Research Article

Nutritional Status and Associated Factors among Older Adults above 65 Years in Harar Town, Eastern Ethiopia: A Community-Based Cross-Sectional Study

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Abstract

Background: *Malnutrition is a major public health concern among older adults in low- and middle-income countries, contributing to increased morbidity, functional decline, and mortality. In Ethiopia, the population aged 60 years and older is projected to rise steadily, yet data on their nutritional status remain scarce. This study aimed to assess the nutritional status and associated factors among adults aged 65 years and older in Harar town, Eastern Ethiopia.*

Methods: *A community-based cross-sectional study was conducted from April 30 to May 29, 2023, among 413 randomly selected adults aged ≥ 65 years in Harar town. Nutritional status was assessed using the validated Mini Nutritional Assessment–Short Form (MNA-SF). Data were entered into EpiData v3.1 and analyzed in SPSS v25. Bivariate and multivariable logistic regression identified factors associated with malnutrition. Crude and adjusted odds ratios (AOR) with 95% Confidence Intervals (CI) were reported, with statistical significance set at p < 0.05.*

Results: *The prevalence of malnutrition was 15.2% (95% CI: 0.18–1.91), and 43.6% (95% CI: 0.38–0.48) were at risk of malnutrition. Factors significantly associated with malnutrition included older age groups from 75 to 84 years (AOR = 4.45; 95% CI: 1.25–15.77) and 85 to 95 years (AOR = 6.54; 95% CI: 1.36–31.31), low educational attainment (AOR = 6.15; 95% CI: 1.26–29.9), recent illness (AOR = 3.16; 95% CI: 1.07–9.26), presence of chronic illness (AOR = 6.48; 95% CI: 2.22–18.86), and poor dietary diversity (AOR = 6.25; 95% CI: 1.38–28.10). Household food insecurity, mild (AOR = 5.62; 95% CI: 1.35–23.30), moderate (AOR = 6.67; 95% CI: 1.69–26.38), and severe (AOR = 6.92; 95% CI: 1.05–45.22), was consistently associated with increased odds of malnutrition.*

Conclusion: *Malnutrition and its risk are common among older adults in Harar town. Key factors include advanced age, chronic illness, poor dietary diversity, and household food insecurity. Public health interventions should focus on improving dietary intake, strengthening nutrition education for older adults and caregivers, and addressing household food insecurity.*

Abbreviations
BMI: Body Mass Index
CI: Confidence Interval
COPD: Chronic Obstructive Pulmonary Disease
DDS: Dietary Diversity Score
DM: Diabetes Mellitus
HFIAS: Household Food Insecurity Access Scale
IHERC: Institutional Health Ethics Review Committee
MNA: Mini Nutritional Assessment

MNA-SF: Mini Nutritional Assessment Short-Form
NGOs: Non-Governmental Organizations
SPSS: Statistical Package for the Social Sciences

1. Introduction

The global population is experiencing a major demographic transition as people are living longer worldwide. Between 2015 and 2050, the percentage of individuals ≥ 65 years old is forecast to rise significantly from 12% to 22%. For the first time, there are

now more seniors than children under 5 years old globally. This rapid aging trend is occurring most quickly in developing nations. Approximately 80% of the world's older population is estimated to reside in low- and middle-income countries by 2050. The number of adults ≥ 65 living in these nations is expected to triple from 524 million in 2010 to 1.5 billion in 2050, according to the World Health Organization's projections [1]. Ethiopia's population had a life expectancy of 63 years in 2018, according to the World Factbook from December 7, 2019, which reflects steady gains in population survival [2]. Metrics based on age structure, such as the potential support ratio, often rely on age thresholds like 65, 60, or 70 years to define the "old-age" bracket and assess societal support systems [3].

Older individuals in Ethiopia face numerous socioeconomic challenges, including homelessness, financial exploitation, and neglect, largely stemming from the absence of state income assistance and a lack of targeted social protection. These hardships are closely linked to household food insecurity and inadequate dietary diversity, which contribute to high rates of malnutrition and chronic illness. Despite being home to more than 5 million senior citizens, Ethiopia does not have a national aging strategy or formally defined benefits for elderly populations [4]. As nutritional problems and noncommunicable diseases rise among the elderly globally, malnutrition has emerged as a significant public health problem among older adults, particularly in developing countries [5,6]. Changes in lifestyle and diet, in combination with underlying poverty, have led to a dual burden of disease where undernutrition and overnutrition coexist, resulting in increased mortality and economic loss among older populations in low-income societies like Ethiopia.

The nutritional health of the elderly is shaped by numerous social factors, chronic health conditions, and pharmaceutical use, which can interfere with nutrient absorption. Physiological changes brought on by aging, including declines in sensory perception, hormonal regulation, gastrointestinal function, renal capacity, and muscle mass, also alter nutritional requirements. Dietary allowances are designed to meet the needs of healthy older adults, but survey data show that many within this group are unable to fulfill their nutritional needs due to functional limitations and social barriers. Kaur et al. suggest that a segment of the senior population is especially susceptible to nutritional deficiencies, with compounding vulnerabilities [7]. Malnutrition affects approximately one in every six older individuals, and this figure is expected to increase as global aging accelerates. Cawood et al. and Leslie & Hankey report that malnutrition is associated with a 30% increase in hospital readmission rates among older adults, representing a major burden for both individuals and national healthcare systems [8,9]. Unfortunately, malnutrition in older populations often goes unrecognized due to inadequate routine screening and assessment.

In Ethiopia, nearly one-third of older adults experience some form of physical or sensory limitation, including difficulties with vision, mobility, and hearing that impair their ability to access and utilize food. While a minority of older adults receive pensions, the majority, especially in rural settings, remain dependent on support from relatives [10]. Malnutrition among older adults is defined as a state of poor nutritional status resulting from insufficient or imbalanced nutrient intake. It is associated with adverse health outcomes such as physical pain, anxiety, and depression. Factors such as feeding difficulties, reduced mobility, psychological stress, widowhood, illiteracy, caregiving responsibilities, poverty, and limited access to health and social services further elevate the risk of malnutrition in the elderly. Mezemir et al., argue that older adults, often overlooked, represent a vital societal resource who require protection and investment. Timely diagnosis and identification of malnutrition and its risk factors are essential to design effective public health interventions targeted at this vulnerable group [11].

