

ARSI UNIVERSITY
COLLEGE OF HEALTH SCIENCE
DEPARTMENT OF PUBLIC HEALTH



Under nutrition and Its Associated Factors among Adult Cancer Patients
Receiving Chemotherapy: A Cross-Sectional Study at Asella Teaching
and Referral Hospital, Oromia, Southeast Ethiopia, 2025.

By: Ketema Bogale (BSc)

A thesis submitted to the Department of Public Health, College of Health Sciences,
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December, 2025
Asella, Ethiopia

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Advisors: Mr. Abdurehman Kalu (MPH, Assi't Professor)
Mr. Kabtamu Tolosie (MSc, Assis't professor of biostatistics)

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Name of investigators	Ketema Bogale
Name of advisors	Mr. Abdurehman Kalu (MPH, Assi't Professor) Mr. Kabtamu Tolosie MSc, Assis't professor of biostatistics)
Title of the research project	Undernutrition and Its Associated Factors among Adult Cancer Patients Receiving Chemotherapy: A Cross-Sectional Study at Asella Teaching and Referral Hospital, Oromia, Southeast Ethiopia, 2025.
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Address of investigator	Phone Number: 0920389678 Email: ketemabogale2@gmail.com
Address of the principal Advisor	Phone:0924545690 Email: abdurehmankelu900@gmail.com
Address of co-advisor Advisor	Phone: 0910458533 Email: kabtamuto@gmail.com

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ABBREVIATIONS AND ACRONYMS

AOR	Adjusted Odds Ratio
ARTH	Asela Referral and Teaching Hospital
BMI	Body Mass Index
CI	Confidence Interval
COR	Crude Odd Ratio
MST	Malnutrition Screening Tools
MUST	Malnutrition Universal Screening Tools
NCD	Non-communicable Disease
PGSGA	Patient Generated Subjective Global Assessment
SPSS	Statistical Package for Social Science
SSA	Sub-Saharan Africa
TASH	Tikur Anbessa Specialized Hospital
WHO	World Health Organization

ABSTRACT

Background: Undernutrition is a major global public health issue, affecting an estimated 30–80% of cancer patients during the course of their illness. In Ethiopia, the nutritional status of adult cancer patients receiving chemotherapy remains insufficiently studied, especially in regional settings such as Oromia, with most existing evidence coming from urban centers like Addis Ababa.

Objective: This study aimed to assess the prevalence of undernutrition and associated factors among adult cancer patients receiving chemotherapy at Asella Referral and Teaching Hospital, Oromia, southeast Ethiopia, in 2025.

Methods: An institution-based cross-sectional study was conducted from August 11 to October 18, 2025, involving 214 adult cancer patients undergoing chemotherapy. Participants were selected using systematic random sampling. Data were collected using a structured, pretested questionnaire, the Patient-Generated Subjective Global Assessment (PG-SGA) tool, and anthropometric measurements. Completed questionnaires were entered into Epi-Data version 4.7, exported to the Statistical Package for the Social Sciences (SPSS), and analyzed using it. Descriptive statistics summarized the data. Variables with $p < 0.25$ in bivariate analysis were entered into multivariable logistic regression. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were used to report associations, and significance was set at $p < 0.05$.

Results: A total of 214 participants completed the study, yielding a response rate of 98.62%. The mean age of the respondents was 54.8 ± 13.7 years. The overall prevalence of under nutrition based on PG-SGA was 61.7% (95% CI: 55.2–68.2). Factors significantly associated with under nutrition included Stage III cancer (AOR=4.26, 95% CI: 1.14–15.99), Stage IV cancer (AOR=4.79, 95% CI: 1.30–17.71), loss of appetite (AOR=3.47, 95% CI: 1.14–10.50), vomiting (AOR=7.71, 95% CI: 2.07–28.71), diarrhea (AOR=4.10, 95% CI: 1.43–11.70), and consuming fewer than three meals per day (AOR=2.83, 95% CI: 1.20–6.66).

Conclusion: Under nutrition was highly prevalent among adult cancer patients receiving chemotherapy in the study area. Advanced disease stage, inadequate meal frequency, loss of appetite, vomiting, and diarrhea significantly increased the risk of under nutrition. Strengthening routine nutritional assessment, early identification of high-risk patients, and integrating nutrition-focused interventions into oncology care are strongly recommended.

Keywords: Prevalence, under nutrition, Cancer, Chemotherapy, Asella, Hospital, Ethiopia

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1. INTRODUCTION

1.1 Background

Cancer is a broad group of diseases characterized by the uncontrolled proliferation of abnormal cells, which can invade surrounding tissues and metastasize to distant organs(1). This malignant transformation is typically driven by genetic mutations, which may result from internal (endogenous) factors such as inherited genetic predispositions or external (exogenous) influences, including environmental exposures, diet, and lifestyle behaviors. The progression from localized tumors to systemic disease through metastasis is a defining feature of cancer and contributes significantly to its associated morbidity and mortality(2, 3).

Malnutrition is a general term that includes both under nutrition and over nutrition. under nutrition occurs when an individual's intake of energy, protein, or micronutrients is insufficient to meet their physiological needs for maintenance, growth, or recovery from illness. Even when caloric intake appears adequate, under nutrition can occur if the diet lacks essential nutrients or if the body is unable to absorb and utilize them effectively(4).

Among individuals with cancer, under nutrition is one of the most frequent and serious complications, particularly in those with solid tumors, advanced disease stages, or undergoing intensive therapies(5). Cancer profoundly affects the body's metabolism, often resulting in increased energy expenditure, impaired nutrient absorption, and disruption of normal physiological processes. These metabolic changes are further aggravated by the side effects of cancer treatments such as chemotherapy and radiation, which frequently cause appetite loss, nausea, vomiting, and gastrointestinal disturbances. Collectively, these factors contribute to significant nutritional decline, which compromises immune function, reduces tolerance to treatment, increases the risk of complications, and worsens survival outcomes (5-7).

The Malnutrition Universal Screening Tool (MUST) is a widely used five-step screening instrument designed to identify adults who are malnourished, at risk of malnutrition (under nutrition), or obese. It provides practical guidelines for nutritional risk assessment and management in clinical and community settings and can be applied by a range of healthcare professionals (8).

