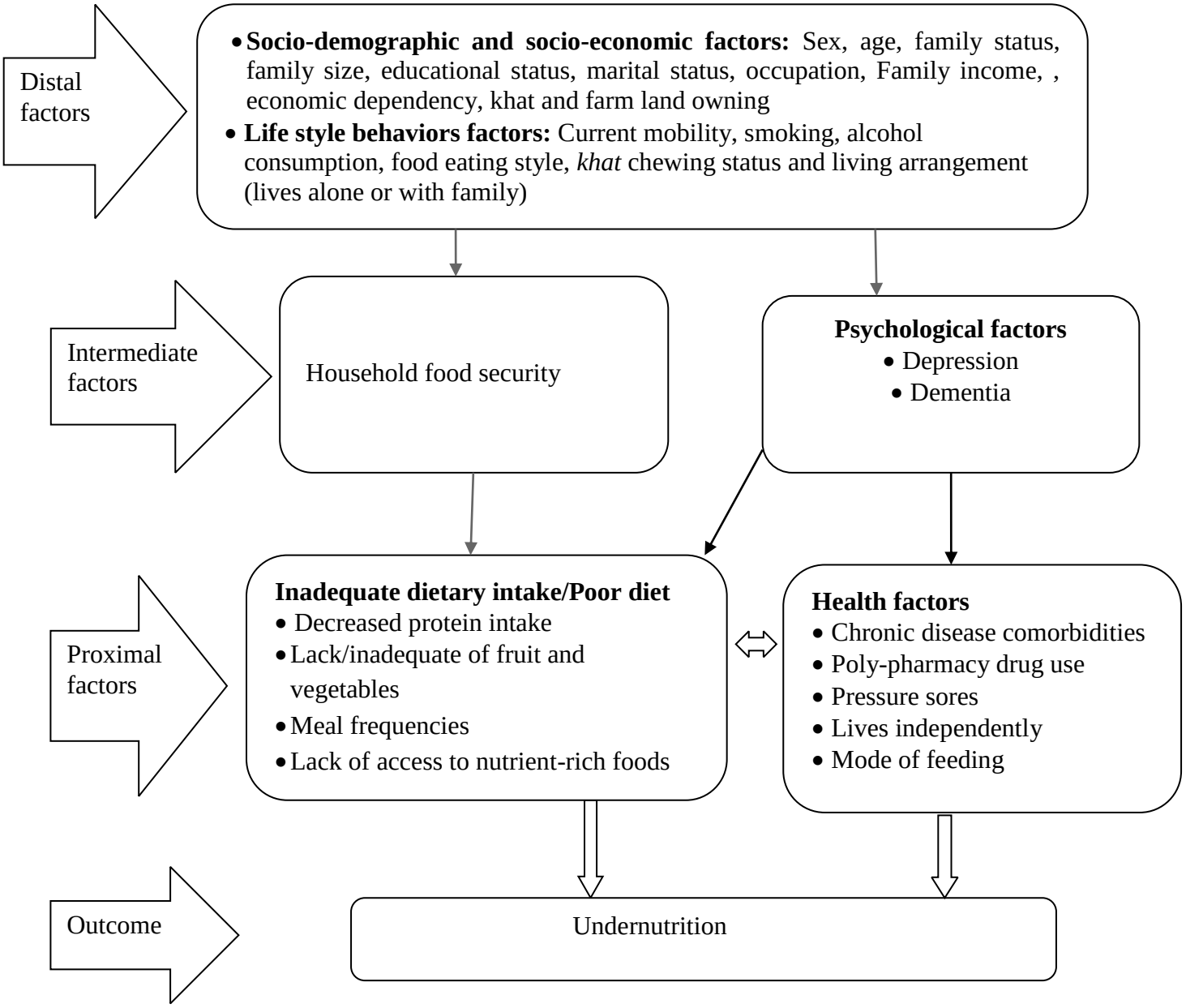


Figure 1: Conceptual framework showing risk factors associated with nutritional health in elderly people (Adapted from Borrel, 2001 and UNICEF with modification)

3. MATERIALS AND METHODS

3.1. Study area and period

The study was conducted in the Haramaya district, East Hararghe zone, Oromia Region, Eastern Ethiopia. Haramaya district is located 500km away from Addis Ababa, the capital city of Ethiopia. The altitude of this district ranges from 1400 to 2340 meters above sea level. It is named after the administrative center, Haramaya town. It is bordered on the south by Kurfa Chele, on the west by Kersa on the north by Dire Dawa on the east by Kombolcha and on the southeast by the Harari Region. A survey of the land in Haramaya district shows that 36.1% is arable or cultivable, 2.3% pasture, 1.5% forest, and the remaining 60.1% is considered built-up, degraded or otherwise unusable. *Khat*, vegetables and fruits are important cash crops to the area. Kombolcha and Haramaya are major producers of vegetables (Central Statistical Agency, 2017). Haramaya district has 33 rural kebeles and two urban kebeles (Haramaya district health office, 2020).

The total population of the Haramaya district is estimated to be about 310,363 of which 155,379 are males and 154,984 are females. Out of these total populations, the total number of elderly population of the district was estimated to be about 15,084 of which 7,512 are males and 7,572 are females (Haramaya district health office, 2020). The study was conducted from March 01 to 31, 2020.

3.2. Study design

A community based cross-sectional study design was used.

3.3. Source population

All elderly population who are living in the Haramaya district

3.4. Study population

All randomly selected elderly individuals who are living in selected kebeles of Haramaya district

3.5. Inclusion and Exclusion criteria

3.5.1. Inclusion criteria

All elderly people aged ≥ 60 years old that were living in selected kebeles and available during the data collection period were included in the study.

3.5.2. Exclusion criteria

Elderly individuals who were unable to communicate and give information due to serious illness and whose both extremities were amputated were excluded from this study.

3.6. Sample Size Determination

For objective 1: The prevalence of under nutrition in older age

The sample size was calculated using single population proportion formula considering a 22.7% prevalence of undernutrition from the similar study(Adhana *et al*., 2019), at 0.05 level of significance, 0.04 marginal error at 95% level of confidence and calculated as below and finally 10 % non-response rate was added.

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

Where:

n= minimum sample size required for study

p= estimated prevalence from literature 22.7% (0.227)

$Z_{\alpha/2}$ = critical value at 95% confidence level of certainty (1.96).

d= margin of error 4% (0.04).

Thus, n is calculated as:

$n = (1.96)^2(0.227)\ (0.773)/\ (0.04)^2 = 422$

After 10% non-response rate was added to the sample size the final sample size obtained was 465.

For objective 2: Factors associated with undernutrition in the older age group

The sample size for factors associated with undernutrition was calculated for some factors obtained from different literature by using the statistical calculation of EPI INFO statistical

software version 7 with the following assumptions: power 80%, 95% confidence level and ratio of unexposed to exposed 1.

After the sample sizes were calculated for the first and second objectives for different factors, the largest sample size from objective 2 was 366 and 465 from objective 1. So, 465 samples were taken as the final sample size for this study (Table 1).

After the sample sizes were calculated for the first and second objectives for different factors, the largest sample size from objective 2 was 366 and 465 from objective 1. So, 465 samples were taken as the final sample size for this study (Table 1).

Table 1: Objective two sample size calculation for elderly population of Haramaya district, Eastern Ethiopia, 2020

Variables	Proportion of older age Undernutrition		Sample size computed	Computed sample size + 10% NRR	Reference
	Exposed	Unexposed			
Smoking status of the participant	Current smoker (41.2%)	Never smoker (26.1%)	328	366	(Damião *et al*., 2017)
HHFS	Food insecure (29.3%)	Food secured (13.6%)	238	262	(Legesse *et al*., 2019)
Decline food intake	Yes (25.7)	No (12.9)	328	361	(Wondiye *et al*., 2019)

3.7. Sampling Procedures

Simple random sampling technique was employed to select seven kebeles from 33 rural kebeles of Haramaya district. For each of the randomly selected kebeles, the total number of elderly individuals greater than or equal to 60 years old were identified through reviewing records from the baseline data conducted by the Haramaya university health research team

office and the sample size needed for each selected kebeles were calculated proportionally from the total elderly population living in each randomly selected kebeles. The amounts of samples needed from each randomly selected kebeles were framed using their particular code number of the house that had elderly persons. From this list, the needed sample size from each selected kebeles were drawn through simple random sampling technique from the framed household with elderly individual and finally the data were collected from the randomly selected individuals on home to home basis(Figure 2).

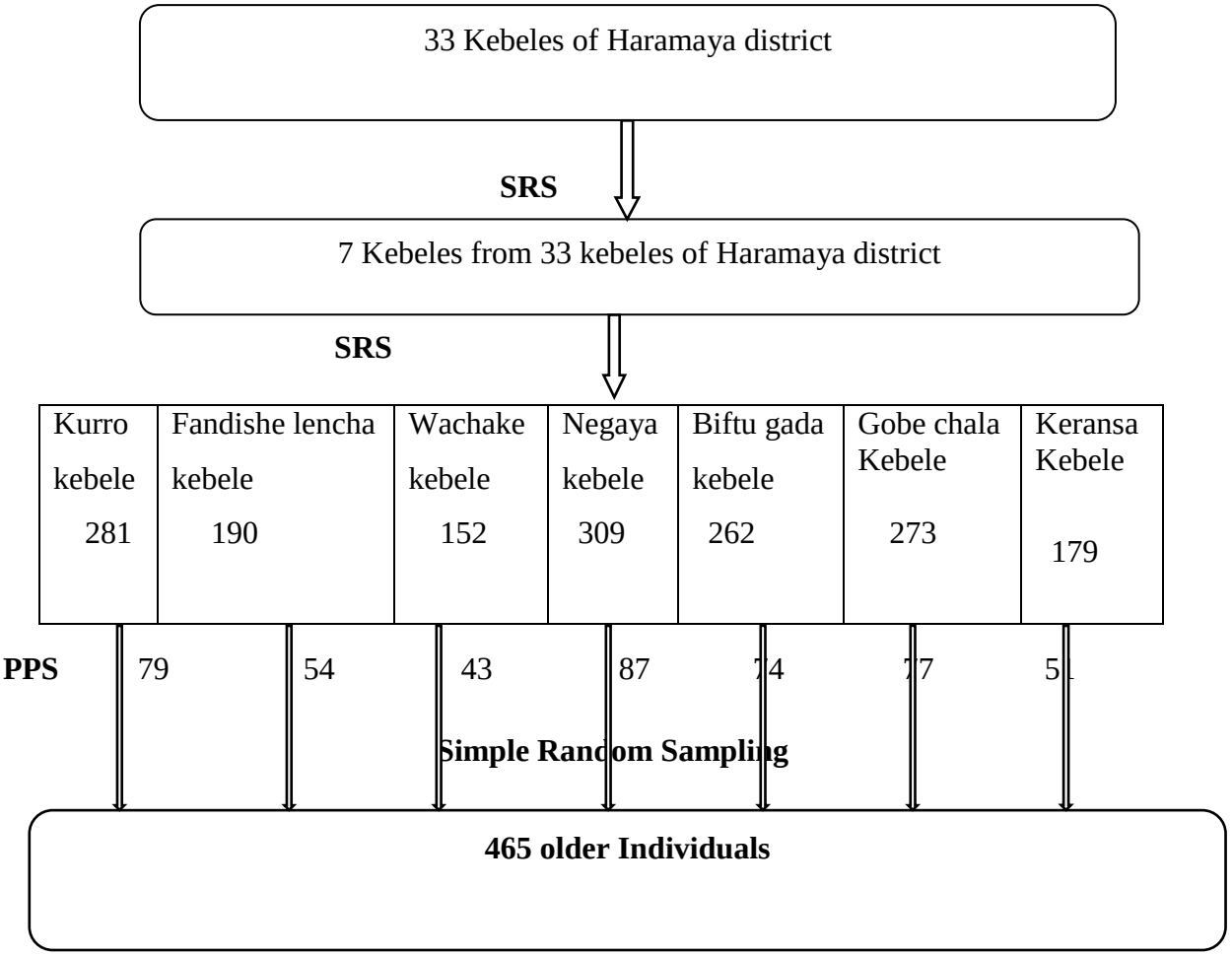


Figure 2: Sampling procedure for the sample size needed for the assessment of undernutrition and factors associated among elderly people living in Haramaya district, Oromia region, Eastern Ethiopia, 2020.