Ethiopia currently faces a silent public health crisis. Malnutrition among older adults is estimated to affect more than 20% nationwide, significantly diminishing quality of life and personal well-being. This vulnerability is not just a numerical burden; it is a profound threat to the foundations of health and dignity in later life. Yet despite its magnitude, this issue has received insufficient research attention. Ethiopia has one of the highest rates of older adult malnutrition in Africa, surpassing the continental average of 18% [12]. In the northwest region, studies estimate malnutrition prevalence rates between 9% and 22% [13]. The situation is more severe in eastern Ethiopia, where over half of older adults (51.7%) are classified at risk of malnutrition and another 15.7% are already malnourished [14].

Despite its growing importance, research on older adult malnutrition in Ethiopia remains limited. Existing studies disproportionately focus on children and general adult populations, leaving geriatric nutritional needs poorly understood and largely neglected. This lack of targeted research has dire consequences. Chronic diseases, urban residency, depression, and food insecurity act as potent risk factors that compound malnutrition and undermine the health and independence of elderly individuals. Policymakers and healthcare workers, hampered by a lack of comprehensive data and assessment tools, are unable to address the issue effectively and equitably. The consequences extend far beyond statistics. Malnutrition exacerbates existing health conditions, limits functional autonomy, and erodes the overall vitality of older adults. The absence of community-level data creates challenges for decision-makers, who struggle to allocate resources, establish support systems, and create evidence-based programs to mitigate these risks. This study aims to fill that knowledge gap by establishing a detailed baseline on the prevalence and determinants of malnutrition among older adults in Harar town, eastern Ethiopia. In doing so, it seeks not only to shed light on a neglected issue but also to catalyze the development of tailored interventions, screening protocols, and public health strategies that uphold the health, dignity, and agency of Ethiopia's aging population. By presenting robust, community-

based evidence, this research affirms that the lives of older adult's matter. It challenges the silence surrounding malnutrition and calls for urgent, coordinated action. Through better data, we can begin to craft a future where aging is supported with care, where nutritional health is a right and not a privilege, and where every individual, regardless of age, can thrive.

2. Methodology

2.1. Study Area and Period
A community-based cross-sectional study was conducted in Harar Town, Eastern Ethiopia, from April 30 to May 29, 2023. Harar is located approximately 526 kilometers east of Addis Ababa and had an estimated population of 263,657, consisting of 100,126 males and 98,854 females. 49.5% of the population is estimated to be rural inhabitants, while 50.5% are urban dwellers, which is around 137,000 (M:F = 124,000:68,000) urban residents [15]. The region comprises six urban and three rural districts, further subdivided into 19 urban and 17 rural kebeles, which are the smallest administrative units in Ethiopia.

2.2. Study Design
A quantitative cross-sectional design was employed to assess the nutritional status and associated factors among older adults aged 65 years and above.

2.3. Study Population and Eligibility
The source population for this study included all adults aged 65 years and above residing in Harar Town, Eastern Ethiopia. These individuals represent a growing segment of the population who are particularly vulnerable to nutritional challenges due to physiological aging, comorbidities, and socio-economic constraints. The study population specifically consisted of older adults aged 65 years and above who were residing in the selected kebeles during the time of data collection. Only individuals who were physically present, cognitively able, and willing to participate were included in the final sample. This defined population allowed for the assessment of nutritional status and associated factors within a community-based context, ensuring representativeness and relevance to the broader elderly population in urban Harar.

2.4. Sample Size Determination and Sampling Technique
The sample size for the first objective was calculated using a single population proportion formula, assuming a 95% confidence level, a 5% margin of error, a prevalence of 20.53%, and a design effect of 1.5. Including a 10% non-response rate, the final sample size was 413 [16].

$$n=(1.96^2 \times 0.2053(1 - 0.2053) \div 0.05^2) \times 1.5 = 375.9 \approx 376$$

Considering a 10% non-response rate, the sample size becomes 413.

For the second specific objective, to assess factors associated with nutritional status, a separate sample size calculation was performed using Epi Info version 7.1.5. This was based on key assumptions, including a 95% confidence interval, 80% power, estimated proportions of exposure among cases and controls, and an odds ratio from previous studies. The estimated required sample size for this objective was 207 participants. However, since the required sample size for the first objective (413) was larger and sufficient to detect associations, it was adopted as the final sample size for the study.

A multistage sampling technique was applied. Initially, five kebeles (04, 05, 09, 14, and 17) were randomly selected from the 19 kebeles in Harar Town using Random Number Generator Software version 3.1. The total sample was then proportionally allocated across the selected kebeles based on the population of older adults in each area: 19.1% from kebele 04, 19.9% from kebele 05, 19.2% from kebele 09, 20% from kebele 14, and 21.8% from kebele 17. Within each kebele, participants were then selected using a simple random sampling approach, aiming to enhance the representativeness of the study population.

2.5. Data Collection Methods
Data collection in Harar Town was conducted through face-to-face interviews using a structured and pre-tested questionnaire. Anthropometric measurements (height and weight) were taken using calibrated scales. The questionnaire included the Mini Nutritional Assessment–Short Form (MNA-SF), a globally validated tool developed by the Nestlé Nutrition Institute, with 90% sensitivity and 80% specificity [17]. Its effectiveness, affordability, and speed make it ideal for identifying malnutrition and its risk among older adults, allowing for timely interventions [18,19]. Dietary Diversity Score (DDS) was assessed using a 24-hour recall, with scores calculated based on the number of food groups consumed out of twelve food groups [20]. Household food security was measured using the Household Food Insecurity Access Scale (HFIAS), which captures experiences of food insufficiency and access limitations [21]. Together, MNA-SF, DDS, and HFIAS provided a comprehensive assessment of nutritional status and household food conditions in the study population.