In this context, nutritional assessment and support are critical components of comprehensive cancer care. Despite advances in cancer therapy, under nutrition remains a prevalent yet under-recognized condition in oncology settings, particularly in low-resource environments. The risk of undernutrition in cancer patients is influenced by multiple factors, including the metabolic effects of malignancy, the type and stage of cancer, side effects of treatment, recurrent infections, inadequate nutritional interventions, and limited awareness among healthcare providers regarding the impact of nutritional status on treatment outcomes and prognosis(6). Other factors that can contribute to undernutrition in cancer patients include gastrointestinal disorders such as nausea or diarrhea, changes in smell and taste, psychological stress, and pain(9). In Ethiopia, where healthcare systems face resource limitations and delayed cancer diagnosis is common, there is a growing need for context-specific data on the burden of undernutrition among cancer patients. Understanding the prevalence and associated factors is essential to guide timely interventions, improve patient outcomes, and inform policy and clinical practice.

1.2. Statement of the Problem

Globally, cancer ranks as the second leading cause of death and continues to have a profound impact on individuals' quality of life. According to global estimates, cancer cases are expected to increase by 65%, rising from 12.7 million in 2008 to 21 million by 2030(10). The World Health Organization (WHO) further projects that by 2035 there will be 24 million new cancer cases and 14.5 million cancer-related deaths annually, with nearly 70% of these deaths occurring in low- and middle-income countries. Recent statistics indicate that one in five men and one in six women worldwide develop cancer during their lifetime, and one in eight men and one in eleven women die from the disease (6, 11). In 2020 alone, approximately 19.3 million new cancer cases and nearly 10 million deaths were reported globally, underscoring the urgent need for improved prevention, early detection, and treatment strategies(9).

Alongside the increasing burden of cancer, undernutrition remains a widespread and under-recognized complication. The WHO estimated that by 2015, 17.6% of the global population would be undernourished, with the majority residing in developing regions such as South Asia and sub-Saharan Africa. Alarming, nearly 20% of cancer patient deaths are attributed not to cancer itself but to undernutrition and its complications. Evidence from follow-up studies shows

that undernourished cancer patients have a two to five times higher risk of mortality compared to their well-nourished counterparts (2, 12, 13).

Cancer-related undernutrition differs significantly from simple starvation. It arises from a complex interplay of factors, including reduced food intake, gastrointestinal dysfunction, altered metabolism, increased energy expenditure, mental health issues, and decreased physical activity(7). Despite its impact, the high prevalence and consequences of undernutrition in oncology settings are often overlooked. Studies from countries like Germany, France, Spain, and Brazil have reported undernutrition rates ranging from 20% to over 70% among cancer patients, and also 10–20% of cancer patients' deaths are related to undernutrition, not the malignancy itself. However, clinical recognition and management remain poor yet. European hospital data revealed that only one in three at-risk cancer patients received any form of nutritional support (7, 14).

Undernutrition in cancer patients is driven not only by the disease itself but also by the adverse effects of anti-cancer therapies such as chemotherapy and surgery. These treatments often compromise nutritional intake through side effects like nausea, altered taste and smell, mucositis, and gastrointestinal disturbances, leading to progressive nutritional decline. As a result, undernutrition impairs treatment tolerance, diminishes therapeutic response, and significantly reduces quality of life, ultimately contributing to poor clinical outcomes and increased mortality (11, 15, 16). It also exacerbates weight loss and depletion of body reserves, which further compromises patients' functional status and prognosis. Beyond these direct effects, undernutrition increases susceptibility to infections, delays wound healing, heightens treatment toxicity, prolongs hospital stays, and raises healthcare costs. Despite its far-reaching consequences, cancer-related undernutrition remains frequently under-recognized and inadequately managed in clinical practice, highlighting the urgent need to integrate routine nutritional screening and intervention throughout the cancer care continuum (17-19).

In Ethiopia, cancer accounts for approximately 5.8% of all national deaths. Although comprehensive population-based data remain limited outside of Addis Ababa, national estimates suggest there are around 60,960 new cancer cases and over 44,000 cancer-related deaths each year. Alarming, more than 80% of patients are diagnosed at an advanced stage of the disease. Cancer also ranks among the top four contributors to non-communicable disease (NCD)

mortality in the country, alongside cardiovascular diseases, diabetes mellitus, and chronic respiratory diseases(3).

Moreover, under nutrition is a critical yet under-recognized complication among adult cancer patients in Ethiopia. Several studies conducted in oncology centers have reported a high burden of under nutrition, with prevalence estimates ranging from 48% to 64.4%(20, 21). However, existing research is predominantly focused on urban settings such as Addis Ababa, leaving substantial gaps in evidence from regional areas, including the Oromia region. Furthermore, many healthcare facilities across the country, especially in regional settings, face critical shortages of trained nutritionists and lack standardized nutritional screening protocols or cancer-specific dietary interventions. This is particularly concerning given the widespread late-stage cancer diagnosis in Ethiopia, which further elevates patients' risk of nutritional decline. In light of these challenges, this study aims to assess the prevalence of undernutrition and its associated factors among adult cancer patients receiving chemotherapy at Asella Teaching and Referral Hospital in Oromia, southeast Ethiopia.

1.3. Significance of the study

Understanding the prevalence and associated factors of undernutrition among adult cancer patients receiving chemotherapy is essential for improving cancer care outcomes. As cancer incidence increases, especially in resource-limited settings, timely recognition and management of nutrition-related complications are critical. This study will provide valuable baseline data to support the integration of nutritional screening into routine oncology care. It will enable healthcare providers, including physicians, nurses, and medical officers, to offer more comprehensive and patient-centered treatment.

Additionally, the findings will inform policymakers and program planners about the nutritional burden among cancer patients, guiding resource allocation and intervention strategies. By addressing a gap in the local evidence base, particularly in Ethiopia, this study may also support future academic research and raise patient awareness about the impact of cancer therapies on nutrition. Ultimately, it has the potential to contribute to better clinical outcomes, reduced treatment complications, and improved quality of life for cancer patients and their families.