3.8. Data Collection instruments

3.8.1. Data collection tools

Data were collected using set of pre-tested structured questionnaires including Socio demographic and life style situations, Full Mini nutritional Assessment, Geriatrics Depression scale, dementia assessment (6CIT scale), seven days nutritional factors and health related factors. During the preparation of the questionnaire, related published articles were reviewed from similar studies and contextualized.

A MNA questionnaire which was developed by Nestle Nutrition Institution was adopted from the similar study(Guigoz, 2006) with contextualization and the seven days food consumption assessing questionnaire was taken from world food program document with modification (WFP, 2014).

The Socio-demographic and socio-economic factors were includes: age, sex, ethnicity, marital status, educational status, family occupation, family size, family income of the study participants and the household food security status which was assessed by food consumption score (FCS) questionnaire (WFP, 2014). A lifestyle factor assessing questionnaire includes: living arrangement, *khat* chewing status, cigarette smoking, alcohol consumption, food eating style and current mobility status.

The full MNA assessment tool includes 18 questions grouped in to 4 main categories: Anthropometric assessment (BMI, weight loss, mid arm and calf circumferences), General assessment (lifestyle, medication, mobility and presence of depression or dementia), Short dietary assessment (number of meals, food and fluid intake, and autonomy of feeding) and Subjective assessment (self-perception of health and nutrition). Each answer has a numerical value and contributes to the final score, which has a maximum of 30. A score < 17 points is indicative of undernutrition; score 17-23.5 points at risk for undernutrition, and score 24-30 points are considered as well-nourished (Guigoz, 2006).

3.8.2. Data collection procedure

Data collection was carried out with pre-tested structured questionnaires through a face-to-face interviewer-administered with anthropometric measurements. All anthropometric

measurements (weight, height, MUAC, demi-span and CC) were measured as a component of a full MNA. Weight was measured with a portable digital weight scale. During weight measurement the zero mark was checked after each reading for accuracy and it was recorded to the nearest 0.1 kg with the subject in light dress/remove heavy outer clothes and barefoot. Height was recorded to the closest 0.1 cm utilizing a stadiometer after the subject standing erect and looking straight ahead with heels, buttocks and shoulders pressed against the stadiometer. Demi span measurement was used by quantifying the distance from the midline at the sternal notch to the web between the middle and ring fingers along outstretched arm whenever participants were unable to stand on the stadiometer or have severely curved spines and finally height was calculated using a standard formula (females height in cm = (1.35 × demi span in cm) + 60.1 and males height in cm = (1.40 × demi span in cm) + 57.8) for each study participants measured with demi span (Hickson and Frost, 2003). Mid Upper Arm Circumference (MUAC) was measured to the nearest 0.1 cm at the mid-point between the tip of the acromion and the olecranon process on the back of the arm while the subject holding the forearm in horizontal position. The MUAC measurement was performed on the subject's arm hanging freely along the trunk using inextensible MUAC tape. The calf circumference was measured at the widest between the ankle and knee to the nearest 0.1 cm using a non-stretchable tape in a sitting position or stand with his/her weight evenly distributed on both feet and manipulated to maintain close contact with the skin without compression of underlying tissues.

The BMI was computed from the body weight in kilograms divided to the squared of the estimated height in meter (kg/m^2). The Weight loss assessing question that was found in the MNA questionnaire was estimated through asking questions as "Has your waistband or other internal clothes gotten looser?" Instead of "How much weight do you think you have lost? More or less than 3 kg" and the responses were estimated to kilograms depends on the degree of internal clothes looseness like looser pants and belts in the waist and lighter in the thighs and other outer and inner clothes. The amount of fluid intake by the study participants that was measured as cups were estimated as <3 cups as <1 liter, 3-5 cups as 1-1.5 liters and >5 cups as > 1.5 liters(Nestle Nutrition Institute, 2012).

The psychological stress or depression status was assessed through geriatric depression scale short form (GDS-SF). The questions consist of 15 questions inquiring the participants' mood. Answers were given based on the feelings in the last week before the day of data collection; answers were in the form of "yes" or "no". One point was given either to the answer "yes" or to the answer "no" depending on the question. Score one point for yes answer for questions number 2,3,4,6,8,9,10,12,14 and 15; score one for no answers for question number 1,5,7,11 and 13. A GDS score of 0 to 4 is normal or has no depression and a GDS score of greater than or equal to 5 suggests depression(Greenberg, 2012, Block, 2020).

The dementia status was measured with Six-Item Cognitive Impairment Test (6CIT) questionnaire. It includes one memory, two calculation and three orientation questions. The components are given a weighting when scored that leads to a value between 0 and 28, with higher numbers representing more significant cognitive impairment (0-7 points considered as no dementia, 8-9 points considered as mild dementia and 10-28 points as severe dementia)(H.J.Woodford and J.George, 2007).

3.8.3. Data Collectors

Six diploma Nurses were used for data collection and one Health officer and two BSc Nurses were recruited for supervision during data collection.

3.9. Study Variables

3.9.1. Dependent variable

- Elderly undernutrition (Yes/No)

3.9.2. Independent Variables

- **Proximal factors:** Inadequate dietary intake (decreased protein intake, lack or inadequate fruit and vegetables intake, decreased meal frequencies and lack or inadequate access to nutrient-rich foods) and chronic disease comorbidities, poly-pharmacy drug use, pressure sores, lives independently (not having regular follow up or admission at any Health institution) and mode of feeding (need assistance or not need assistance during eating food).

- **Intermediate factors:** household food security, psychological factors (depression and dementia).
- **Distal factors:** Lifestyle behaviors (current mobility, smoking, alcohol consumption, food eating style, *khat* chewing and living arrangement (living alone or with family)), sex, age, Family income, family status, economic dependency, *khat* farm and crop land owning, family size, educational status, marital status and occupation.

3.10. Operational/standard definitions

Elderly: An individual whose aged ≥ 60 years old. Young-old: individuals aged from 60 – 74 years old; Aged: individuals aged from 75 – 84 years old; Oldest-old: individuals aged from 85+ years old(Adhana *et al*., 2019, Naja *et al*., 2017).

Undernutrition: Elderly who had MNA score < 17 points coded as 'Yes' for undernutrition and those who had MNA score 17 to 23.5 points which considered as at risk of malnutrition and 24-30 points were considered as normal coded as 'No' for undernutrition for this study.

Poly-pharmacy: Taking more than 3 prescription drugs per day.

Chronic disease co-morbidities: older individuals that have clinically confirmed chronic disease such as hypertension, diabetic mellitus, chronic heart disease and the like (Han *et al*., 2009).

Dementia status: According to 6CIT dementia screening tool individuals who had a score of between 0 and 7 was considered as having normal score (no dementia), where as individuals who had a score of between 8 and 9 were considered as having mild dementia and individuals who had a score of between 10 and 28 were considered as having severe dementia(H.J.Woodford and J.George, 2007).

Depression status: Individuals with GDS score ≥ 5 points suggested as depressed and GDS score < 5 points were considered as no depression/normal(Greenberg, 2012).

Household food security status: A FCS score of 0-21 points were considered as household food insecure, score 21.5-35 points as borderline for household food insecurity and score >35 points were considered as household food secured(WFP, 2014).

Seriously ill: Elderly individuals those who were unable to communicate due to sickness were considered as seriously ill.

3.11. Data quality control

Before the actual data collection was started pre-test was done among 5% of sample size in similar area (Damota kebele) of the study area which was not selected in the randomly selected kebeles to check accuracy, to estimate time, questions wording, language understandability, any inconsistency and necessary corrections were made before the actual data collection period and the data collected for the pre-test were not included in the data analysis.

Training was given for both data collectors and supervisors for two consecutive days on the objective of the study, data collection tools with their procedures for objective measurement and interview methods by the principal investigator. The supervisors were following the activities every day to make sure the completeness of questionnaires and all data collection processes.

Data collectors were supervised closely on daily basis to ensure whether the data collectors were filling the questionnaire correctly or not and completeness of the collected data. Any missing data were identified and confirmed before the start of the next day schedule of each data collectors. The recruited data collectors were experienced in anthropometric measurements and they were also updated through two days training on the data collection procedures, neutrality of interviewers, responsibilities of the data collector, how to measure study subjects' anthropometry and how to calibrate weight scale before measuring each study participants and rights of respondents.

The participant's shoes and heavy clothes were removed before weighing and the weight scale was calibrated routinely using a material weight is known to ensure the accuracy of weight scale before measuring each individual participated in the study. Mid-upper arm and Calf circumferences were measured using flexible and non-stretched measuring tape to keep measurement accuracy.

Probing and words contextualization were used at the time of interviewing for questions that were difficult to respond directly forward and the English version of the questionnaires were translated into Afan Oromo version for the purpose of understandability and retranslated to English version after the data has been collected for analysis of the data. The study was used a worldwide validated full form MNA tool with the 91% accuracy, 87.9% sensitivity and 89.6%

specificity(Mesfin *et al*., 2020) and 96% sensitivity, 98% specificity, and 97% positive predictive values according to the clinical status(VELLAS *et al*., 1999).

EpiData software was used for data entry and double data entry for 5% of the questionnaire was performed to realize consistency in data entry and separately entered data was checked to correct mismatches.

3.12. Data processing and analysis

Data were entered using EpiData Version 3.02 and exported to SPSS Version 22 for data analysis. Univariable analysis was used to determine frequencies of variables. Cross-tab was done to identify the relationship between undernourished and not undernourished individuals with independent associated factors. Food consumption score was recoded to same variables by using standard 7-day food frequency data and grouped all the food items into specific food groups and sum all the consumption frequencies of food items of the same group, and recode the value of each group above 7 as 7. Multiplied the value obtained for each food group by its weight and created new weighted food group scores and sum the weighed food group scores, thus creating the food consumption score (FCS). Then, categorized by using the appropriate thresholds, recoded the variable food consumption score, from a continuous variable to a categorical variable as poor, borderline and acceptable food consumption score.

The MNA score to identify the prevalence of elderly undernutrition was calculated from the 18 questions of the MNA questionnaire. From the 18 questions of MNA 2 questions: psychological stress or depression status (measured by GDS-SF questionnaire) and dementia status (measured by 6CIT questionnaire) were collected separately and their scores were computed from their respective questions. Afterwards, they were recoded according to MNA questions standard and finally they were added to the other 16 questions of the MNA to calculate MNA score for assessing elderly nutritional status.

Bivariable logistic regression analysis was done to see the association between the dependent variable and each independent variable. All covariates that were significant at p-value < 0.25 in the bivariable analysis were taken to multivariable analysis to control for all possible confounding variables. Multi-colinearity effect was checked to see the linear correlation among

the independent variables by using Variance inflation factor. Model fitness was checked by using Hosmer-Lemeshow goodness of fit test (p-value= 0.372).

Odds ratio along with 95% interval was estimated to measure the strength of the association. Level of statistical significance was declared at p-value less or equal to 0.05. Results were displayed using tables and figures.