2.6. Anthropometric Measurements
Weight and height were measured using calibrated digital scales and stadiometers to the nearest 0.1 kg and 0.1 cm, respectively. Participants wore light clothing and no shoes. Body Mass Index (BMI) was subsequently calculated [22].

2.7. Data Collection Process
Four trained data collectors and two supervisors conducted data collection. Questionnaires were translated into Amharic and Afaan Oromo and then back-translated to English. Daily review of completed forms ensured data completeness and accuracy. Before the actual data collection, the questionnaire was pretested (10% of the total sample size) in one of the selected kebeles, which were not in the study. The purpose of pretesting is to ensure that respondents can understand the questions and to verify the wording, logical

sequence, and skip patterns of the questions. Modification on the questionnaire was to be made accordingly after the pretest. Data was collected for one month with the respective data collectors and supervisors.

2.8. Study Variables
- **Dependent Variable:** Nutritional status (MNA-SF score: 0–7 = malnourished, 8–11 = at risk, 12–14 = normal) [17,23].
- **Independent Variables:** Socio-demographic characteristics, health conditions (e.g., chronic illness, recent illness, medication use), functional status, dietary diversity, feeding practices, and food insecurity.

2.9. Operational Definitions
- **Dietary Diversity:** Low (≤3 food groups), medium (4–5), or high (≥6) based on HDDS classification [24].
- **Feeding Practices:** Good (≥3 meals/day), moderate (2 meals/day), or poor (≤1 meal/day) [25-27].
- **Food Insecurity:** Categorized as food secure (0–1), mildly (2–8), moderately (9–16), or severely (17–27) food insecure per HFIAS [21].
- **Age Grouping:** 65–74 = young-old, 75–84 = middle-old, ≥85 = very old [28].

2.10. Data Quality Assurance
The questionnaire was pretested (10% of the sample) in a non-selected kebele. Data collectors were trained for one day. Supervisors and the principal investigator checked daily for accuracy and completeness. Measurement tools were recalibrated regularly.

2.11. Data Processing and Analysis
Data were entered in EpiData 3.1 and analyzed using SPSS v25. Nutritional status was categorized and dichotomized for regression analysis (malnourished/at risk vs. normal). Bivariate logistic regression identified candidate variables (p<0.25) for multivariable regression. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were calculated29. Model fitness was assessed using the Hosmer–Lemeshow test (p = 0.859), and multicollinearity was checked using VIF (<10) [29].

2.12. Ethical Considerations
Ethical approval was obtained from the Haramaya University Institutional Health Ethics Review Committee (IHERC) on April 20, 2023 (Ref. #071/2023). Official letters were submitted to local health authorities and zonal health posts. Written informed consent was obtained from participants or caregivers. Privacy and confidentiality were maintained. Participants identified as severely malnourished were referred for clinical support.

3. Results
3.1. Socio-Demographic Characteristics
Of the 401 sampled older adults in Harar Town, 401 completed the interview, yielding a high response rate of 97.1%. The participants had a mean age of 74.22 years (±7.71), ranging from 65 to 92 years. The majority were female (59.1%), and just over half were married (50.6%). Nearly half (44.4%) identified as Muslim. Among caregivers or partners, 22.4% were retired, and 15.7% of participants had attained secondary education (grades 9–12). (Table 1)

Characteristics	Categories	Frequency	Percentage (%)
Age	Young old (65 to 74 years of age)	219	54.6%
	Middle old (75 to 84 years of age)	116	28.9
	Old (>85 years of age)	66	16.5
Educational Status	Unable to read and write	125	31.7
	Able to read and write	73	18.2
	Primary school (grades 1-8)	58	14.5
	Secondary school (grade 9-12)	85	21.2
	college and above	60	15.0
Occupation of the Respondent	Merchant	65	16.2
	Government employee	71	17.7
	Daily laborer	18	4.5
	Housewife	45	11.2
	Farmer	8	2.0
	Retired	184	45.9
Living Condition	With partner	213	53.1
	With Children's	106	26.4
	Lives alone	63	15.7

	Other	19	4.7
Source of Household Food	From market	397	99.0
	From agriculture	2	0.5
Household Family Size?	0 to 5 people	326	81.3
	6 to 15 people	71	17.7
Any use of the Following Substances	Khat	88	21.9
	Cigarette	20	5.0
	Alcohol	37	9.2

Table 1: Socio-Demographic Characteristics of Nutritional Status and Associated Factors among Older

3.2. Co-Morbidities and Health-Related Factors

Among the 401 respondents, 52.9% (n=212) reported being ill in the past three months. Categorically, 8.5% had gastrointestinal issues, 8.0% cardiovascular problems, 7.0% respiratory illnesses, 4.0% endocrine disorders such as diabetes mellitus (DM), 3.7% musculoskeletal problems, 3.5% urinary issues, 3.2% neurological conditions, 2.7% immune-related illnesses including arthritis and systemic infections, 2.2% hematologic problems like anemia, 2.0% eye-related conditions, 1.5% dental problems, 0.7% cancer, 0.4% surgical issues, and 0.2% dermatologic diseases. Chronic medical conditions were reported by 43.6% of respondents, with hypertension (16.7%) and DM (12.2%) being the most prevalent, followed by respiratory conditions like asthma or COPD (5.5%), HIV/AIDS (2.5%), and other unspecified illnesses (7.0%). In the two weeks preceding the survey, 39.7% experienced symptoms such as nausea (15.0%), diarrhea (10.5%), constipation and headache (9.5%), and vomiting (5.0%). Regarding healthcare utilization and medication, 28.7% had visited a health facility, while 38.2% were taking medications. Of these, 13.7% took one medication, 16.5% two, 5.5% took three, and 3.0% took four medications. As for mobility status, 81.8% could move independently, 11.7% required assistance, and 6.5% were unable to move.