2. LITERATURE REVIEWS

2.1. Cancer and Malnutrition

2.1.1. Global Evidence

Over the past 34 years, researchers have used different criteria to define it, and studies have been conducted worldwide on populations that differ in socioeconomic status, educational level, age group, and severity of illness. Based on many reports worldwide, an estimated 13-69 % of hospitalized patients are malnourished (22). A study in Singapore showed that malnourished cancer patients had a longer hospital stay and were more likely to be re-admitted within 15 days. The main difference between the actual cost of hospitalization and the average cost for malnourished patients was greater than for well-nourished patients. A study conducted in Iran reports, about 53.1% of the patients with cancer were suffering from malnutrition. It is estimated that about 50% of the patients with cancer finally die as a result of cancer-related malnutrition (23). As stated by Global Cancer Observatory statistics, stomach cancer in males and breast cancer in females are the most frequently diagnosed cancers in Iran (24).

Research done in Brazil showed that malnutrition is caused by several factors and may vary according to the type of tumor, its stage, and treatment. Malnutrition in cancer patients is frequently reported in the literature and found in almost 75% of patients at diagnosis. It is also significantly associated with increased morbidity and mortality, reduced response and tolerance, higher cost, the diminished chance of survival, and worse quality of life (14). The same study done in Brazil at a University Hospital in Rio Grande found that high prevalence of malnutrition (77%), severe weight loss (40%), and reduction in food consumption (41.7%) with gastrointestinal symptoms (75%). And also this research showed that more than 70% of patients had co-morbidity associated with cancer, especially hypertension and cardiovascular disease(6).

Summary: globally, cancer-related malnutrition is associated with poor treatment outcomes, increased morbidity, and high healthcare costs. The prevalence of malnutrition varies by region and cancer type, with severe cases particularly common in patients with advanced disease or those receiving complex treatment regimens.

2.1.2. Evidence from Ethiopia

In Ethiopia, malnutrition remains a prevalent and significant concern among cancer patients. It adversely affects nearly every aspect of a patient's health, contributing to increased susceptibility to infections, heightened treatment-related toxicity, prolonged hospital stays, and elevated health-care costs. Cancer patients are especially vulnerable to nutritional deficiencies due to the dual burden of the disease and the side effects associated with treatment modalities, including chemotherapy and radiotherapy (21). Ethiopian studies consistently show a high burden of malnutrition, ranging from 48% to 64.4% among adult cancer patients undergoing treatment. Major risk factors include advanced disease stage, treatment side effects, food insecurity, socioeconomic challenges, and low dietary diversity (20, 21, 25).

In Ethiopia, cancer-related malnutrition is widespread and exacerbated by treatment side effects, socioeconomic factors, and food insecurity. However, research remains limited, particularly in regional settings, highlighting a need for further investigation.

2.2. Prevalence of Malnutrition among Adult Cancer Patients

Malnutrition is a common and serious concern among cancer patients, with global prevalence estimates ranging from 50% to 80% depending on cancer type, stage, and assessment methods used (26). It is increasingly recognized as a major comorbidity that adversely affects treatment outcomes, quality of life, and overall survival. Numerous studies across the world have demonstrated a high burden of malnutrition among hospitalized cancer patients. For instance, a study from Latin America found that 65.6% of hospitalized cancer patients were malnourished (27). A comprehensive systematic review and meta-analysis involving 20 cross-sectional and 45 cohort studies found that the overall prevalence of malnutrition was 41%(28).

A cross-sectional study conducted in Brazil found that most patients were classified as moderately malnourished (66.2%), followed by severe malnutrition (20.8%), as assessed using the Subjective Global Assessment (SGA) tool (29). A multicenter study in Brazil reported a malnutrition rate of 20.3% among hospitalized patients, with a threefold increased risk among cancer patients (66.3%)(30). Additionally, a cross-sectional study involving 277 hospitalized patients at the Institute of Integrative Medicine Prof. Fernando Figueira, a referral oncology center in Recife, Pernambuco, Brazil, reported a malnutrition prevalence of 71.1%. Among these patients, 35.4% were classified as moderately malnourished, while 35.7% were severely

malnourished(31). Similarly, a study conducted in Malaysia reported that the overall prevalence of undernutrition among cancer patients was 56.9%(32). Moreover, a cross-sectional study conducted in two hospitals from January to March 2023 in Dhaka, Bangladesh, revealed that the prevalence of undernutrition based on the Patient-Generated Subjective Global Assessment (PG-SGA) tool was 67%(33).

In Palestine, a study at Al-Hussein Governmental Hospital in Beit Jala revealed a higher prevalence of malnutrition among patients with advanced-stage cancer. Malnourished individuals had significantly lower functional status and greater fatigue compared to those who were well- or moderately nourished(11). In Africa, a systematic review and meta-analysis estimated the overall prevalence of undernutrition among cancer patients to be 32.8%(34). In Libya, 25% of cancer patients were identified as severely malnourished, while 73.5% were either moderately malnourished or at risk, and only 1.5% were well-nourished (35). In addition, a cross-sectional study conducted among 123 cancer outpatients undergoing chemotherapy at the National Radiotherapy, Oncology, and Nuclear Medicine Centre of Korle Bu Teaching Hospital in Accra, Ghana, found that 31.7% of the patients were suspected of being malnourished, while 62.6% were classified as severely malnourished (36). Similarly, a study conducted in Nairobi, Kenya, among cancer outpatients receiving treatment at Kenyatta National Hospital and Texas Cancer Centre reported that 19.7% of the patients were moderately malnourished (classified as SGA-B), while 11.3% were found to be severely malnourished(37).

In Ethiopia, the prevalence of malnutrition among adult hospitalized cancer patients has also been reported as high. According to a national systematic review and meta-analysis of ten Ethiopian studies with a combined sample of 2,020 patients found a pooled malnutrition prevalence of 49.2%. Subgroup analysis by year revealed significant variation: in 2020, prevalence in Addis Ababa reached 86.5%; in 2021, it ranged from 17.1% to 58.2%; in 2022, from 48.1% to 56.7%; and in 2023, from 19.3% to 61.4%(1) A cross-sectional study in Amhara regional state referral hospitals indicated a prevalence of 55.6%(12). Furthermore, another study at the same hospital reported an overall malnutrition prevalence of 58.4% among chemotherapy patients, with rates higher among males (73%) and females (91%), and a particularly high rate (74.7%) among those with advanced-stage disease (38). Similarly, a study conducted in 2018 at the same institution found that 63.1% and 27.5% of patients were moderately and severely

undernourished, respectively, based on PG-SGA scoring (20). Furthermore, a cross-sectional study conducted at the Oncology Treatment Center of Hawassa University Comprehensive Specialized Hospital reported that 48.1% of adult cancer patients undergoing chemotherapy exhibited some level of under nutrition(21).