3.13. Ethical Considerations

Ethical clearance was obtained from the institutional health research ethics review committee (IHRERC) of the college of health and medical sciences, Haramaya University Health and Medical Sciences College. A written permission letter was obtained from Haramaya district health office to each selected kebeles leader for their cooperation during data collection period.

Before starting interview and anthropometric physical measurement information on study's possible risk, benefit, confidentiality, privacy, his/her voluntary activity, right of withdrawal, and the time the questionnaire will take was given for each study participants and finally voluntary written informed consent was signed between data collectors and each study participants.

4. RESULTS

4.1. Socio demographic characteristics of respondents

A total of 465 elderly were invited. Of these 449 elderly were participated in the study giving a response rate of 96.6%. About two third 294 (65.5%) of the study participants were females. The age of study participants were ranged from 60-100 years with mean (±SD) age of 67.89 (± 7.478) years. Regarding educational level 426 (95%) of the study participants were unable to read and write. Of the study participants about 179 (40 %) were economically depends on family and about 226 (60%) of the study participants had chat farm. More than half 243 (54.1%) of the study participants had crop farm and majority of the respondents' monthly income was < 2000ETB which accounts for 250 (94%) (Table 2).

Table 2: Socio-demographic and socio-economic characteristics of elderly population of Haramaya district, Oromia region, Eastern Ethiopia, 2020 (n=449).

Characteristics	Category	Frequency	Percentage (%)
Sex	Male	155	34.5
	Female	294	65.5
Age	Young-old (60-74)	368	82.0
	Aged (75-84)	61	13.6
	Oldest-old (≥85)	20	4.5
Marital status	Married	274	61.0
	Widowed	165	36.7
	Single and Divorced	10	2.2
Ethnicity	Oromo	448	99.8
	Amhara	1	0.2
Religion	Muslim	447	99.6
	Orthodox	2	0.4
Educational level	Unable to read and write	426	94.9
	Able to read and write	23	5.1
Occupation	Farmer	154	34.3
	House wife	116	25.8
	Depend on family	179	39.9
Khat farm owning status	Yes	266	59.2
	No	183	40.8
Number of *khat* farm	0.5-4 Qind	250	94.0
	5-20 Qind	16	6.0
Crop farm owning status	Yes	243	54.1
	No	206	45.9
Number of crop farm	0.5-1.5 Qind	162	66.7
	1.51-2 Qind	81	33.3
Average monthly family income	0-500	316	70.4
	501-1000	76	16.9
	>=1001	57	12.7
Family status	No	93	20.7
	Yes	356	79.3
Family size	One	53	14.9
	Two	50	14.0
	Three and above	253	71.1

4.2. Life style characteristics of study participants

About two third 296 (65.9%) of the study participants were eating food with family. Three hundred fifty three (78.6%) of the study participants were *Khat* chewer and majority 245 (69.4%) of them were chewing on daily basis. Almost all 441 (98.2 %) of the study participants were not consuming alcohol and majority 367 (81.7%) of them were not smoking cigarette.

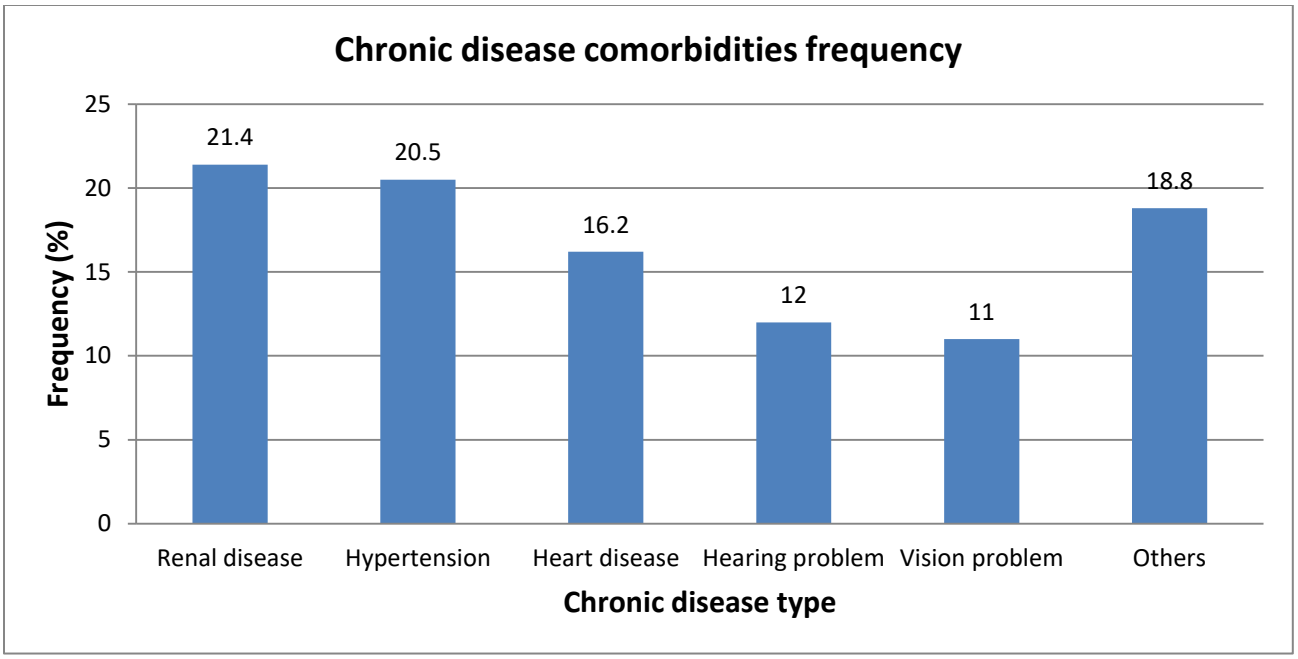
More than half 246 (54.8%) of the study participants were consume meal only once per a day (Table 3).

Table 3: Life style characteristics of the study participants of Haramaya district, Oromia region, Eastern Ethiopia, 2020 (n=449)

Characteristics	Category	Frequency	Percentage (%)
Food eating condition	Alone	153	34.1
	With family	296	65.9
Daily meal frequency	One meal	246	54.8
	Two meals	172	38.3
	≥ Three meals	31	6.9
Khat chewing status	Yes	353	78.6
	No	96	21.4
Frequency of chewing	Every day	245	69.4
	Every other day	83	23.5
	Only with friends	25	7.1
Alcohol consumption status	Yes	8	1.8
	No	441	98.2
Cigarette smoking status	Yes	82	18.3
	No	367	81.7
Frequency of smoking	Every day	67	81.7
	Every other day	14	17.1
	Only with friends	1	1.2

4.3. Health status characteristics of the study participants

About one fourth 117 (26.1%) of the study participants had chronic disease. From the self-reported chronic disease Hypertension and Renal disease were holds the majority which both cases accounts about 21% (Figure 3).

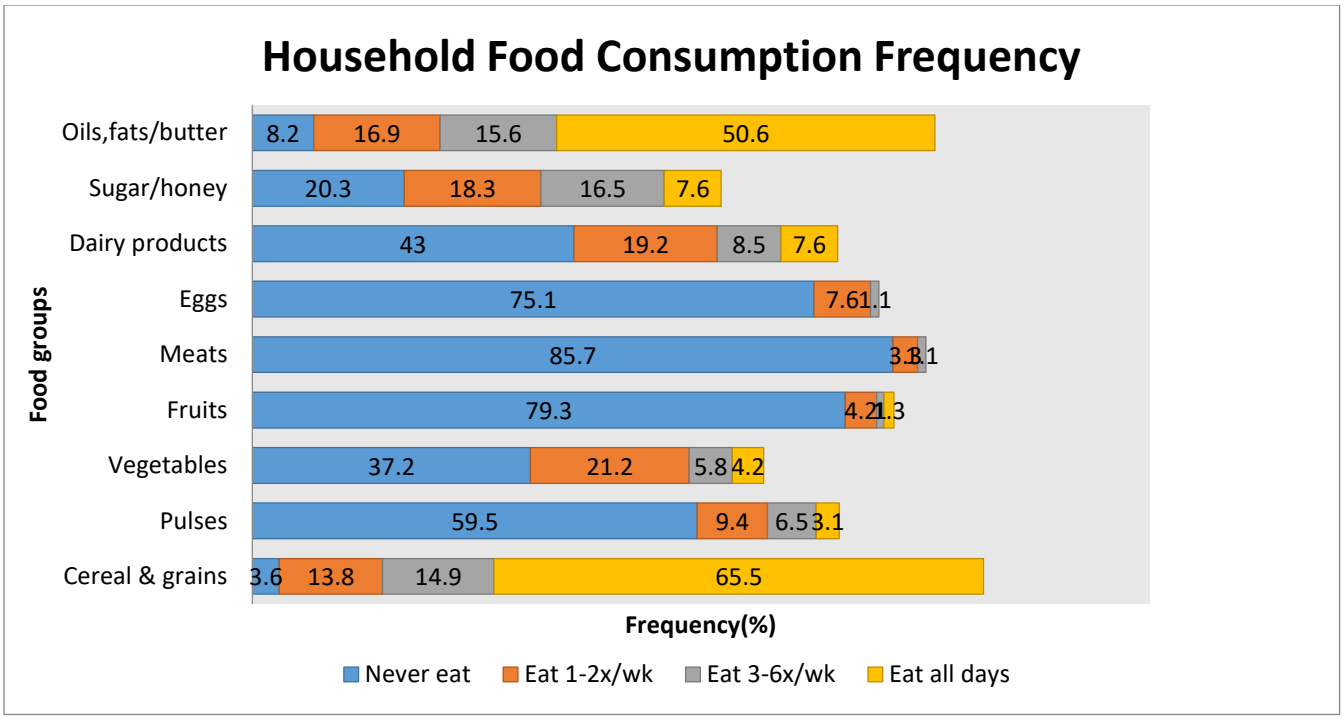


Others = Diabetic Mellitus, Arthritis, Gastritis (PUD), Bronchial asthma

Figure 3: Self-reported medical condition of the study participants in Haramaya district, Oromia region, Eastern Ethiopia, 2020.

4.4. Seven days household food consumption frequency of the study participants

About two third (65.5%) of study participants were consumed food from cereals and grains daily within seven days prior to data collection period. None of the study participants were eats meat and eggs on daily basis and very few (1.1%) participants consumed meat and eggs 3-6 times per week within seven days before data collection period (Figure 4).



X/wk= times per week

Figure 4: Households Food Consumption Frequency of study participants of Haramaya district, Oromia region, Eastern Ethiopia, 2020.

4.5. Household food security status among elderly population

Out of 449 elderly individuals participated in the study 277 (61.7%) were categorized under poor food consumption score (Household food insecure) (Figure 5).

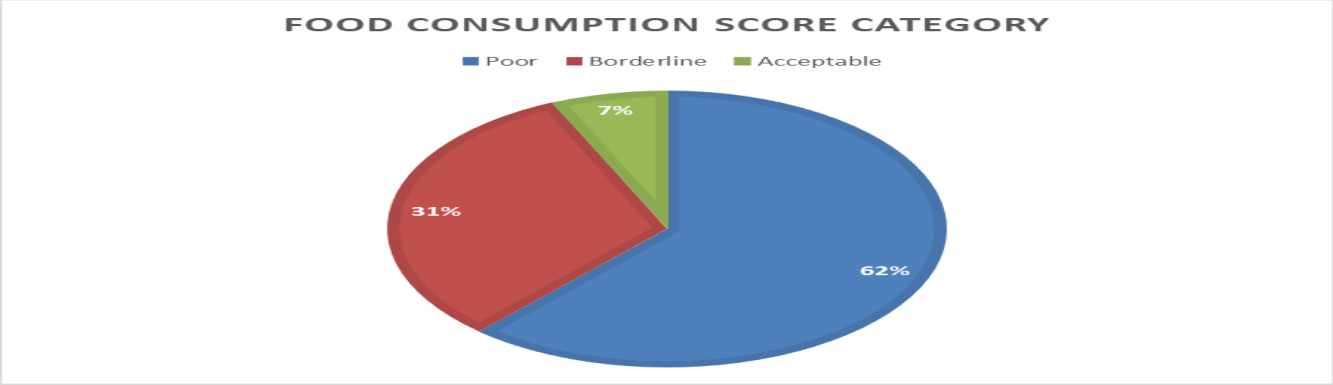


Figure 5: Households Food Consumption Score of study participants of Haramaya district, Oromia region, Eastern Ethiopia, 2020.