3.3. Feeding Practice

The majority, 87.8% (352) of the respondents were able to feed themselves, while the rest, 12.2% (49) needed help from others to eat. Almost one-fourth, 22.4% (90), of the respondents usually ate alone, while 35.7% (143) sometimes ate alone, 28.9% (116) always ate with family members, and 13.0% (52) of them sometimes ate with family members. Also, 70.6% (283) of them had regular feeding habits like breakfast, lunch, snack, and dinner, while 29.4% (118) responded that they eat when they have access to food. From the respondents, 14.7% (59) of them had difficulty eating, swallowing, and chewing due to an illness (Figure 1),
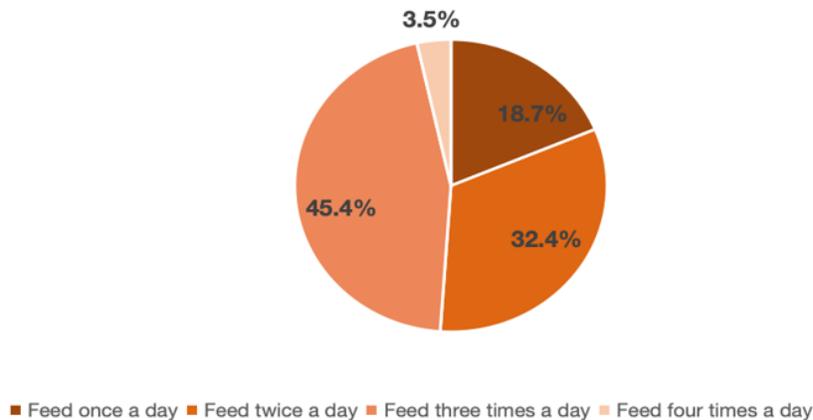

Figure 1: Feeding Practice of Adults above 65 Years in Harar Town, Eastern Ethiopia, 2023 (n=401)

3.4. Dietary Diversity Score

The mean number of dietary food groups consumed by the respondents in 24 hours was 5.02 ±1.52, with a minimum of three food groups and a maximum of nine. Among the 401 respondents, 20.9% (84) had only three food groups in their diet, 17.7% (71) had four, 25.4% (102) had five food groups, 17.0% (68) had six, 12.5% (50) had seven food groups, 5.7% (23) had eight food groups, and 0.7% (3) had nine food groups in their diet. In summary, 20.9% (84) of the respondents had low dietary diversity intake, 43.1% (173) had medium dietary diversity intake, and the rest, 35.9% (144) of the respondents, had high dietary diversity intake. Figure 2 shows the diversity of consumption of 12 food groups for adults ≥ 65 years of age.
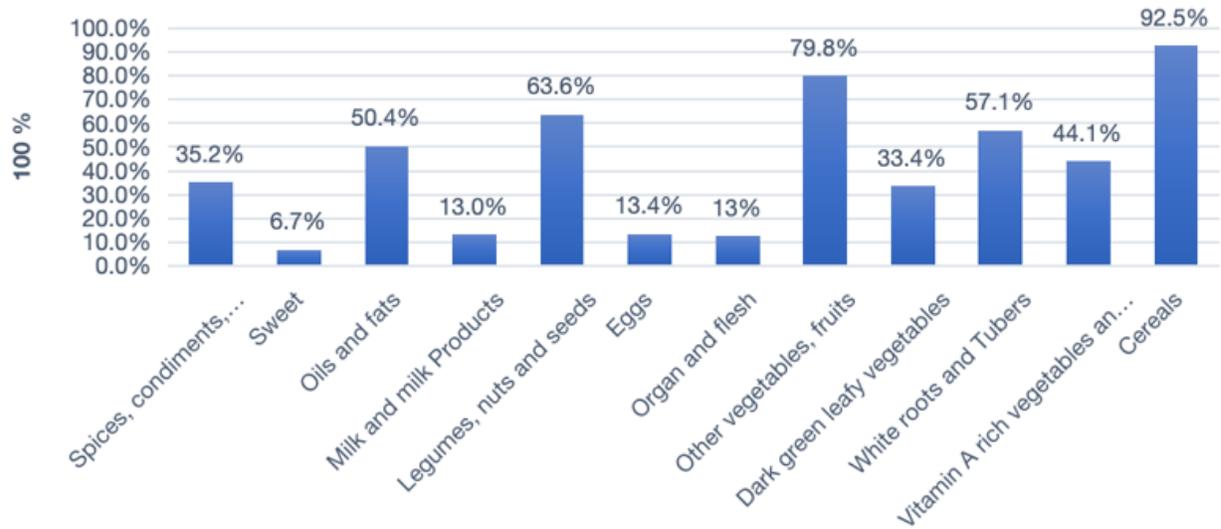
Figure 2: Percentage of Adults Consuming the 12 Different Food Groups in Adults Above 65 Years in Harar Town, Eastern Ethiopia, 2023 (n=401)

In addition to calculating mean dietary diversity scores, the next table (Table 2) provides information on the foods that are eaten by those with the lowest dietary Analyzing dietary diversity scores and which foods are added by those with a higher score. Dietary patterns are analyzed in this example by looking at the food groups consumed by at least 50% of households under each category. Table 2 shows what dietary diversity in each tertile looks like in Harar; egg, organ, and flesh were consumed by only 1.25% in the low dietary diversity score.