Summary: Malnutrition is a major concern among cancer patients globally and in Ethiopia. The prevalence is high and varies across regions, with rates particularly elevated in advanced stages of disease and among those undergoing combined treatments. Ethiopian data show significant regional variation, underscoring the need for localized studies.

2.3 Factors associated with malnutrition among adult cancer patients

Numerous factors contribute to the development of malnutrition in cancer patients, including socio-demographic characteristics, dietary intake patterns, disease-related factors, and treatment modalities (20, 39, 40).

2.3.1. Socio-demographic characteristics

Age, gender, and socioeconomic status are key factors influencing nutritional risk in cancer patients. A study in Malaysia found that individuals aged 56-65 years were particularly vulnerable to malnutrition, with gender differences observed, as more men were malnourished compared to women (41). Similarly, studies in Iran and Brazil have identified advanced age as a risk factor for malnutrition, with elderly cancer patients facing greater challenges in maintaining nutritional status(42).

A cross-sectional study at the oncology unit of Shahid Jalil Hospital in Yasuj, Iran, reported a strong association between age and malnutrition risk, with nearly 55% of patients aged 18–65 years being at high risk. The study also revealed that a gender disparity, showing that 48.65% of men were at high risk compared to 18.8% of women. Moreover, gastrointestinal tumors were more prevalent in male patients, and cancer-related mortality was notably higher among men—primarily due to biological, molecular, and genetic differences between sexes(2). According to GLOBOCAN data, in Iran, males are most frequently diagnosed with stomach cancer, while breast cancer is most common among females (43).

Summary: Age, gender, and socioeconomic status are significant determinants of malnutrition risk among cancer patients. Advanced age and low socioeconomic status are particularly critical factors, highlighting the need for targeted nutritional interventions.

2.3.2. Dietary intake patterns

Dietary intake patterns among cancer patients are frequently disrupted due to a variety of disease- and treatment-related symptoms. An observational study conducted in India reported that the most common factors contributing to reduced food intake over the past two weeks were nausea (43.9%), appetite loss (38.6%), mouth sores (17.5%), constipation (15.8%), and pain (8.8%)(44). These symptoms, especially anorexia, are known to significantly reduce food consumption and contribute to the development of malnutrition at various stages of the cancer journey, including diagnosis, treatment, recovery, and survivorship. Anorexia, defined as a lack or loss of appetite leading to involuntary dietary restriction, plays a central role in malnutrition among cancer patients (45).

Similarly, a prospective study in India that assessed patients' nutritional status through clinical and biochemical parameters emphasized the impact of symptoms such as nausea, vomiting, diarrhea, mouth sores, and constipation. These symptoms not only reduce food intake but also affect nutrient absorption, alter energy expenditure, and contribute to progressive weight loss (46). Supporting this, a cross-sectional nutritional assessment conducted in Iran revealed that 50.4% of cancer patients had reduced food intake. The most frequently reported symptoms were depression (38.8%), anorexia (37.8%), dry mouth (32.5%), nausea (25%), and pain (23.1%)(47). In addition, a descriptive cross-sectional study from Korea reported that 69% of cancer patients experienced altered food intake. This was primarily attributed to anorexia, vomiting, and changes in taste and smell perception. All of these are common side effects of cancer therapy and potent contributors to malnutrition (48).

Summary: Disruption of dietary intake due to cancer-related symptoms like anorexia, nausea, and mouth sores is a major contributing factor to malnutrition. Effective management of these symptoms is crucial for improving nutritional outcomes.

2.3.3. Disease-related factors

Disease-specific characteristics, including cancer type and stage, play a significant role in determining the nutritional status of patients. A cross-sectional study conducted at an oncology

and palliative care unit in northeastern Brazil found that severe malnutrition was most prevalent among patients with upper gastrointestinal tract cancers(48). Similarly, research from the oncology unit of Shahid Jalil Hospital in Yasuj, Iran, reported that gastrointestinal cancers were the most common, followed by breast and hematological malignancies (2). Studies from Italy and Iran further support this finding, indicating that malnutrition was more frequently observed in patients with gastro-esophageal and pancreatic cancers, while those with breast cancer had a lower likelihood of undernutrition (15, 16).

In Kenya, a study assessing cancer patients' nutritional needs revealed that the majority of participants were in advanced stages of cancer, with 27.2% at stage II, 27.2% at stage III, and 24.3% at stage IV. The most common cancer types included breast cancer (29.7%), female genital cancers (22.9%), and cancers of the lip, oral cavity, and pharynx (18.5%). The study further categorized nutritional intervention needs, showing that 17.2% of patients required minimal intervention, 14.2% needed ongoing nutritional education and pharmacologic support, 34.8% required symptom-based nutritional management, and 33.8% necessitated critical nutrition care(49).

In the Ethiopian context, a cross-sectional study conducted at Tikur Anbessa Specialized Hospital demonstrated a high burden of malnutrition among cancer patients, particularly those with lung cancer (64.4%), followed by breast cancer (56.8%), colorectal cancer (56.3%), and gastric and nasopharyngeal cancers (both 46.3%). Moreover, malnutrition was significantly more prevalent in patients with advanced-stage disease, with 74.7% of stage IV and 58.2% of stage III patients affected (38).

Summary: Disease type and stage are critical factors in determining the nutritional status of cancer patients, with gastrointestinal cancers and advanced disease stages being particularly associated with malnutrition.

2.3.4. Behavioral factors

Behavioral factors such as alcohol use and poor diet can affect cancer risk and nutritional status. A study from the Norwegian EPIC cohort found a higher risk of total and breast cancer in people who drank more alcohol. Among drinkers, those who ate less fatty fish had even greater cancer risk. A separate cohort study showed that breast cancer risk increased with alcohol intake.

Compared to non-drinkers, the risk was 1.21 times higher for those drinking 1–2 drinks per day and 1.38 times higher for those drinking 3 or more drinks daily. The risk was mainly seen in women with estrogen receptor-positive tumors. The type of alcohol—wine, beer, or spirits—did not make a difference. Even small amounts of alcohol may raise the risk, likely due to hormone-related effects (50).