4.6. Mini Nutritional Assessment results among elderly population

More than half 252 (56.1%) of the study participants were had a decreased food intake over the past three months due to appetite loss, digestive problems, chewing or swallowing difficulties. Regarding the current mobility status of the study participants about 434 (97%) of the study participants were goes out. About 425 (95%) of the study participants were not take more than three drugs on daily basis and 431(96%) were had no pressure sore or skin ulcers.

Concerning food and fluid intake of the participants majority 393 (87.5%) were self-fed without any problem and 362 (80.6%) of them drink fluid less than or equal to five cups or one and half liters per a day. More than a half 246 (54.8%) of the study participants were eat only one meal/day (Table 4)

Table 4: MNA result of elderly population of Haramaya district, Oromia region, Eastern Ethiopia, 2020 (n=449).

Characteristics	Category	Frequency	Percentage (%)
Food intake decreased status in the last 3 months	Severely decrease	101	22.5
	Moderately decrease	151	33.6
	Not decrease	197	43.9
Current mobility status	Bed or chair bound	6	1.3
	Able to get out of bed/chair but does not go out	9	2.0
	Goes out	434	96.7
Amount of fluid intake/day	< 3 cups/<1L	190	42.3
	3-5 cups/1-1.5L	172	38.3
	>5 cups/>1.5L	87	19.4
Weight loss status in the last 3 months	Weight loss >3kg	65	14.5
	Does not know	153	34.1
	Weight loss between 1 & 3kg	159	35.4
	No weigh loss	72	16.0
BMI (Kg/m^2)	BMI < 19	181	40.3
	BMI >=19 to <21	124	27.6
	BMI >=21 to <23	79	17.6
	BMI >=23	65	14.5
Lives independently(Not have regular follow up or admission at any HC/hospital)	Yes	137	30.5
	No	312	69.5
Full meals frequency/day	One meal	246	54.8
	Two meal	172	38.3
	Three meals	31	6.9

Mode of feeding (self-fed or need assistance to eat food)	Unable to eat without assistance	9	2.0
	Self-fed with some difficulty	47	10.5
	Self-fed without any problem	393	87.5
Self-view of nutritional status	Views self as being malnourished	183	40.8
	Uncertain of nutritional status	183	40.8
	Having no nutritional problem	83	18.5
Self-view of health status	Not as good	158	35.2
	Does not know	79	17.6
	As good	168	37.4
	Better	44	9.8
Taking > 3 prescription drugs/day	Yes	24	5.3
	No	425	94.7
Pressure sore status	Yes	18	4.0
	No	431	96.0
Intake of fruits or vegetables/day	Yes	359	80.0
	No	90	20.0
Mid-Upper Arm Circumference (MUAC) in cm	MUAC < 21	56	12.5
	MUAC 21 to 22	110	24.5
	MUAC > 21	283	63.0
Calf circumference (CC) in cm	CC < 31	271	60.4
	CC ≥ 31	178	39.6

4.7. Depression and dementia status among elderly population

Of the study participants majority 328 (73.1%) had psychological depression and only seventy five (16.7%) were demented (Figure 6).

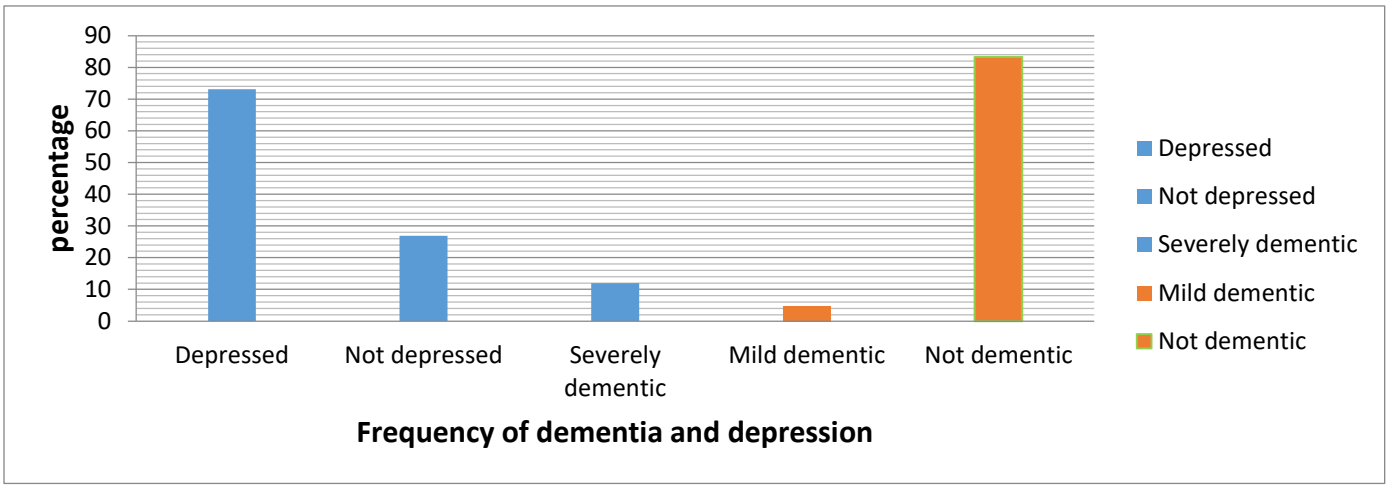


Figure 6: Depression and dementia status of elderly population of Haramaya district, Oromia region, Eastern Ethiopia, 2020 (n=449).

4.8. Prevalence of Undernutrition among elderly population

The overall prevalence of undernutrition among elderly population in Haramaya district was 51% (95% CI: 46.3%, 55.5%) (Figure 7).

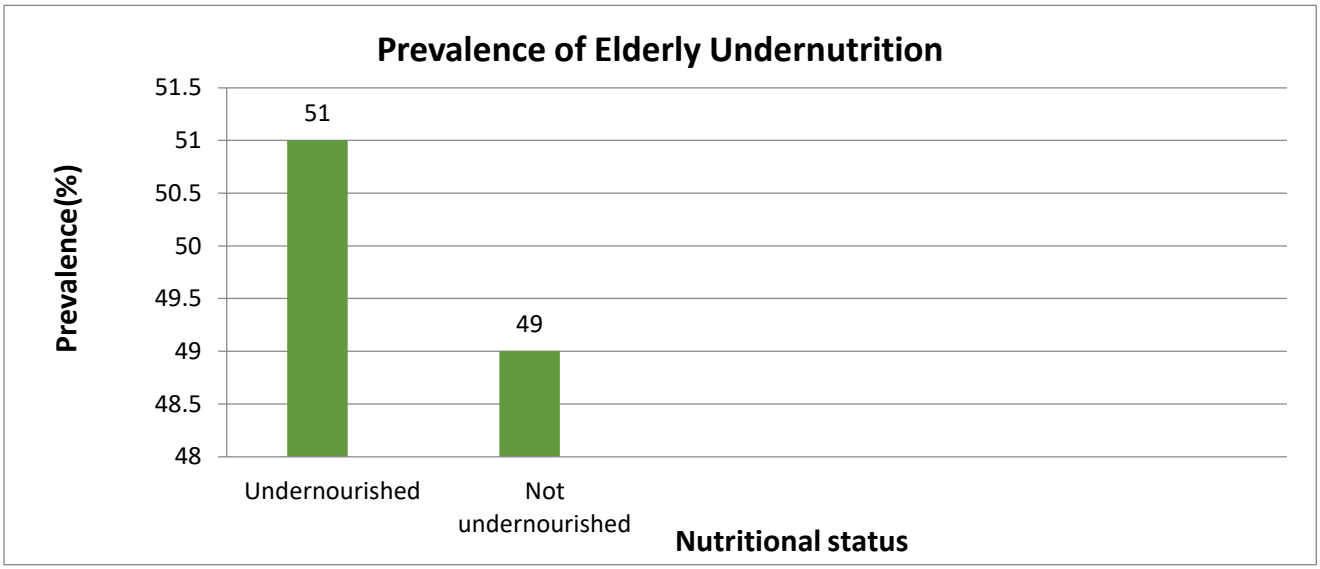


Figure 7: Prevalence of undernutrition among elderly population of Haramaya district, Oromia region, Eastern Ethiopia, 2020.

4.9. Factors associated with undernutrition among elderly population

In bivariable logistic regression analysis, factors such as being female [(COR=1.61; 95% CI: (1.09, 2.39)], being in aged age group (age 75-84 years old) [(COR= 2.4; 95% CI: (1.35,4.23)] and Being in oldest-old age group (age ≥85 years old)[(COR= 10.48; 95% (CI: 2.4,45.8)], being widowed [(COR= 1.94; 95% CI: (1.31,2.87)], not having *khat* farm [(COR=2.01; 95% CI: (1.37,2.95)], not having crop farm [(COR= 1.48; 95% CI: (1.02,2.15)], not having family/supporters[(COR= 6.5; 95% CI: (3.62,11.51)], being housewife [(COR= 2.1; 95% CI: (1.26,3.38)] and economically depends on family [(COR= 3.01; 95% CI: (1.92,4.71)], having chronic disease comorbidity [(COR= 1.87; 95% CI: 1.22,2.88)] and living in food insecure household [(COR= 7.2; 95% CI: (2.84,18.19)] were the variables that positively associated with elderly undernutrition at p-value < 0.25.

In multivariable logistic regression analysis, being housewife, having chronic disease comorbidity, living in food insecure household, not having family and being in oldest-old age group were the factors that had a statistically significant association with elderly undernutrition at p-value <0.05. Being housewife was about 2.4 times more likely to be undernourished when compared to being farmers [(AOR=2.35; 95% CI: (1.17, 4.70)]. Elderly individuals with chronic disease comorbidities were about two times more likely to be undernourished when compared to elderly individuals that had no chronic disease comorbidities [(AOR=2.11; 95% CI: (1.27, 3.52)] and living in food insecure household were about 4.4 times to be undernourished when compared to being in household food secured [(AOR=4.37; 95% CI: (1.60, 11.93)]. Not having a family/supporter were about 3.2 times more likely to be undernourished when compared to its counterparts [(AOR=3.19; 95% CI: (1.54, 6.61)] and being in oldest-old age group (≥85 years old) were about 6.6 times more likely to be undernourished when compared with that of being in young-old age group [(AOR=6.63; 95% CI: (1.31; 33.60)] (Table 5).

Table 5: Factors associated with elderly undernutrition in bivariate and multivariate analysis in Haramaya district, Oromia, Eastern Ethiopia, 2020 (n=449).