| | | **DDS Cat** | | | | | |
| | | **Low Dietary Diversity Score** | | **Medium Dietary Diversity Score** | | **High Dietary Diversity Score** | |
		Count	Column N %	Count	Column N %	Count	Column N %
Eaten Cereals	No	7	8.3%	14	8.1%	9	6.3%
	Yes	77	91.7%	159	91.9%	135	93.8%
Vitamin A-Rich Vegetables and Fruits	No	73	86.9%	94	54.3%	57	39.6%
	Yes	11	13.1%	79	45.7%	87	60.4%
White Roots and Tubers	No	38	45.2%	77	44.5%	57	39.6%
	Yes	46	54.8%	96	55.5%	87	60.4%
Dark Green Leafy Vegetables	No	78	92.9%	119	68.8%	70	48.6%
	Yes	6	7.1%	54	31.2%	74	51.4%
Other Vegetables and Fruit	No	31	36.9%	28	16.2%	22	15.3%
	Yes	53	63.1%	145	83.8%	122	84.7%
Organ and Flesh	No	83	98.8%	156	90.2%	112	77.8%
	Yes	1	1.2%	17	9.8%	32	22.2%
Eaten Eggs	No	83	98.8%	157	90.8%	107	74.3%
	Yes	1	1.2%	16	9.2%	37	25.7%

Legumes, Nuts, and Seeds?	No	34	40.5%	69	39.9%	40	27.8%
	Yes	50	59.5%	104	60.1%	104	72.2%
Milk and Milk Products	No	83	98.8%	161	93.1%	105	72.9%
	Yes	1	1.2%	12	6.9%	39	27.1%
Oils and Fats	No	81	96.4%	104	60.1%	14	9.7%
	Yes	3	3.6%	69	39.9%	130	90.3%
Eaten Sweet	No	81	96.4%	169	97.7%	124	86.1%
	Yes	3	3.6%	4	2.3%	20	13.9%
Spices, Condiments, Beverages	No	84	100.0%	134	77.5%	42	29.2%
	Yes	0	0.0%	39	22.5%	102	70.8%

**Table 2: Dietary Diversity Composition under each Category**

3.5. Food Security with Household Food Insecurity Access Scale (HFIAS)

The results, shown in Table 3, indicate a moderate degree of food insecurity among these older adult households based on limited access to adequate, nutritious foods. Specifically, over half of households (64.8%) reported worrying about having enough food sometimes or often. An even greater proportion (59.4%) were sometimes or often unable to eat their preferred foods. 61.3% of households reported sometimes or often eating a limited variety of foods. More extreme manifestations of hunger were rarer but still experienced by a subset of households. Occasionally, 17.7% reported going to sleep hungry, rarely or sometimes. While few households reported experiencing outright hunger often, the data shows many older adults face challenges accessing nutritious, high-quality diets regularly. This indicates a moderate degree of food insecurity among the surveyed. About 61.3% of the respondents have had a limited variety of foods, and 62.6% of them do not want the food they eat to have the highest percentage of the total population with restrictions on certain food groups and disinterest. Among 401 households, 11.2% (45) experienced severe food insecurity, 28.7% (115) experienced moderate food insecurity, 27.7% (111) experienced mild food insecurity, and 32.4% (130) were found to be food secure.

3.6. Nutritional Status of Older Adults above 65 Years

The nutritional status of the older adults was assessed using the Mini Nutritional Assessment (MNA) A tool that categorizes scores into malnourished, at-risk for malnutrition, or normal nutritional status. As shown in Figure 3, 15.2% (95% CI: 0.18-0.19) of the adults were malnourished, 43.6% (95% CI: 0.38-0.48) were at risk for malnutrition, and 41.1% had normal nutritional status (95% CI: 0.36-0.46).
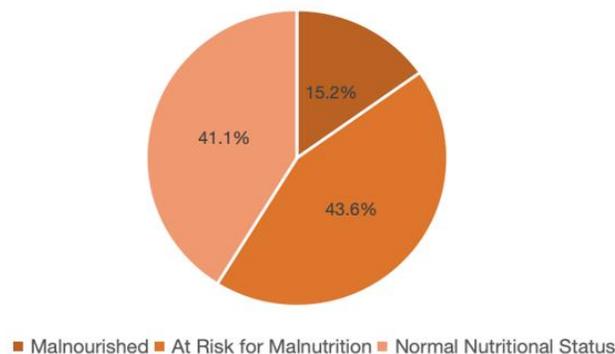
Figure 3: Nutritional Status/MNA Score of 401 Adults above the Age of 65 in Harar Town, Eastern Ethiopia

The descriptive statistics for Body Mass Index (BMI) among the sample of 401 adults over 65 years indicated concerning levels of undernutrition in this older population. The BMI scores ranged from a minimum of 15 to a maximum of 29, with the mean BMI being 21.37 ± 2.364. This shows that, on average, the older adults were somewhat underweight, with most individuals within 2 units of the mean. Considering a BMI <19, underweight was found to be 14.2% (57); BMI between 19 and 21, normal weight was 41.1% (165); BMI between 21 and 23, and Overweight was 26.4% (106), and a BMI greater than 23 was obese, 18.2% (73).

3.7. Factors Associated with Nutritional Status

In the analysis of bi-variable logistic regression, variables with a p-value of < 0.25 were age, Marital status, educational status,

occupational status, partner's occupation, living partner, substance use, illness in the past 3 months, history of chronic illness, illness in the past 2 weeks, visited to health facility in the past three months, are you currently taking medication, functional mobility, difficulty in swallowing, ability of respondent to feed by himself, with whom are you feeding, time of having a meal, feeding habit, dietary diversity, and HFIAS category (Table 3).