2.3.5. Types of treatments

Cancer treatments, particularly chemotherapy and radiotherapy, are strongly linked to the development of malnutrition. A large-scale study in China found that nearly 58% of cancer patients undergoing chemotherapy were either moderately or severely malnourished(51). A study conducted at Cachar Hospital and Research Center in India reported that most patients were treated with radiotherapy, chemotherapy, or a combination of both. Many of them also underwent surgery along with these treatments (39). In Ethiopia, similar trends were observed, with higher malnutrition rates in patients receiving combined chemotherapy and radiation therapy (73.1%) compared to those receiving chemotherapy alone (56.3%) (38)(38). These treatments contribute to malnutrition by causing appetite loss, nausea, and gastrointestinal disturbances.

Summary: Cancer treatments, especially chemotherapy and radiotherapy, are significant contributors to malnutrition. The side effects of these treatments, including appetite loss and gastrointestinal issues, exacerbate the nutritional challenges faced by cancer patients.

2.4 Conceptual Framework

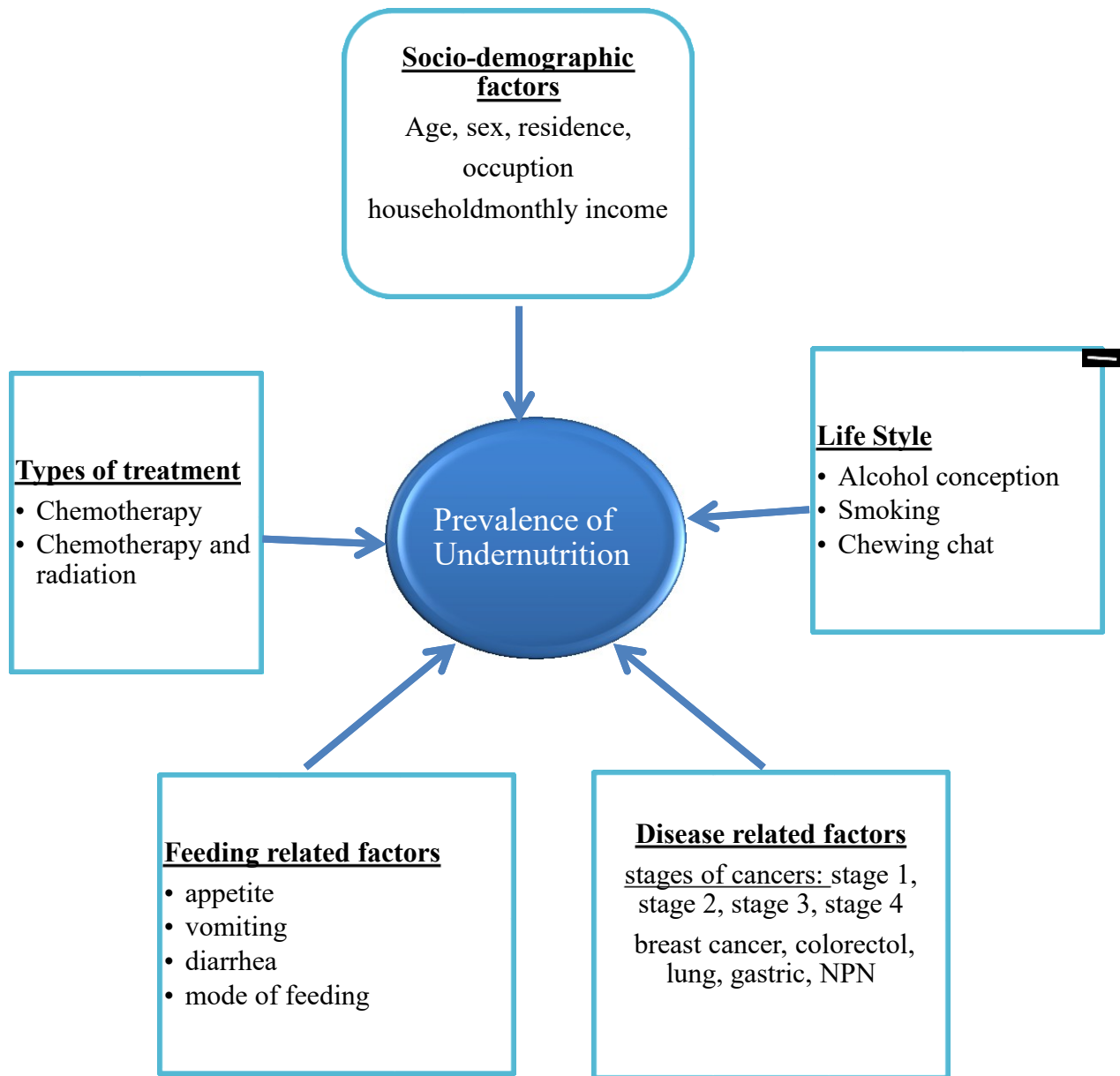


Figure 1: A conceptual framework adapted from the scientific researches on the prevalence of undernutrition and associated factors among adult cancer patients receiving chemotherapy (15, 16, 38).

3. OBJECTIVES

3.1. General Objective

To assess the prevalence of undernutrition and its associated factors among adult cancer patients receiving chemotherapy at Asella Teaching and Referral Hospital, Oromia, Southeast Ethiopia, in 2025.

3.2. Specific Objectives

- ✓ To determine the prevalence of undernutrition among adult cancer patients receiving chemotherapy in the study area.
- ✓ To identify factors associated with undernutrition among adult cancer patients receiving chemotherapy.

4. METHOD AND MATERIALS

4.1- Study area and period

This study was conducted at Asella Teaching and Referral Hospital, located in Asella town in the Arsi Zone of Oromia Regional State, approximately 175 km southeast of Addis Ababa. The hospital is a major public health facility providing preventive, curative, diagnostic, and palliative services, and serves as a referral center for Asella town and surrounding districts, with an estimated catchment population of 4.25 million people.

The oncology unit of the hospital, established in December 2018, provides chemotherapy services to cancer patients from the Arsi Zone and neighboring areas. Hospital records indicate that 417 cancer patients received chemotherapy during the three months preceding the study, and the unit treats an average of 4–9 patients per day.

Data collection for this study was carried out from August 11 to October 18, 2025.

4.2. Study designs

An institution-based cross-sectional study design was employed to assess the prevalence of undernutrition and its associated factors among adult cancer patients receiving chemotherapy at Asella Teaching and Referral Hospital.