Variable	**Category**	**Undernutrition**		**COR (95%CI)**	**AOR (95%CI)**
		YES (%)	**NO (%)**		
Sex	Male	67(43.2)	88(56.8)	1	1
	Female	162(55.1)	132(44.9)	1.61(1.089,2.386)*	0.89(0.48,1.66)
Age	Young-old	170(46.2)	198(53.8)	1	1
	Aged	41(67.2)	20(32.8)	2.39(1.35,4.23)*	1.43(0.68,3.02)
	Oldest-old	18(90)	2(10)	10.48(2.40,45.83)*	**6.63(1.31,33.60)****
Marital status	Married	123(44.9)	151(55.1)	1	1
	Widowed	101(61.2)	64(38.8)	1.94(1.31,2.87)*	1.56(0.81,2.99)
	Divorced and Single	5(50)	5(50)	1.23(0.35,4.34)	0.77(0.15,3.89)
Educational level	Able read & write	9(39.1)	14(60.9)	1	1
	Unable read & write	220(51.6)	206(48.4)	1.66(0.70,3.92)*	0.91(0.33,2.52)
Khat farm owning status	Yes	117(44)	149(56)	1	1
	No	112(61.2)	71(38.8)	2.01(1.37,2.95)*	1.04(0.42,2.62)
Crop farm owning status	Yes	113(46.5)	130(53.5)	1	1
	No	116(56.3)	90(43.7)	1.48(1.02,2.15)*	0.51(0.23,1.14)
Food eating style	Alone	105(68.6)	48(31.4)	3.03(2.01,4.58)*	1.61(0.85,3.07)
	With family	124(41.9)	172(58.1)	1	1
Has supporting family in home	Yes	152(42.7)	204(57.3)	1	1
	No	77(82.8)	16(17.2)	6.46(3.62,11.51)*	**3.19(1.54,6.61)****
Occupation	Farmers	55(35.7)	99(64.3)	1	1

	Housewife	62(53.4)	54(46.6)	2.07(1.26,3.38)*	**2.35(1.17,4.70)****
	Depend on family	112(62.6)	67(37.4)	3.01(1.92,4.71)*	1.31(0.63,2.74)
Average monthly family income in ETB	0-500	172(54.4)	144(45.6)	1.64(0.93,2.91)*	0.90(0.45,1.81)
	501-1000	33(43.3)	43(56.7)	1.06(0.53,2.11)*	0.86(0.40,1.85)
	>=1001	24(42.1)	33(57.9)	1	1
Chronic disease status	Yes	73(62.4)	44(37.6)	1.87(1.216,2.882)*	**2.11(1.27,3.52)****
	No	156(47)	176(53)	1	1
HHFS status (FCS)	Poor	178(64.3)	99(35.7)	7.19(2.844,18.19)*	**4.37(1.60,11.93)****
	Borderline	45(31.7))	97(68.3)	1.86(0.709,4.856)	1.36(0.49,3.78)
	Acceptable	6(20)	24(80)	1	1

* = P-value < 0.25, ** = P-value < 0.05.

5. DISCUSSION

This study revealed that the overall prevalence of undernutrition among the sampled community-dwelling elderly population was 51%. Having chronic disease comorbidity, being housewife, not having family, Being in oldest-old age group and Being household food insecure were the factors that were positively associated with elderly undernutrition.

The prevalence of elderly undernutrition found in this study was less than the prevalence found by study findings in Netherlands (56.8%)(Borkent *et al*., 2019). This finding difference may be due to the characteristics of the study population's geographical location and the tool used to assess nutritional status of the population. To the contrast to this, the prevalence of elderly undernutrition of this study was greater than the studies conducted in different areas of India including Puducherry, south India (24.8% and 17.9%), and south India (9.1%)(Kalaiselvi *et al*., 2016, Krishnamoorthy *et al*., 2018, Konda *et al*., 2018). The difference may be occurred due to tool used to assess nutritional status, socio-economic difference and sample size for the population under study. A limited study that were conducted in Ethiopia also reported the prevalence lower than this study finding (17.1-22.7%)(Wondiye *et al*., 2019, Adhana *et al*., 2019, Legesse *et al*., 2019). The difference may be due to socio-economic status of the study area, population residence (Rural vs. Urban) and tool used for nutritional assessment (MNA vs. BMI).

Regarding the association between occupation and the elderly undernutrition the finding of this study showed that there was a significant association between being housewife and elderly undernutrition. Being housewife were nearly about 2.4 times more likely to be suffer from undernutrition when compared to being farmers. This finding was parallel with the study findings conducted in Puducherry, China which was reported that about 95% of undernourished elderly were unemployed and a study conducted among elderly population of Nepal was also reported unemployed were 3.23 times more likely to be malnourished when compared to its counterparts(Krishnamoorthy *et al*., 2018, Tamang *et al*., 2019). Another similar study that was conducted in south India revealed similar finding which showed unemployment was statistically significant association with elderly undernutrition when seen with its counterparts(Konda *et al*., 2018).

Being in an advanced age particularly being in oldest-old age group was also one of the variables found to be a statistically significant association with elderly undernutrition. Being in an oldest-old age group was about 6.6 times more likely to be undernourished when compared to being in a young-old age group. This finding was supported by different studies conducted at different study settings throughout the world. Of these studies a study conducted in Debra Markos of Ethiopia, Bogota Colombia, Sri Lanka, and china which reported being in oldest-old 3.45 times, 1.02 times, 1.06 times, and 1.09 times more likely to be undernourished respectively(Adhana *et al*., 2019, Chavarro-Carvajal *et al*., 2015, Damayanthi *et al*., 2018, Wei *et al*., 2018). Another study that were conducted in Puducherry (South India) being in ≥70 years old were 2.4 times more likely to be undernourished(Krishnamoorthy *et al*., 2018), in Gondar (Ethiopia) being ≥85 years old were 3.9 times more likely to be suffer from undernutrition(Legesse *et al*., 2019), in Finland being in an advanced age were significantly associated with undernutrition(Nykanen *et al*., 2013), in France being in oldest-old (≥85 years old) were more likely to be suffer from undernutrition(Torres *et al*., 2014).

Another finding of this study showed that chronic disease comorbidity had a significant association with elderly undernutrition. Having chronic disease comorbidity increases the chance of being undernourished by about two folds when compared with individuals that were not having chronic disease comorbidities. This finding was supported by studies conducted in different study areas. The study conducted in rural area of west Bengal reported individuals with chronic disease comorbidity were 3.8 times more likely to be undernourished(Ghosh and Dasgupta, 2017). Likewise, a study conducted in Bogota of Colombia reported having a chronic disease comorbidity increases the chance of being undernutrition by 16%(Chavarro-Carvajal *et al*., 2015) and another similar finding was reported from study conducted in Nigeria which declared having the chronic case increases the odds of being undernourished by 2.105 folds(Adebusoye *et al*., 2014). Moreover, a study reports from Nepal and Taiwan also supports the finding of this study by reporting having a chronic disease comorbidities increased the chance of being suffered from undernutrition by 3.01 and 2.64 folds when compared to elderly individuals that had no chronic disease comorbidities respectively(Tamang *et al*., 2019, Poda *et al*., 2019).

Regarding the association between elderly undernutrition and household food security status this study found that being household food insecure were about 4.4 times more likely suffer from undernutrition when compared to being in household food secured. This finding was supported with the result found from the study done in Gondar which declared that the odds of undernutrition was 1.95 times higher among household food insecure respondents(Legesse *et al.*, 2019).

Another finding of this study was not having a family increased the chance of being undernourished by about 3.2 folds when compared to that of having a family. This finding was supported by the studies conducted in Saudi Arabia, south-eastern Brazil and Spain which all of them reported that living alone was positively associated with elderly undernutrition(Nykanen *et al.*, 2013).

5.1. Strengths and limitations of the study

The strengths of this study are that this study considered the household food security status the one which did not considered by many studies on similar title. It was done on community-dwelling elderly while many studies done on elderly population nutrition assessment were done on hospitalized elderly patients.

The study could have the following limitations: this study was focused only on rural elderly population which might not represent the urban residents. Since prevalence study by itself shows the snapshot of the specific time period the magnitude of undernutrition in this study result only showed the result of the past three months before the data collection. Some information obtained from elderly on some questions might suffer from recall bias. Micronutrient status was not assessed for study participants due to resource constraints.

6. CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

This study finding revealed that the prevalence of elderly undernutrition is very high in Haramaya district, Eastern Ethiopia. This finding makes the elderly undernutrition the public health problem in the study area.

Being in oldest-old age group, having chronic disease comorbidity, being housewife, not having family and living in food insecure household were the factors that were positively associated with elderly undernutrition.

6.2. Recommendations

For Haramaya district health office:

- To implement nutrition intervention among elderly population.

For East Hararghe zone health department:

- To support and follow the implementation of elderly nutrition intervention and provide feedback for gaps with action taking in collaboration with all stakeholders.

For researchers:

- To conduct further study on elderly nutrition status assessment by changing study methodology with adding biochemical parameters and to report the findings for all stakeholders for action.

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8. ANNEXES

8.1. Informed voluntary consent form for head of Haramaya district health office

My name is ……..,I am working as a data collector in a study being conducted in this community by Olika Gizachew who is studying for his master's degree at Haramaya University, College of Health and Medical Sciences. I kindly request you to lend me your attention to explain you about the study, study participants and your district being selected as the study setting.

Study title: Prevalence of undernutrition and Associated factors among elderly population in Haramaya district, East Hararghe zone, Eastern Ethiopia.

Aim of the Study: The findings of the study help Haramaya district health office to plan on older age nutrition status assessment and interventions. Moreover, the aim of this study is to write a thesis as a requirement for the partial fulfillment of master's program in Master's degree in Public Health Nutrition.

Procedure and duration: I will be interviewing older people greater than sixty years old individuals using a questionnaire to provide me a relevant data that is helpful for the study. I will interview them about 60 questions using a questionnaire that will totally takes about 25 to 30 minutes, so I kindly ask them to spare their time with me.

Risks and benefits: There is a limited minimal risk that may face them when participating in this study and will take about 25 to 30 minutes of their working time. There will not be any direct payment for participating in this study. Moreover, the finding from this research may reveal important information for the local health planners and implementers.

Confidentiality: The information participants will provide us will be confidential. There will be no information that will identify participants in particular. The finding of the study will be general to the study participants and will not reflect any thing particular of individual person or housing. The questionnaire will be coded to exclude showing names and other specific identity. No reference will be made in oral or written reports that could link participants to the research.

Rights: Participation of the study will be fully voluntary. Participants have the right to declare to participate or not in this study. If they decide to participate, they have the right to withdraw

from the study at any time and this will not label for any loss of benefits which they otherwise entitled. Participants do not answer any question that they do not want to answer.

Contact Address: If you have any question or inquire at any time please contact with the following addresses:

Principal investigator: Olika Gizachew, Email:olikagizachew1@gmail.com,Mobile phone: 0913999671/0945913252, Haramaya University College of Health and Medical Sciences Institutional Research Ethical Review Committee: Office phone: 0254662011 and P. O. Box: 235, Harar.

Declaration of informed voluntary consent: I have read the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that have been unclear. I was informed that participants have the right to withdraw from the study at any time or not to answer any question that they do not want. Therefore, I declare my voluntary consent to allow this study to be conducted in _____kebeles on behalf of the kebeles management with my initials (signature) as indicated below.

Name & Signature of the head of health center_____ Date_____

Name & Signature of data collector _____ Date_____

8.2. Afan Oromo version of information sheet and informed consent form with head of Haramaya district health office

Walii galtee I/G/W/E/F aanaa Haramayaatif waliin taasifamu

Ani maqaan koo……..jedhama. Kanan hojjedhu qorannoo Obbo Oliiqaa Gizaachoo barnoota isaanii digirii lammaffaaf Yuuniversiitii Haramayaa, Koollejjii Fayyaa fi Meedikalaatti barataa jiraniif ragaa qorannoo funaanudha. Kanaafis duraan dursee waan isin gaafadhuu fi waa'ee qorannichaa waanan isiniif ibsu yaadaan akka na dhaggeeffattanii fi qorannicha irratti ga'ee hirmaannaa isinirraa eegamu akka nu faana taataniif kabaja waliin isin gaafadha.