HFIAS	No	Yes	Rarely Once or twice in the past four weeks	Sometimes Three to ten times in the past four weeks	Often More than ten times in the past four weeks
1. Worry about Food	35.2% 141	64.8% 260			
1a. How Often			28.7% 115	29.7% 119	6.7% 27
2. Not able to Eat	40.6% 163	59.4% 238			
2a. How Often			28.2% 113	19.0% 76	12.2% 49
3. Eat limited Variety.	38.7% 155	61.3% 246			
3a. How Often			21.7% 87	27.4% 110	12.5% 50
4. Have you Eaten Foods you Really didn't Want?	37.4% 150	62.6% 251			
4a. How Often			29.4% 118	26.2% 105	6.7% 27
5. Eaten Smaller Meal	45.6% 183	54.4% 218			
5a. How Often			21.9% 88	18.7% 75	2.5% 10
6. Eaten Fewer Meals	50.9% 204	48.9% 196			
6a. How Often			26.4% 106	18.7% 75	2.5% 10
7. No Food of Any Kind	66.6% 267	33.4% 134			
7a. How Often			15.2% 61	14.0% 56	2.0% 8
8. Slept Hungry	82.3% 330	17.7% 71			
8a. How Often			9.2% 37	5.5% 22	2.2% 9
9. Whole Day and Night without Food	98.0% 394	2.0% 8			
9a. How Often			2.0% 8	0.0% 0	0% 0

Table 3: Shows the Household Food Insecurity Access Scale (HFIAS) Survey Administered to 401 Households with Adults over 65 Years Old in Harar Town

3.8. Multivariate Logistic Regression of Factors Associated with Malnutrition in Harar Town

The multivariate logistic regression analysis identified several factors associated with malnutrition in adults over 65 years old in Harar town, Ethiopia. Those in the older age groups of 75-84 years (AOR=2.58, 95% CI: 1.26-5.31) were 2.58 times more likely to be malnourished than those aged 65-74; participants 85-95 years were 2.90 times more likely to be malnourished (AOR=2.90, 95% CI: 1.20-6.99). Adults over 65 who could only read and write were 4.17 (AOR=4.17, 95% CI: 1.43-12.14) times more likely to be malnourished than their counterparts. Having an illness in the past 3 months was proven to be statistically significant (p-value =

0.001) to having 2.77 odds of being malnourished compared to not being ill in the past 3 months (95% CI = 1.49-5.14).

Feeding practice also emerged as a significant predictor. Compared to those with good feeding practices, individuals with poor and moderate feeding habits had 4.77 (95% CI =1.82-12.46) and 2.83 (95% CI =1.44-5.56) times the odds of experiencing malnutrition, respectively (p-values of both < 0.003). poor and moderate dietary diversity are also significantly associated with malnutrition, with an odd of 4.00 and 2.82, respectively (AOR=4.28, 95% CI: 1.65-9.65) (AOR=2.82, 95% CI: 1.47-5.42).

Variable and Categories	Nutritional Status		Crude Odds Ratio With CI	Adjusted Odds Ratio	P-Value
	Malnourished or at Risk	Normal Nutritional Status			
Age					
65-74	96 (23.9%)	123 (30.7%)	1	1	1
75-84	64 (16.0%)	52 (13.0%)	1.57(1.00-2.48)	2.58(1.26-5.31)	0.010*
85-95	43 (10.7%)	23 (5.7)	2.39 (1.35-4.24)	2.90(1.20-6.99)	0.017*
Marital Status					
Single	28 (7.0%)	16 (4.0%)	1	1	1
Married	68 (17.0%)	135 (33.7%)	0.28 (0.14-0.56)	0.19(0.07-0.52)	0.001*
Divorced	25 (6.2%)	27 (6.7%)	0.52 (0.23-1.20)	0.30(0.09-1.01)	0.06
Widowed	82 (20.4%)	20 (5.0%)	2.34 (1.06-5.13)	1.83(0.63-5.34)	0.20
Educational Status					
Unable to Read and Write	66 (16.5%)	59 (14.7%)	3.67 (1.57-6.02)	1.51(0.57-4.02)	0.40
Able to Read and Write	55 (13.7%)	18 (4.5%)	8.40 (3.8-18.4)	4.17(1.43-12.1)	0.01*
Primary Education	27 (6.7%)	31 (7.7%)	2.39 (1.1-5.2)	1.06(0.35-3.12)	0.91
Secondary Education	39 (9.7%)	46 (11.5%)	2.33 (1.1-4.76)	2.28(0.82-6.34)	0.11
College and Above	16 (4.0%)	44 (11.0%)	1	1	1
Substance Use					
Yes	105 (26.3%)	37 (9.3%)	0.21 (0.13-0.33)	0.18 (0.09-0.34)	<0.001*
No	98 (24.5%)	160 (40.0%)	1	1	1
Illness in the Past 3 Month					
Yes	127 (31.7%)	62 (15.5%)	3.66 (2.42-5.54)	2.77 (1.49-5.14)	0.001*
No	76 (19.0%)	136 (33.9%)	1	1	1
History of Chronic Illness					
Yes	111 (27.7%)	64 (16.0%)	2.52 (1.68-3.79)	0.59 (0.32-1.06)	0.07
No	92 (22.9%)	134 (33.4%)	1	1	1
Illness in the Past 2 weeks					
Yes	97 (24.2%)	62 (15.5%)	2.00 (1.33-3.01)	0.56 (0.30-1.04)	0.06
No	106 (26.4%)	136 (33.9%)	1	1	1