4.3. Source and study population

4.3.1. Source Population

The source population consists of all adult cancer patients receiving chemotherapy treatment at Asella Teaching and Referral Hospital, Oromia Region, Southeast Ethiopia.

4.3.2. Study population

The study population included selected adult cancer patients attending the oncology unit and undergoing chemotherapy at Asella Teaching and Referral Hospital during the data collection period who met the eligibility criteria.

4.4. Eligibility criteria

4.4.1 Inclusion criteria:-

- Adult cancer patients aged 18 years and above
- Patients who have received at least one cycle of chemotherapy

- Patients who were conscious, oriented, and able to communicate effectively during the interview

4.4.2 Exclusion criteria:-

- Patients with critical illness and unable to respond during the data collection
- Patients with documented cognitive or psychological impairments that affect their ability to communicate were excluded

4.5. Sample size and sampling procedures

4.5.1. Sample size determination

1. The sample size for the 1st objective of this study was calculated using the single population proportion formula, based on the following assumptions:

- Confidence level = 95% ($Z = 1.96$)
- Margin of error (d) = 5% (0.05)
- Estimated prevalence (p) = 58.2%, based on a previous study conducted at Tikur Anbessa Specialized Hospital (38).

The formula used is $n = \frac{(Z \alpha / 2)^2 p(1-p)}{d^2}$

$$n = \frac{(1.96)^2 0.58(1-0.58)}{0.05^2} = 374$$

Where:

- n = initial calculated sample size
- Z = standard score corresponding to 95% confidence
- p = estimated prevalence of undernutrition (58.2%)
- d = margin of error (5%)

Since the total study population ($N = 417$) are less than 10,000, a **finite population correction** was applied using the formula:

$$nf = \frac{ni}{1 + \frac{ni}{N}} = \left(\frac{n}{1 + N/n} \right) \quad nf = \frac{n \times N}{N + n}$$

$$nf = \frac{(374 \times 417)}{417 + 374} = \frac{155958}{791} \approx 197$$

- nf = corrected sample size
- N = total population (417)
- n = initial sample size (374)

Finally sample size after adding a 10% non-response rate = $197 + (10\% \text{ of } 197) = 197 + 20 = \mathbf{217}$

2. Sample size for the 2nd objective was calculated using the double population proportion formula by Epi Info statistical calculation, considering 80% power and a one-to-one ratio based on a study conducted at Tikur Anbessa Specialized Hospital cancer center in Ethiopia (**40**).

Table 1: Summary of sample size calculation for factors associated with prevalence of undernutrition among adult cancer patients receiving chemotherapy at Asella Teaching and Referral Hospital using Open Epi 7.2.5.0

Variables selected as association factors	Assumptions					Sample size with a 10% non-response rate		
	OR	P1	Ratio	Power	CI	N	10%NR	N
Stage of cancer	7.2	74.7%	1:1	80%	95%	108	10.8	119
Loss of appetite	4.5	69.6%	1:1	80%	95%	120	12	132
Diarrhea	7.8	82.5%	1:1	80%	95%	154	15.4	169

NB: OR = odds ratio, P1= proportion of exposed, Ratio = cases to control & CI = confidence interval, N=10% non-response rate and n=final simple size

- The sample size of the 1st objective (prevalence of undernutrition) was found to be higher than the second. Therefore, the final sample size for this study was the 1st objective sample size (**217**)

4.5.2. Sampling procedure

Arsi University Asella Teaching and Referral Hospital was purposively selected as the study site because it is the sole public health facility providing chemotherapy services to cancer patients in the Arsi Zone. This makes it an ideal setting to access the target population. Based on records from the oncology unit, 417 adult cancer patients received chemotherapy over the past three months, which serves as the sampling frame for this study. A systematic random sampling technique was used to select 217 participants during the data collection period.

The sampling interval (k) was calculated by dividing the total number of eligible patients (417) by the desired sample size (217), resulting in approximately $k = 2$. On the first day of data collection, the first participant was randomly selected from the first two patients using a simple

lottery method. Subsequently, every 2nd eligible patient was recruited consecutively until the sample size was reached. In cases where a selected patient does not meet the inclusion criteria or refuses to participate, the next eligible patient was approached to maintain the sampling interval and sample size.

$$\text{Sampling interval (K)} = \frac{\text{Total population}}{\text{Sample size}} = 417/217 = 2$$

4.6. Variables of the study

4.6.1. *Dependent variables*

Undernutrition was assessed using PG-SGA and categorized as well-nourished vs. undernourished.

4.6.2. *Independent variables*

Socio-demographic and economic factors: (Age, sex, marital status, educational status, occupation, ethnicity, religion, residence, household monthly income, weight, height, BMI, etc.)

Disease-related factor: Type of cancer, stage of cancer, and comorbidities

Treatment-related factor: Type of treatment

Feeding-related factors: Appetite status, mode of feeding, and mobility

Lifestyle: Alcohol consumption, smoking, and khat chewing

4.7. Operational definitions

Adult oncology patients: patients above 18 years old receiving chemotherapy for cancer disease in the oncology unit.

Malnutrition is characterized by the presence of two or more of the following: insufficient energy intake, weight loss, loss of muscle mass and loss of subcutaneous fat, localized or generalized fluid accumulation, or decreased functional status(38).

Nutritional status: nutritional conditions of the respondents will be classified according to Body Mass Index (BMI). It is calculated that the ratio of weight to height in meters squared(38).

Nutrient intake: types and amount of selected nutrients (energy, protein, calcium, sodium, iron, zinc, dietary fiber, vitamin C, and folic acid) consumed by adult oncology patients, concerning recommended dietary intakes(38).

SGA Score of nutritional status: According to the sum of points assigned to each item, patients were initially classified into: Well-nourished: less than 17 points. Undernourished (moderate and severe): greater than or equal to 17 points(38).

4.8. Data collection procedures

Data were collected through face-to-face interviews using a structured and standardized questionnaire. The instrument includes sections on socio-demographic characteristics, clinical information, dietary habits, and nutritional assessment. Nutritional status was evaluated using the Patient-Generated Subjective Global Assessment (PG-SGA) tool along with anthropometric measurements such as height and weight. Body Mass Index (BMI) was calculated to classify nutritional status.