Mata Duree Qorannichaa

Hir'ina nyaataa fi dhimmoota isaan walqabatan manguddoota waggaa ja'aatamaa fi isaa olii (≥60) aanaa Haramayaa keessa jiraatan irratti gaggeessuudha.

Kaayyoo Qorannichaa

Jalqabarratti bu'aan qorannoo kanaa kan fayyadu Waajjira Eegumsa fayyaa aanaaHaramayaa kan gargaaru yoo ta'u, lammaffarratti kaayyoon qorannoo kanaa eebba barnoota digrii lammaffaa geggeeffamaa jiruufi.

Adeemsaa fi Yeroo qorannichaa

Ani gaaffilee adda addaa waanan gaafadhuuf ragaa dhugaa irratti hundaa'eefii qorannichaaf gargaaru akkan argadhuuf gargaarsa barbaachisaa akka laattaniifi. Kanan gaafachuuf deemu hanga gaaffii 60 yoo ta'u walii galatti hanga daqiiqaa 25-30 fudhata.

Miidhaa fi Faayidaa Qorannichaa

Qorannoo kana keessatti sababa hirmaataniif faayidaan kallattiin isaanif kennamu hin jiru. Akkasumas miidhaan isaanirra gahus baay'ee xiqqaadha, kunis yeroo qabdu keessaa gara daqiiqaa 30 kennuun alatti kan hin jirre dha. Garuu bu'aan qorannoo kanaa namoota karoora baasaniif ragaa barbaachisaa ta'a.

Iccitii ragaalee

Iccitiin Ragaalee nuti funaannuu iccitiin kan eeggamee taa'udha. Ragaan kamuu addatti baasee waa'ee nama dhuunfaa hirmaataa qorannichaa ibsu hin jiraatu. Gaaffileen gaafatamu lakkoofsa addaa kennammeefii waan jiruuf maqaan hirmaataa hin barbaachisu. Ragaan nama dhuunfaa qorannoo wajjiin addatti baasee ibsu tokkollee hin jiraatu.

Mirga hirmaataa qorannichaa

Hirmaattonni qorannoo kanaa hundi hirmaachuu kan danda'an mirga isaaniin ta'a. Hirmaachuu dhiisuf mirga qabu. Yoo hirmaachuuf murteessan, gaaffii fi deebii kennaa jiran yeroo barbaaddetti addaan kutuu danda'u, kana jechuun faayidaan ala ta'a jechuu miti. Gaaffii fi deebii keessatti gaaffii hin barbaadneef deebii kennuu diduu ni danda'u.

Karaa ittiin qorataa qunnamtu

Yoo gaaffiis ta'ee komii jiraate yeroo barbaaddetti lakkoofsa bilbilaa armaan gadiin qaama dhimmi ilaaluu qunnamuu dandeessa.

Lakk. Bilbilaa: 0913999671/0945913252 kan qorannicha geggeessuu fi 0254662011/ P.O. Box. 235, Harar---- Institutional Health Research Ethics Review Committee (IHRERC). Haramaya Yuuniversiitiitti koree qorannoo fayyaa fi seera qabeessummaa isaa hordofu.

8.3. Participant Information Sheet & Informed voluntary Consent Form for Study Participants

My name is ……..,I am working as data collector for the study being conducted in this community by Olika Gizachew who is studying for his master's degree at Haramaya University, College of Health and Medical Sciences. I kindly request you to lend me your attention to explain you about the study and being selected as the study participant.

Study title: Prevalence of undernutrition and associated factors among elderly population in Haramaya district, East Hararghe Zone, Eastern Ethiopia

Aim of Study: The findings of the study help Haramaya district health office to plan on older age nutrition status assessment and interventions. Moreover, the aim of this study is to write a thesis as a requirement for the partial fulfillment of master's program in Public Health Nutrition.

Procedure and duration: I will be interviewing you using a questionnaire to provide me a relevant data that is helpful for the study. There are about 60 questions to answer when I will fill the questionnaire by interviewing you. The interview will take about 25 to 30 minutes, so I kindly ask to spare me this time for the interview.

Risks and benefits: The risk of being participating in this study is very minimal, but only taking few minutes from your time. There will not be any direct payment for participating in this study. Moreover, the finding from this research may reveal important information for the local health planners and implementers.

Confidentiality: The information you will provide us will be confidential. There will be no information that will identify you in particular. The finding of the study will be general to the study participants and will not reflect any thing particular of individual person or housing. The questionnaire will be coded to exclude showing names and other specific identity. No reference will be made in oral or written reports that could link participants to the research.

Rights: Participation of the study will be fully voluntary. You have the right to declare to participate or not in this study. If you decide to participate, you have the right to withdraw from the study at any time and this will not label for any loss of benefits which you otherwise entitled. You do not answer any question that they do not want to answer.

Contact Address: If you have any question or inquire at any time about the study or procedures, please contact with the following address:

Principal investigator: Olika Gizachew Wantolo

Email:olikagizachew1@gmail.com

Mobile phone: 0913999671/0945913252

Haramaya University College of Health and Medical Sciences Institutional Research Ethical Review Committee: Office phone: 0254662011

P.O Box: 235, Harar.

Declaration of informed voluntary consent: I have read the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality, the rights of participating and the contact address for any queries. I have been given the opportunity to ask questions for things that have been unclear. I was informed that participants have the right to withdraw from the study at any time or not to answer any question that they do not want. Therefore, I declare my voluntary consent to allow this study to be conducted in _____kebeles on behalf of the kebeles management with my initials (signature) as indicated below.

Name & Signature of the head of health center_____ Date_____

Name & Signature of data collector _____ Date_____

8.4. Afan Oromo version of participant information sheet and informed voluntary consent form

Walii galtee hirmaattota qorannichaa waliin geggeeffamu

Ani maqaan koo……..jedhama. Kanan hojjedhu qorannoo Obbo Oliiqaa Gizaachoo barnoota isaanii digirii lammaffaaf Yuuniversiitii Haramayaa, Koollejjii Fayyaa fi Meedikalaatti barataa jiraniif ragaa qorannoo funaanudha. Kanaafis duraan dursee waa'ee qorannichaa fi maalif hirmaataa qorannichaa taatanii akka filamtaniif waanan isiniif ibsuuf yaadaan akka na dhaggeeffattanii fi gaaffileen itti aansee isin gaafadhuuf nuffii malee akka naaf deebiftaniif kabaja guddaa waliin isin gaafadha.

Mata Duree Qorannichaa

Hir'ina nyaataa fi dhimmoota isaan walqabatan manguddoota waggaa ja'aatamaa fi isaa olii (≥ 60) Aanaa Haramayaa keessa jiraatan irratti gaggeessuu.

Kaayyoo Qorannichaa

Jalqabarratti bu'aan qorannoo kanaa kan fayyadu Waajjira Eegumsa fayyaa Aanaa Haramayaa kan gargaaru yoo ta'u, lammaffarratti kaayyoon qorannoo kanaa eebba barnoota digrii lammaffaa geggeeffamaa jiruufi.

Adeemsaa fi Yeroo qorannichaa

Ani gaaffilee adda addaa waanan gaafadhuuf ragaa dhugaa irratti hundaa'eefii qorannichaaf gargaaru akkan argadhuuf gaaffileen isin gaafadhuuf obsaa akka naaf deebistaniifi. Kanan isin gaafachuuf gaafachuuf deemu hanga gaaffii 60 yoo ta'u walii galatti hanga daqiiqaa 25-30 fudhata.

Miidhaa fi Faayidaa Qorannichaa

Qorannoo kana keessatti sababa hirmaattaniif faayidaan kallattiin isaanif kennamu hin jiru. Akkasumas miidhaan isinirra gahus baay'ee xiqqaadha, kunis yeroo qabdan keessaa gara daqiiqaa 30 naaf kennuun gaaffilee isin gaafadhuuf waan silaa hojjechuuf jettan adda kuttanii deebii naaf kennuun yeroo gubdaniin alatti miidhaa isin irraan geessisu kan hin jirre dha. Garuu bu'aan qorannoo kanaa namoota karoora baasaniif ragaa barbaachisaa ta'a.

Iccitii ragaalee

Iccitiin Ragaalee nuti isinirraa fudhannuu kan eeggamuudha. Ragaan kamuu addatti baasee waa'ee keessan ibsu hin jiraatu. Gaaffileen gaafatamu lakkoofsa addaa kennammeefii waan

jiruuf maqaan keessan hin barbaachisu. Ragaan nama dhuunfaa qorannoo wajjiin addatti baasee ibsu tokkollee hin jiraatu.

Mirga hirmaataa qorannichaa

Hirmaataa qorannoo kanaa ta'uun fedhii guutuun keessan qofa irratti kan hundaa'e ta'a.qorannicha irratti hirmaachuu dhiisuu mirga qabdu. Yoo hirmaachuuf murteessan, gaaffii fi deebii kennan yeroo barbaaddettanitti addaan kutuu dandeessu, kana jechuun faayidaan ala ta'a jechuu miti. Gaaffii fi deebii keessatti gaaffii hin barbaadneef deebii kennuu diduu ni dandeessu.

Karaa ittiin qorataa qunnamtan

Yoo gaaffiis ta'ee komii jiraate yeroo barbaaddetti lakkoofsa bilbilaa armaan gadiin qaama dhimmi ilaaluu qunnamuu dandeessa.

Lakk. Bilbilaa: 0913999671/0945913252 kan qorannicha geggeessuu fi 0254662011/ P.O. Box. 235, Harar---- Institutional Health Research Ethics Review Committee (IHRERC). Haramaya Yuuniversiitiitti koree qorannoo fayyaa fi seera qabeessummaa isaa hordofu.

Walii galtee hirmaattota qorannichaa waliin geggeeffamu

Ani waraqaa ragaa hirmaattotaa dubbisee/ naaf dubbifamee jira. Ifatti kaayyoo qorannichaa, adeemsa, miidhaa fi bu'aa, iccitii, mirgaa fi lakkoofsa yeroo rakkoon uumamee fi gaaffiin jiraate ittiin qunnamu argadheen jira. Carraa gaaffii naaf hin galle yeroo kamittuu gaafachuu danda'uu fi yeroon barbadetti qorannicha keessaa itti bahuu danda'u naaf kennamee jira. Kanaaf, ani walii galtee qorannicha keessatti ittiin hirmaadhu mallattoo kootiin akka armaan gadiitti nan seena.