Ability to Feed by Him/Herself					
By Oneself	163 (40.6%)	189 (47.1%)	1	1	1
Help from Others	40 (10.0%)	9 (2.2%)	4.54 (1.94-10.6)	1.77 (0.63-4.99)	0.27
With Whom are you Feeding					
Always Alone	56 (14.0%)	34 (8.5%)	1	1	1
Sometimes Alone	78 (19.5%)	65 (16.2%)	0.72 (0.42-1.24)	2.25 (0.97-5.20)	0.06
Always with Family	42 (10.5%)	74 (18.5%)	0.34 (0.19-0.61)	1.43 (0.55-3.72)	0.45
Time to Have a Meal					
Regular	122 (30.4%)	161 (40.1%)	1	1	1
Irregular	81 (20.2%)	35 (9.2%)	2.88 (1.83-4.55)	1.75 (0.85-3.61)	0.12
Feeding Habit					
Poor Feeding Habits	60 (15.0%)	15 (3.7%)	7.9 (4.19-15.03)	4.77 (1.79-12.46)	0.001*
Moderate Feeding Habit	77 (19.2%)	52 (13.0%)	2.93 (1.85-4.65)	2.83 (1.44-5.56)	0.003*
Good Feeding Habit	66 (16.5%)	131 (32.7%)	1	1	1
Dietary Diversity					
Low DDS	58 (14.5%)	26 (6.5%)	5.24 (2.29-9.39)	4.0 (1.82-12.46)	0.002*
Medium DDS	102 (25.4%)	71 (17.7%)	3.37 (2.11-5.38)	2.83 (1.44-5.56)	0.002*
High DDS	43 (10.7%)	101 (25.2%)	1	1	1
HFIAS					
Food Secured	32 (8.0%)	98 (24.4%)	1	1	1
Mild Food Insecurity	63 (15.7%)	48 (12.0%)	4.02 (2.32-6.95)	2.82(1.29-6.17)	0.009*
Moderate Food Insecurity	73 (18.2%)	42 (10.5%)	5.32 (3.06-9.23)	5.57(2.45-12.6)	<0.001*
Food Insecure	35 (8.7%)	10 (2.7%)	10.7 (4.77-24.1)	6.33(2.07-19.3)	0.001*

Table 4: Multivariate Logistic Regression of Factors Associated with Nutritional Status in Adults >65 Years old in Harar

Households with all levels of food insecurity (mild, moderate, and severe) were more likely to experience malnutrition than food-secure households. The odds of experiencing malnutrition increased with the severity of food insecurity. The odds of being malnourished were 2.82 times higher (95% CI: 1.29-6.17) for households with mild food insecurity, 5.57 times higher for households with moderate food insecurity (95% CI: 2.45-12.65), and 6.33 times higher for households with severe food insecurity (95% CI: 2.07-19.33). Finally, being married (AOR=0.19, 95% CI: 0.07-0.52) and using substances (AOR=0.18, 95% CI: 0.09-0.34) were found to have lesser odds against malnutrition than the compared categories.

4. Discussion

The findings from this study, showing advanced age, being able to read and write or having an informal education, illness, feeding practice, poor dietary diversity, and household food insecurity as factors associated with malnutrition are consistent with prior research in Ethiopia. This study found that 15.2% (95% CI: 0.18-1.91) of the adults were malnourished, and 43.6% (95% CI:

0.38-0.48) were at risk of malnutrition. The reported malnutrition prevalence in similar Ethiopian populations range from 11% to 27% [13,14,30-33]. A recent systematic review determined the pooled national malnutrition prevalence to be 20.5% in older Ethiopians [16]. Higher rates are often seen in Northern regions, for example, 27.6% in South Gonder and 27.9% in West Arsi [16,30]. Again, a moderate prevalence is seen in the southwestern and southern parts of Ethiopia [31,34]. This study's lower Eastern region prevalence aligns with studies showing geographic variabilities. These regional distinctions may arise from long-term differences in cultures and dietary patterns between the north and the east. Environmental factors like higher altitudes and proneness to drought in the North could also contribute to the higher burden of malnutrition in the North.

This study found an increased odd of being malnourished amongst the very old and middle-aged with malnourished being 2.58 and 2.90, respectively, were associated with significantly higher odds of malnutrition, which was consistent with most studies done in most parts of Ethiopia. This is a typical result of metabolic changes

associated with aging, and many studies have been done in Ethiopia that also seemed to associate it with mental wellness [11,35]. Most studies found that an age >80, or the very old age group, has increased odds of malnutrition compared to the young old. A study done in Wolaita Sodo found the odds of being malnourished 1.6 times higher in adults older than 80 years of age [31]. In another study done in Northwest Amhara, the odds of being very old and malnourished were found to be 4.91 times [11]. A study done in Debre Markos also showed that amongst old adults, being very old and middle-old was significantly associated with malnutrition, with odds of 3.45 times in very old and 5.25 times in middle-old adults [32]. A meta-analysis in Ethiopia also showed that being young-old had far lower odds than those of being older than 85 years old [16].

This study found that the odds of being malnourished are 4.17 times higher in adults having informal education or who can read and write. Also, several studies conducted in different regions of Ethiopia have found consistent evidence that having only an informal education or illiteracy is associated with higher rates of malnutrition. For example, studies by Muluneh et al., Yordanos et al., Kidest et al., and Hiwot et al. all found illiteracy or lack of formal education was linked to increased malnutrition risk [11,13,31,36]. The 2022 study by Hiwot et al. further quantified this relationship, reporting that those able to just read and write but without formal education had over 6 times higher adjusted odds of malnutrition compared to literate individuals with education [13]. These consistent findings across multiple studies in Ethiopia provide strong evidence for an association between lack of formal education and malnutrition. The exact mechanisms require further research, but potential factors include reduced health knowledge and income potential among those without formal education. Overall, these studies demonstrate a link between informal education and malnutrition risk in Ethiopia.

This study found that recent illness was a significant predictor of malnutrition among older adults in Harar Town. Participants who reported being ill within the past three months were nearly three times more likely to be malnourished (AOR: 2.77; 95% CI: 1.49–5.14; p = 0.001). Illness in older adults often leads to reduced appetite, impaired nutrient absorption, and increased metabolic demands, all of which can contribute to a rapid decline in nutritional status. This finding is supported by studies such as Tesfaye et al. who reported that chronic illness and functional dependency significantly increased the likelihood of undernutrition among elderly populations in Ethiopia [37]. Similarly, Abdu et al. identified previous hospitalizations and chronic conditions as key drivers of nutritional deterioration [14]. These consistent findings highlight that illness not only compromises the immune system but also limits food intake and nutrient utilization, placing older adults at greater risk of malnutrition. Therefore, integrating routine nutritional screening into care for recently ill elderly patients is essential for early detection and intervention.