Trained data collectors interviewed eligible participants after obtaining verbal and written informed consent. In addition to the questionnaire, measurements were taken using calibrated weighing scales and stadiometers following standard procedures. Data were collected digitally using Kobo Toolbox on smartphones or tablets to ensure efficiency, reduce errors, and facilitate real-time data monitoring. Participants were interviewed in private settings within the oncology unit to maintain confidentiality and comfort.

4.9. Data quality assurance

To ensure the quality and consistency of the data, several measures were implemented. The data collection tool was adapted from validated sources and translated into Afaan Oromo and Amharic, then back-translated into English to maintain consistency. A pretest was conducted on 5% of the sample size at Adama Hospital prior to the main study to evaluate clarity, language appropriateness, and content relevance. Feedback from the pretest was used to revise and improve the tool accordingly.

Data collectors and supervisors underwent one day of training on the study objectives, ethical considerations, interview techniques, and anthropometric measurement procedures. The training

ensured standardization and reduced inter-observer variability. Each day, the collected data were carefully reviewed and checked for completeness and consistency by the investigator. If any questionnaires were found to be incomplete or unclear, they were returned to the data collectors for correction. The collected data were coded, edited, and entered into Epi-Data version 4.7 to minimize data entry errors

4.10. Data processing and analysis procedure

The collected data were exported to SPSS version 27.0 for further analysis. Descriptive statistics were performed to summarize the frequency and percentage distributions of variables. A binary logistic regression analysis was conducted to identify factors associated with the prevalence of undernutrition. Variables with a p-value less than 0.25 in the bivariate analysis were included in a multivariable logistic regression model to determine independent predictors. The goodness of fit of the final model was assessed using the Hosmer-Lemeshow test. Multicollinearity among independent variables was evaluated using diagnostic tests such as the variance inflation factor (VIF). The strength of associations was expressed as adjusted odds ratios (AORs) with 95% confidence intervals (CIs). Statistical significance was declared at a p-value less than 0.05.

4.11. Ethical considerations

Prior to the commencement of the study, ethical clearance was obtained from the Institutional Review Board (IRB) of Arsi University. A formal permission letter was also secured from the Department of Public Health and the relevant administrative bodies of ARTH. Study participants were clearly informed about the purpose, procedures, and significance of the research. Participation was entirely voluntary, and individuals were assured of their right to refuse or withdraw at any stage without any consequence. To maintain confidentiality, no personal identifiers such as names, were recorded on the questionnaire. All collected information was kept strictly confidential and used solely for research purposes. Participant privacy was respected throughout the data collection process.

4.12 Dissemination of the results

The final findings of this study will be compiled and submitted to the Department of Public Health at Arsi University as part of the fulfillment of academic requirements. Copies of the thesis will also be deposited in the libraries of Asella Referral and Teaching Hospital and Arsi Zone Health Bureau. Additionally, the results will be disseminated through presentations at relevant

seminars and professional conferences, and efforts will be made to publish the study in nationally or internationally recognized peer-reviewed journals to reach a broader scientific community.

5. RESULTS

5.1. Socio-demographic and economic-related characteristics of respondents

A total of 214 adult cancer patients participated in the study, resulting in a response rate of 98.62%. The mean age of the respondents was 54.80 ± 13.68 years, and nearly half, 97 (45.3%), were between 50 and 65 years old. Females accounted for 141 (65.9%) of the participants.

Regarding religion and ethnicity, 114 (53.3%) were Muslim, and the majority, 168 (78.5%), were Oromo. More than half of the respondents, 130 (60.7%), resided in rural areas. A large proportion, 166 (77.6%), were married.

Overall, 138 (64.5%) had attended formal education. Slightly more than half, 115 (53.7%), reported having more than five family members. In terms of monthly household income, 118 (55.2%) earned more than 5,000 Ethiopian Birr (ETB) per month (Table 1).

Table 2: Socio-demographic and economic-related characteristics of cancer patients receiving chemotherapy treatment in Asella referral and teaching hospital at oncology unit, Arsi zone, Oromia regional state, southeast Ethiopia, 2025(n=214)

Characteristics	Category	Frequency	Percent
Age of participants	18-29	6	2.8
	30-49	72	33.6
	50-65	97	45.3
	>65	39	18.2
	Mean($\pm$ SD)	54.80 $\pm$ 13.68	
Sex of participants	Male	73	34.1
	Female	141	65.9
Residence of participant	Urban	84	39.3
	Rural	130	60.7
Participant 's Religion	Muslim	114	53.3
	Orthodox	70	32.7
	Protestant	30	14.0
Participant's Ethnicity	Oromo	168	78.5
	Amhara	38	17.8
	Others	8	3.7
Participant's Current marital status	Married	166	77.6
	Windowed	28	13.1
	Divorced	16	7.5
	Single	4	1.9
Participant's educational level	No education	42	19.6
	Read and write	35	16.4
	Primary school (1-8)	79	36.9
	Secondary school (9-10)	31	14.5
	Collage and above	27	12.6
Occupation of participant	House wife	62	29.0
	Farmer	40	18.7
	Governmental employee	46	21.5
	Daily laborer	37	13.2
	Merchant	17	6.1
Educational status of father	Illiterate	12	3.6
	Read and write	47	14.1
	Primary school	63	18.9
	Secondary school	89	26.6
	Collage and above	114	34.1
Family members	<5	99	46.3
	$\geq$ 5	115	53.7
Household monthly income	>2500	37	17.3
	2500 to 5000	59	27.6
	5001 to 10000	99	46.3
	>10000	19	8.9

5.2. Lifestyle: Alcohol consumption, cigarette smoking, and khat chewing among cancer patients.

Of the 214 respondents, 68 (31.8%) reported a history of alcohol consumption, 39 (18.2%) had a history of smoking, and 52 (24.3%) reported chewing khat (Figure 2).