Maqaa fi Mallattoo hirmaataa/hirmaattuu_____Guyyaa_____

Maqaa fi mallattoo ragaa funaanaa_____Guyyaa _____

8.5. Questionnaire for Participant Interview (English version)

Questionnaire English part

Client number _____ Client code _____

Name of data collector: _____Signature_____ Date: _____

Name of supervisor: _____ Signature_____ Date_____

PART I: Socio-demographic and life style factors questionnaire (circle on the response)

S.N.	Questions	Responses	Code	Skip to Q
Q101	Sex	1= Male 2= Female		
Q102	Age	_____		
Q103	Marital status	1= Single 2= Married 3= Divorced 4= Separated 5= Widowed		
Q104	Ethnicity	1= Oromo 2= Amhara 3= Tigrai 4= others (specify……)		
Q105	Religion	1= Muslim 2= Orthodox 3= Protestant 4= Other (Specify…….)		
Q106	Educational level	1. Unable to read and write 2. Can read and write 3. Primary school (1-8) 4.Secondary school (9-12) and above		
Q107	What is your occupation?	1= Farmer 2= Housewife 3= Dealer (skip to Q8) 4= depend on family 5= Other (specify……...)		Q108
Q108	Do you have chat farm?	1= Yes 2= No (skip to Q110)		Q110
Q109	How many qind of Land size of chat?	_____		
Q110	Do you have Land for crop?	1= Yes 2= No(skip to Q112)		Q112
Q111	How many qind of crop land do you have?	_____		
Q112	How much is your monthly income in ETB?	1._____ETB 2. Don't know		
Q113	Do you have family?	1=Yes (skip to Q114) 2=No (skip to Q115)		Q114 Q115
Q114	How many families do you have?	1= One		

		2= Two 3=Three and above		
Q115	Do you normally eat alone or with family?	1 = alone 2 = with family		
Q116	Do you chew chat?	1= Yes (skip to Q117) 2= No		Q117 Q118
Q117	How frequent?	1= Every day 2= Every other day 3= Only With my friends		
Q118	Do you drink alcohol?	1= Yes 2= No		
Q119	Do you smoking cigarette?	1 = Yes 2 = No		Q120 Q121
Q120	How frequent?	1= Every day 2= Every other day 3= Only With my friends		
Q121	Do have any chronic disease?	1= Yes 2= No		Q122
Q122	If yes for Q121, which disease do you have?	1= Hypertension 2= Renal disease 3= Heart disease 4= Hearing problem 5= Vision problem 6= Other (specify……..)		

Part II: Household food consumption score (FCS) (√)

S.N	In the past 7 days, how often have you eaten	0 Never	1 <1/wk	2 1-2/wk	3 Often 3-6/wk	4 Always Every day
Q201	Any food made from grains—injera, teff, millet, sorghum, maize, rice, wheat, bread, biscuits, or any other grain product—or any food made from tubers—potatoes, sweet potatoes, carrots, or other foods made from roots or tubers?					
Q202	Any pulses (beans, lentils, peas)?					
Q203	Any vegetables?					
Q204	Any fruits?					
Q205	Any meat: beef, lamb, goat, fish, chicken, or, liver, kidney, or other organ meats?					
Q206	Any eggs					
Q207	Any dairy products—milk, cheese, yogurt (Not including butter)?					
Q208	Any sugar or honey?					
Q209	Any oil, fat, or butter?					

PART III: MNA QUESTIONNARES

S.N	Questions	Response options	Code
Q301	Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?	0 = severe decrease in food intake 1 = moderate decrease in food intake 2 = no decrease in food intake	
Q302	Weight loss during the last 3 months?	0 = weight loss greater than 3kg 1 = does not know 2 = weight loss between 1 and 3kg 3 = no weight loss	
Q303	How would you describe your current mobility?	0 = bed or chair bound 1 = able to get out of bed / chair but does not go out 2 = goes out	
Q304	Has suffered psychological stress or acute disease in the past 3 months?	0 = yes 2 = no	
Q305	Neuropsychological problems (dementia)	0 = severe dementia or depression 1 = mild dementia 2 = no psychological problems	
Q306	Body Mass Index (BMI) = weight in kg/Ht. in m^2 Weight in kg = _____ Height in m= _____	0 = BMI less than 19 1 = BMI 19 to less than 21 2 = BMI 21 to less than 23 3 = BMI 23 or greater	
Q307	Lives independently (not having regular hospital follow up)	1 = yes 0 = no	
Q308	Takes more than 3 prescription drugs per day	0 = yes 1 = no	
Q309	Pressure sores or skin ulcers	0 = yes 1 = no	
Q310	How many full meals does the individual eat daily?	0 = 1 meal 1 = 2 meals 2 = 3 meals	
Q311	Selected consumption markers for protein intake •At least one serving of dairy products (milk, cheese, yoghurt) per day. •Two or more servings of legumes or eggs per week •Meat, fish or poultry every day	YES NO YES NO YES NO 0.0 = if 0 or 1 Yes answer 0.5 = if 2 Yes answers 1.0 = if 3 Yes answers	
Q312	Consumes two or more servings of fruit or vegetables per day?	0 = no 1 = yes	
Q313	How much fluid (water, juice, coffee, tea, milk...) is consumed per day?	0= less than 3 cups 0.5 = 3 to 5 cups 1 = more than 5 cups	

Q314	How did you eat your food? (Mode of feeding)	0 = unable to eat without assistance 1 = self-fed with some difficulty 2 = self-fed without any problem	
Q315	What do think about your nutritional status? (Self-view of nutritional status)	0 = views self as being malnourished 1 = is uncertain of nutritional state 2 = views self as having no nutritional problem	
Q316	In comparison with other people of the same age, how does the patient consider his / her health status?	0 = not as good 0.5 = does not know 1 = as good 2 = better	
Q317	Mid-Upper arm circumference (MUAC) in cm MUAC in cm =_____	0 = MUAC less than 21 0.5 = MUAC 21 to 22 1 = MUAC greater than 22	
Q318	Calf circumference (CC) in cm =_____	0 = CC less than 31 1 = CC 31 or greater	

Part IV: The depression assessment questionnaire (GDS) (√)

S.N.	**Question**	**Answer**	
		YES	**NO**
Q401	Are you basically satisfied with your life?		
Q402	Have you dropped many of your activities and interests?		
Q403	Do you feel that your life is empty?		
Q404	Do you often get bored?		
Q405	Are you in good spirits most of the time?		
Q406	Are you afraid that something bad is going to happen to you?		
Q407	Do you feel happy most of the time?		
Q408	Do you often feel helpless?		
Q409	Do you prefer to stay at home, rather than going out and doing new things?		
Q410	Do you feel you have more problems with memory than most people?		
Q411	Do you think it is wonderful to be alive?		
Q412	Do you feel pretty worthless the way you are now?		
Q413	Do you feel full of energy?		
Q414	Do you feel that your situation is hopeless?		
Q415	Do you think that most people are better off than you are?		
Total			

PART V: The 6CIT Dementia Test (for question E of MNA questionnaire)

S.N	**Questions**	**Score range**	**Code**	**Weighting**	**Weighted score**
Q501	What Year is it?	0= Right 1= Wrong		X4	
Q502	What month is it?	0= Right 1= Wrong		X3	
Q503	About what time is it?	0= Right		X3	

		1= Wrong			
Q504	Count back from 20-1	0= count correctly 1= make one error 2= make ≥ 2 errors		X2	
Q505	Say months in reverse? (starting from December)	0= count correctly 1= make one error 2= make ≥ 2 errors		X2	
Q506	Repeat the memory phrase? (repeat the address back to you)	0= all correct 1= one bit wrong 2= 2 parts wrong 3= 3 parts wrong 4= 4 parts wrong 5= all wrong		X2	

8.6. Afaan Oromoo Version of data collection instrument

Gaaffilee Afaanii Hirmaattota Waliin Godhamu

Lakk .Hirmaataa _____ Koodii Hirmaata_____

Maqaa Nama Daataa Guuruu _____ Mallattoo_____ Guyyaa _____

Maqaa Supervaayizaraa: _____ Mallattoo_____ Guyyaa_____

Kutaa I: Gaaffilee Hawaasummaa, Diinagdee fi Maatii waliin walqabatan

T/L	Gaaffii	Deebii	Koodii deebii
Q101	Saala	1= Dhiira 2= Dubartii	
Q102	Umurii	Waggaa/amata_____	
Q103	Sadarkaan fuudha fi heeruma keessanii maali?	1= Kan hin fuune/hin heerumne 2= Kan fuudhe/heerumte 3= Kan hiike/hiikte 4= Kan jalaa du'e/duute	
Q104	Sabni keessan maali?	1= Oromoo 2= Amaaraa 3= Tigree 4= Kan biraa (adda baasi……..)	
Q105	Amantaa kam hordofta?	1= Musliima 2= Ortodoksii 3= Piroteestaantii 4= Kan biraa (adda baasi……..)	
Q106	Sadarkaan barnootaa keessanii akkam?	1= Barreessus dubbisuus kan hin dandeenye 2= Dubbisuu fi barreessuu kan danda'u 3= Kutaa (1-8) kan barate 4= Kutaa (9-12th) fi isaa ol kan baratan	
Q107	Hojiin keessan maali?	1= Qonnaan bulaa 2= Haadha manaa 3= Daldalaa/ltuu 4= Maatii irratti hirkatee kan jiraatu/ttu 5= Kan biraa (adda baasi…….....)	
Q108	Lafa jimaa qabdaa?	1= Eeyyee 2= Lakki (gara Q110 darbi)	
Q109	Deebin Q108 eeyyee yoo ta'e, cindii meeqa qabda?	_____	
Q110	Lafa oomisha midhaanii qabdaa?	1= Eeyyee 2= Lakki (gara Q112 darbi)	
Q111	Deebin Q110 eeyyee yoo ta'e, cindii meeqa qabda?	_____	
Q112	Galiin kee baatiitti meeqa ta'a? (maatirratti hirkatee kan jiraatu/ttu yoo ta'e irra darbi)	1= Qarshii_____ 2= Hin beeku	

Q113	Maatii qabdaa?	1= Eeyyee 2= Lakkii (gara Q115 darbi)	
Q114	Deebin Q113 Eeyyee yoo ta'e, maatii meeqa qabdu?	1= Tokko 2= Lama 3= Sadi fi isaa ol	
Q115	Yeroo mara nyaata kophaa moo maatii waliin nyaattu?	1 = Kophaa/Qofaa nyaadha 2 = Maatii waliin nyaadha	
Q116	Jimaa ni qamaataa?	1= Eeyyee 2= Lakkii (hin qama'u) (gara Q118 darbi)	
Q117	Deebin Q116 eeyyee yoo ta'e, yoom yoom qamaata?	1= Guyyaa hunda 2= Guyyaa tokko tokko oolee 3= Ogguu hiriyoota koo arge qofa	
Q118	Dhugaatii alkoolii ni dhugdaa?	1 = Eeyyee 2 = Lakkii	
Q119	Tamboo ni xuuxxaa?	1 = Eeyyee 2 = Lakkii	
Q120	Deebin Q119 eeyyee yoo ta'e, yoom yoom xuuxxa?	1= Guyyaa hunda 2= Guyyaa tokko tokko oolee 3= Ogguu hiriyoota koo arge qofa	
Q121	Dhibee yeroo dheeraa isinirra ture qabduu?	1= Eeyyee 2= Lakkii (hin qabu)	
Q122	Deebin Q121 eeyyee yoo ta'e, Dhibee kam qabdu?	1= Dhiibbaa dhiigaa 2= Dhibee kalee 3= Dhibee onnee 4= Rakkoo gurraan dhaga'uu 5= Rakkoo ijaan arguu 6= Kan biraa (adda baasi……..…)	

Kutaa II: Gaaffilee nyaatota maatidhaan qophaa'ee mana keessatti nyaatamu ittin safaramu (lakkoofsa deebii jalatti''√" godhi)

T.L	**Guyyoota 7 darban kana keessatti gareewwan nyaataa kanneen nyaattee?**	**Torbanitti yeroo meeqa akka nyaatan**				
		0 kan hin nyaanne	**1** yeroo 1 gadi	**2** Yeroo 1-2	**3** yeroo 3-6	**4** Guyyaa hunda
Q201	Nyaata kamuu waan gosa midhaanii irra hojjetamu buddeena/qixxaa, shuroo/marqaa, mishingaa,					

	boqqoolloo, ruuzaa, qamadii, daabboo ykn nyaatota kamuu waan hundeen isaa nyaatamu kan akka dinnichaa, mixaaxisii, kaarotaa fi nyaatota biraa hiddisaanii nyaatamanii?					
Q202	Nyaata kamuu waan akka baaqelaa, ataraa, misiraa/lawuzii irraa hojatame?					
Q203	Nyaata kamuu kan fuduraa irraa hojjetame fi baalli isaanii magariisaa kan akka raafuu, qoosxaa fi kkf					
Q204	Nyaata kamuu waan kuduraa irraa hojjetaman kanneen akka maangoo, burtukaanaa, paappayyaa fi kkf					
Q205	Gosa nyaata foonii waan akka foon horii, foon hoolaa, foon re'ee, qurxummii, foon lukkuu, tiruu, kalee fi foon qaama keessaa kan akka garaachaa, mar'imaanii fi kan biraa?					
Q206	Nyaata kamuu killee irraa hojjetame?					
Q207	Nyaata kamuu bu'aa aannanii irraa waan akka aannanii, ayibii (dhadhaa osoo hin dabalanne)?					
Q208	Nyaata sukkaaraa ykn dammaa kamuu?					
Q209	Nyaata zayitaa, cooma fi dhadhaa kamuu?					