This study, coupled with existing research, sheds light on the vital role of proper feeding practices in safeguarding older adults' nutritional well-being. Individuals in this study with poor Habits, like eating only once daily, faced a staggering 4.7 times higher risk of malnutrition compared to those with good habits (eating three or more times daily) and those with moderate Eating habits had 2.83 times the odds of being malnourished. This stark finding aligns with research across Ethiopia and beyond, highlighting the detrimental impact of infrequent or inadequate meals on older adults' health. Hiwot Yisak found a 13.5-fold increase in malnutrition risk for those with decreased food intake in South Gondar, Ethiopia, while Kidest Wondiye reported a similar association in Sodo Zuriya [13,31]. A recent study further solidifies this link, demonstrating a dose-dependent relationship between meal skipping and malnutrition risk in the Fogera Zuriya district in Northwest Ethiopia [38]. Factors like poverty, food insecurity, physical limitations, social isolation, and even cognitive decline can all contribute to an increased risk of malnutrition in older adults.

The findings from this study, which show that poor and moderate dietary diversity is associated with higher odds of malnutrition, are consistent with another research conducted in Ethiopia. This study found 4.00- and 2.82-times higher odds of malnutrition for poor and moderate dietary diversity, respectively, compared to good dietary diversity. The consistency of these findings across multiple regions of Ethiopia provides robust evidence that limited dietary diversity is an important risk factor for malnutrition in the elderly. A study done in Metu found that lower dietary diversity was associated with 5.44 times higher odds of malnutrition compared to higher diversity [34]. Another study in Gondar found those with lower dietary diversity had 3.7 times higher odds of malnutrition versus those with higher diversity [13]. Also, another study done in the Fogera Zonal District, Northwest Ethiopia, found the odds of being malnourished to be 1.91 amongst those with low DDS compared to those who have higher DDS [38].

This study's finding that household food insecurity significantly increases the risk of malnutrition among older adults in Ethiopia resonates strongly with research conducted in other countries. This study revealed that mildly, moderately, and severely food-insecure households faced odds of malnutrition 2.82, 5.57, and 6.33 times higher, respectively, compared to food-secure households. This stark correlation mirrors patterns observed in Greece, where they found a 2.63-fold increase in malnutrition risk among elderly individuals struggling with food insecurity [39]. Similarly, Yildiz et al. reported a higher risk of malnutrition in Turkish older adults experiencing moderate and severe food insecurity [40]. These consistent findings across various regions and cultures solidify the importance of food security in reducing malnutrition risk for older adults. When sufficient, nutritious food is unavailable, their vulnerability to nutritional deficiencies and related health problems increases considerably. Factors like limited income, social isolation, physical decline, and cognitive impairment can

further worsen the situation, creating a complex interplay that contributes to both food insecurity and malnutrition among older adults. The lesser odds of marriage and substance use were not seen in previous studies. Even though living with others and having many members in the household has proven to show lesser odds, living single and having no caretakers have proven to show an increased risk [11,38]. More research is needed on the mechanisms for these associations in the Ethiopian context. Overall, this study provides further evidence on important drivers of malnutrition in Ethiopia's growing elderly population. Findings reinforce the need for integrated interventions targeting health, education, food security, and economic factors to address malnutrition in this vulnerable population.

5. Conclusion and Recommendation

The study revealed a high burden of malnutrition among older adults in Harar, with 15.2% classified as malnourished and 43.6% at risk. Key contributing factors included advanced age, recent illness, lack of formal education, low dietary diversity, and household food insecurity. These findings underscore the urgent need for integrated public health strategies to address elderly malnutrition. It is recommended that healthcare providers strengthen routine screening and nutrition counseling for older adults, while district health offices promote awareness and preventive care. The Ministry of Health and NGOs should develop community-based nutrition programs and guidelines targeting this vulnerable population. Policymakers are advised to establish social safety nets and support literacy and health education initiatives. Researchers are encouraged to conduct longitudinal studies to better understand causal links and to incorporate socioeconomic variables like income to enhance future analysis and policy development.

5.1. Strengths and Limitations of the Study

A key strength of this study lies in its use of a standardized and validated tool (the Mini Nutritional Assessment) to evaluate malnutrition among older adults, ensuring consistency and reliability in measurement. However, several limitations should be acknowledged. As a cross-sectional study, it cannot establish causality between risk factors and malnutrition. The reliance on self-reported data may have introduced recall bias, potentially underestimating the actual burden of malnutrition. Additionally, important socioeconomic variables such as household income were not assessed, limiting the analysis of economic influences. Finally, the MNA tool is not designed to detect overweight or obesity, which may overlook aspects of overnutrition in this population. Despite these limitations, the study provides valuable insights for future research and intervention design.

Author Contributions

All authors made substantial contributions to the study. The conception and design of the study were collaboratively developed by Nahom Girma Belete and Tara D'Ann Wilfong. Material preparation, including the development of data collection tools and the coordination of logistics, was carried out by Nahom Girma Belete. Data collection and the initial data analysis were conducted solely by Nahom Girma Belete. The first draft of the manuscript was jointly written by Nahom Girma Belete and Tara D'Ann Wilfong. Nahom Girma Belete, Tara D'Ann Wilfong, and Fekede Asefa Kumsa provided critical revisions, contributing to the refinement of the manuscript's content, structure, and academic rigor. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work, ensuring the accuracy and integrity of the research.

Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics Approval

Ethical approval for this study was obtained from the Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University, College of Health and Medical Sciences, Harar Campus. The proposal, titled "Nutritional Status and Associated Factors Among Older Adults Above 65 Years in Harar Town, Eastern Ethiopia," was reviewed and approved under Reference No. IHRERC/071/2023. The committee confirmed that all ethical requirements were met, and approval was granted on April 20, 2023. The investigator was authorized to begin data collection in accordance with governmental COVID-19 guidelines and instructed to submit progress reports every three months. (The Paper for Ethical Approval will be attached as a supplementary file.)

Consent to Participate

Informed consent was obtained from all individuals who participated in the study.

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