Kutaa III: Gaaffiilee MNA (Lakkoofsa deebii itti mari)

T.L	Gaaffilee	Deebii	Koodii
Q301	Ji'oota sadan darban kana keessatti sababa fedhii nyaataa dhabuutin, nyaatni bullaa'uu diduutin, alanfachuu ykn liqimsuu dadhabuutin nyaata hir'istanii jirtuu?	0 = Nyaata nyaachuu baay'ee yoo hirdhisan 1 = Nyaata nyaachuu xiqqoo yoo hirdhisan 2 = Sirumaa yoo hirdhisuu baatan	
Q302	Ji'oota sadan darban kana keessatti ulfaatinnni qaama keessanii hirdhate meeqa? (qabattoon kofoo/shirrixii, uffanni keessaa fi sabbanni haadholiin mudhiin hidhatan faa itti baldhachuu fi kkf…gaafadhu)	0 = 3kg ol yoo hirdhisan (hedduu yoo hirdhisan) 1 = Yoo hin beekne 2 = 1 fi 3kg gidduu yoo hirdhisan (xiqqoo yoo hir'isan) 3 = Ulfaatinni yoo hirdhachuu baate	
Q303	Sochii kee yeroo ammaan tana akkamiin ibsita?	0 = Siree irra ykn teessoo irra qofa 1 = Siree ykn teessoo irraa ka'uu kan danda'u garuu ala ba'uu kan hin dandeenye 2 = Ala ba'uu kan danda'u	
Q304	Ji'oota sadan darban Kana keessatti	0 = Eeyyee	

	dhiphuu cimaan si muudatee beekaa? ykn yeroo dhiyootti dhukkubsattee turtee?	2 = Lakki	
Q305	Waan akka waa dagachuu ykn mukaa'uu isin muudatee beekaa?	0 = Dagachuu/mukaa'uu cimaa 1 = Dagachuu xiqqaa 2 = Rakkoo dagachuu hin qabu	
Q306	Ulfaatinaa fi dheerina safaranii BMI (kg/m^2) isaa/ishee? Ulfaatina kiilogiraaman(kg)=_____ Dheerina meetiraan(m)=_____	0 = BMI 19 gadi 1 = BMI 19 fi oli fi 21 gadi 2 = BMI 21 fi oli fi 23 gadi 3 = BMI 23 oli	
Q307	Of dandeessanii jiraattuu? Moo (yeroo hedduu hospitaalatti hordoffiif deddeebi'uu/ciisanii turuun jiraa?)	1 = Eeyyee 0 = Lakki	
Q308	Qorichi fudhataa jirtan jiraa? Eeyyee yoo ta'e,guyyaatti qorichoota 3 ol fudhattuu?	0 = Eeyyee 1 = Lakki	
Q309	Gogaa keessanirraa madaa gara ciistanirraa ykn madaa biraa qabduu?	0 = Eeyyee 1 = Lakki	
Q310	Guyyaatti nyaata yeroo meeqa nyaattu?	0 = yeroo 1 1 = yeroo 2 2 = yeroo 3	
Q311	Nyaata pirootiinii nyaachuu agarsiisuuf filataman •Yoo xiqqaate nyaata bu'aa aannanii guyyaatti al tokko argachuu (aannan, ayibii, itittuu). •Killee ykn ocholonii torbanitti yeroo lamaa ol ni nyaattuu? •Guyyaa guyyaan foon, qurxummii ykn foon lukkuu ni nyaattuu?	Eeyyee Lakki Eeyyee Lakki Eeyyee Lakki 0.0 = Yoo eeyyee 0 ykn 1 ta'e 0.5 = Yoo eeyyee 2 ta'e 1.0 = Yoo eeyyee 3 ta'e	
Q312	Nyaata kuduraa fi muduraa guyyaatti yeroo lamaa fi isaa ol ni nyaattuu?	0 = Lakkii 1 = Eeyyee	
Q313	Guyyaatti dhugaatii dhangala'aa waan akka Bishaanii, Juusii, Bunaa, Shaayii, Aannanii ...hagam fayyadamtu?	0.0 = Burcuqqoo 3 gadi ykn litirii 1 gadi 0.5 = Burcuqqoo 3 - 5 ykn litirii 1-1.5 1.0 = Burcuqqoo 5 ol ykn litirii 1.5 ol	
Q314	Nyaata ofumaaf of dandeessanii nyaattu moo nyaachuf gargaarsa barbaaddu?	0 = Nyaachuf gargaarsa kan barbaadu/ddu 1 = Rakkatus ofumaafan kan nyaatu/ttu 2 = Ofumaan of danda'ee kan nyaatu/ttu	
Q315	Haala nyaata keessanii irratti ilaalcha akkamii ofii qabdu?	0 = Hirdhinaa nyaataa qaba jedheen yaada 1 = Hirdhina nyaataa qaba jedhee kan	

		shakku 2 = Hirdhina nyaataa hin qabu jedhee kan amanu	
Q316	Yeroo warra umurii hanga keessanii qaban waliin of madaaltan haala fayyaa keessanii akkamiin ilaaltu?	0.0 = Gaarii miti/isaanii gadi 0.5 = Hin beeku 1.0 = Gaaridha 2.0= Baay'ee gaaridha	
Q317	Safara walakkaa irree harkaa (MUAC) cm'dhaan=_____	0.0 = MUAC < 21 0.5 = MUAC 21 to 22 1.0 = MUAC > 22	Walakkaa Irree Safari!
Q318	Safara sarbaa miilaa (CC)cm'dhaan =_____	0 = CC < 31 1 = CC ≥31	sarbaa Safari!

Kutaa IV: Gaaffilee Mukaa'uummaan ittiin safaramu (akkaataa deebin mallattoo"√" godhi)

T.L.	Gaaffilee	Deebii	
		Eeyyee	Lakki
Q401	Bu'urarraa jireenya ammaan tana jiraachaa jirtutti ni quuftaa?		
Q402	Hojiilee fi fedhii kee hedduu hir'istee jirtaa?		
Q403	Jireenyi kee akka waan duwwaa ta'eetti sitti ni dhaga'amaa?		
Q404	Yeroo hedduu ni gadditaa?		
Q405	Yeroo hedduu miira gaarii keessa ni turtaa?		
Q406	Wanti badaan tokko na muudata jettee ni sodaattaa?		
Q407	Yeroo hedduu gammachuun sitti ni dhaga'amaa?		
Q408	Yeroo hedduu akka nama gargaarsa hin qabne taatetti sitti ni dhaga'amaa?		
Q409	Ala baatee waan haaraa dalaguurra mana taa'uu filattaa?		
Q410	Ati namoota biroorra akka waan waa yaadachuu ykn yaaduu hin dandeenyetti sitti ni dhaga'amaa?		
Q411	Jiraachun baay'ee gaaridha jettaa ni yaaddaa?		
Q412	Haalli amma itti jiraattu kun faayidaa ykn bu'aa hin qabu jettee yaaddaa?		
Q413	Humna guutun qaba jettee yaaddaa?		
Q414	Haalli ammaan tana keessa jirtu abdii kutachiisadha ykn abdii kan hin qabne jettee yaaddaa?		
Q415	Namoonni biroo narra fooyyee qabu jettee yaaddaa?		

Kutaa IV: Gaaffilee hamma waa dagachuu ittiin safaramu (koodii deebii qabutti mari)

S.N	Gaaffilee	Deebii fi koodii deebii	Koodii	Ulfaatina	Ulfaatina deebii
Q501	Ammaan tana bara	0= Qajeellon yoo deebisan		X4	

	meeqaffaa keessa jirra?	1= Qajeellotti yoo deebisuu dhaban			
Q502	Baatin ammaan tana keessa jirru tun tami?	0= Qajeelloon yoo deebisan 1= Qajeellotti yoo deebisuu dhaban		X3	
Q503	Ammaan tana sa'aatin meeqa? (Waaree dura, waaree booda?)	0= Qajeelloon yoo deebisan 1= Qajeellotti yoo deebisuu dhaban		X3	
Q504	Lakkoofsa 20 irraa eegalanii gara duubatti hanga 1 lakkaa'uu?	0= Qajeellotti yoo lakkawan 1= Tokko yoo dogoggoran 2= Lamaa fi isaa ol yoo dogoggoran		X2	
Q505	Baatiwwan amata keessa jiran gara duubatti Hagayya irraa eegalanii haga Fulbaanaa waamuu?	0= Qajeellotti yoo waaman 1= Tokko yoo dogoggoran 2= Lamaa fi isaa ol yoo dogoggoran		X2	
Q506	Waan itti himanii deebi'anii gaafatan yaadatanii waamuu? (Fkn: daandii irra deebitanii galtan gaafachuu ykn waan wal hin fakkaanne 3 waamifiitii, irra deebi'ee waamuu danda'aa/dandeessii?)	0= Hundaa qajeellotti yoo himan 1= Tokko yoo dogoggoran 2= Lama yoo dogoggoran 3= Sadi yoo dogoggoran 4= Afur yoo dogoggoran 5= Hunda yoo dogoggoran		X2	

8.7. Principal Investigator's Curriculum Vitae (CV)

1. Personal detail

Name: Olika Gizachew Wantolo

Sex: Male

Date of Birth: November 28, 1988 G.C

Place of Birth: Sebeta, Finfine surrounding special zone

Marital Status: Married

Nationality: Ethiopian

Address: Shashemene

E-mail: olikagizachew1@gmail.com

Cellular Phone: 0913999671/0945913252

2. Educational background

1998 -2001: 1-4 Grade Debel yahonnes Elementary School (Finfine surrounding special zone)

2002 -2005: 5-8 Grade Tefki Elementary School (Finfine surrounding special zone)

2006-2009: 9-12 Grade sebeta higher and preparatory (Finfine surrounding special zone)

2010-2013: Public Health Officer from Madda Walabu University, College of Health and Medical Sciences.

3. Language proficiency

S/N	Language	Hearing	Writing	Reading	Speaking
1	Afan Oromo	Excellent	Excellent	Excellent	Excellent
2	Amharic	Excellent	Very good	Very good	Very good
3	English	Very good	Excellent	Excellent	Very good

4. Training

I have trained on different topics like: public health emergency management (PHEM), prevention of mother to child transmission of HIV, HMIS, Teaching methodology and deliverology.

5. Working experience

From 2006 t0 2008 E.C I have worked at Agamso and Bere HC as a clinician on adult OPD and as Primary Health Care Unit Director.

From 2008 to 2009 I worked in shashemene health science college as being trainer of HES and HEP.

From 2009 to now I am working in Madda Walabu University, shashemene campus.

6. Computer skill

Good skill in basic computer (Microsoft office Word, Excel, Power point and some statistical software).

7. Reference

1. Dr.Gudina Egata: Haramaya University College of health and medical sciences instructor
Address: Phone No. 0911641362

2. Dr. Kedir Teji: Haramaya University College of health and medical sciences instructor
Address: Phone No.0945809317