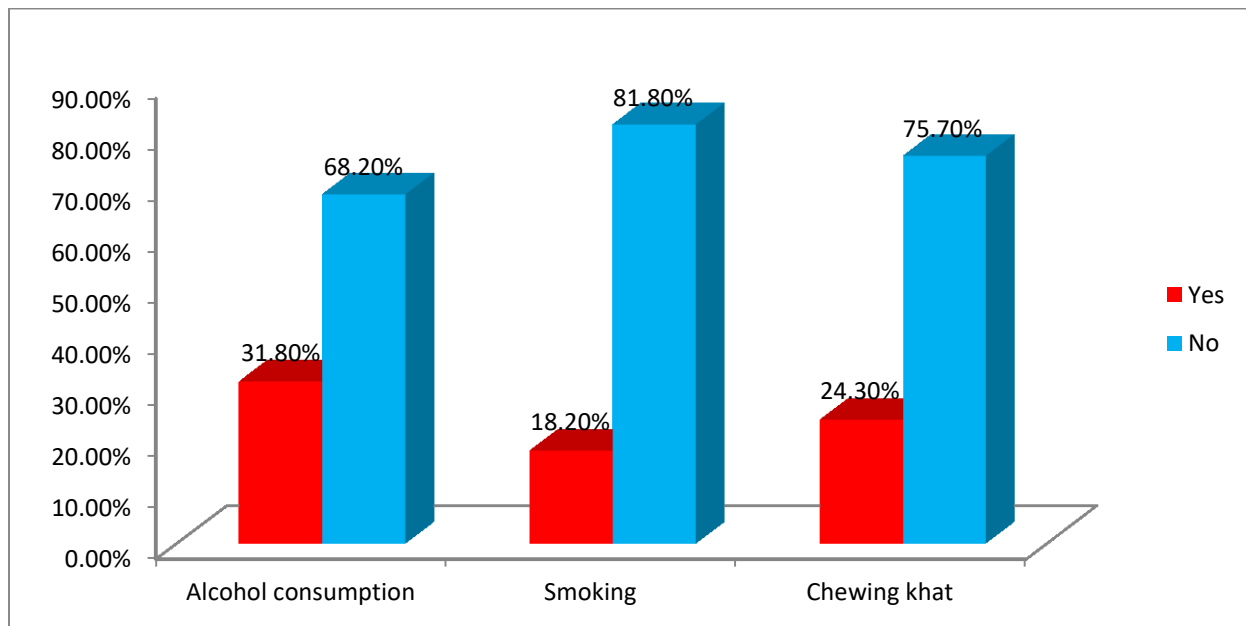


Figure 2: lifestyle of cancer patients receiving chemotherapy treatment in Asella referral and teaching hospital at oncology unit, Arsi zone, southeast Ethiopia, 2025(n=214)

5.3. Disease and treatment-related factors among cancer patients

Among the 214 participants, 93 (43.5%) had at least one pre-existing comorbidity, and 61 (28.5%) reported a family history of cancer. Regarding cancer type, breast cancer was the most common, affecting 55 (25.7%) patients, followed by gastric cancer in 51 (23.8%) and esophageal cancer in 45 (21.0%) patients.

A considerable proportion of the patients were diagnosed at an advanced stage: 80 (37.4%) were in stage IV and 50 (23.4%) in stage III. Stage II accounted for 45 (21.0%), while 30 (14.0%) were in stage I; 9 (4.2%) had un-staged disease due to incomplete clinical documentation.

In terms of treatment, the majority, 157 (73.4%), received chemotherapy alone. Additionally, 49 (22.9%) underwent a combination of chemotherapy and surgery, and 8 (3.7%) received chemo-radiation therapy (Table 3).

Table 3: Disease and treatment-related factors among cancer patients receiving chemotherapy treatment in Asella referral and teaching hospital at oncology unit, Oromia regional state, southeast Ethiopia, 2025(n=214)

Characteristics	Category	Frequency	Percent
Co morbidity	Yes	93	43.5
	No	121	56.5
Family history	Yes	61	28.5
	No	153	71.5
Types of cancers	Breast	55	25.7
	Gastric	51	23.8
	Esophageal	45	21.0
	Colorectal	19	8.9
	Cervical	19	8.8
	Lung	11	5.2
	Prostate	5	2.3
	Others	9	4.2
Stages of cancer	Stage 1	30	14.0
	Stage 2	45	21.0
	Stage 3	50	23.4
	Stage 4	80	37.4
	Not staged	9	4.2
Types of treatment	Chemo-radiation	8	3.7
	Chemotherapy	157	73.4
	Chemotherapy surgery	49	22.9

5.4. Feeding habits and nutritional status among cancer patients

Regarding feeding habits, 147 (68.7%) of the respondents consumed all types of food without major restrictions, while 26 (12.1%) reported consuming mainly liquid diets. Loss of appetite was common and reported by 143 (66.8%) participants. In addition, 134 (62.6%) experienced nausea, and 78 (36.4%) reported vomiting. In terms of dietary intake, 126 (58.9%) consumed fewer than three meals within a 24-hour period. Concerning fluid intake, the majority, 176 (82.2%), reported consuming less than two liters of fluid per day (Table 4).

Table 4: Feeding habit and nutritional status among cancer patients receiving chemotherapy treatment in Asella referral and teaching hospital at oncology unit, Oromia regional state, southeast Ethiopia, 2025(n=214)

Characteristics	Category	Frequency	Percent
Types of feeding	All types	147	68.7
	Semi-solid & liquid	41	19.2
	Only liquid	26	12.1
Any problem during eating and chewing	Yes	159	74.3
	No	55	25.7
Pain during swallowing	Yes	50	23.4
	No	164	76.6
Loss of appetite	Yes	143	66.8
	No	71	33.2
Loss of test	Yes	43	20.1
	No	171	79.9
Nausea	Yes	134	62.6
	No	80	37.4
Vomiting	Yes	78	36.4
	No	136	63.6
Constipation	Yes	65	30.4
	No	149	69.6
Diarrhea	Yes	74	34.6
	No	140	65.4
Meal frequency	<3 time	126	58.9
	≥3 times	88	41.1
Fluid intake in 24hrs	<2 litter	176	82.2
	≥2 litter	38	17.8
Decrease in eating habits	Yes	155	72.4
	No	59	27.6
Regularly eating breakfast habit	Yes	78	36.4
	No	136	63.6

5.5. Nutritional status of cancer patients assessed using the Malnutrition Universal Screening Tool (MUST) and anthropometric measurements

Based on BMI measurements, nearly half of the patients (46.7%) were underweight with a BMI below 18.5. An additional 24.8% had a BMI between 18.5 and 20, while only 28.5% had a BMI above 20.

Based on MUST classification, 29.9% of patients were at low risk of malnutrition, 20.1% were at medium risk, and 50.0% were at high risk. Overall, more than two-thirds of the patients (70.1%) were at medium or high nutritional risk.

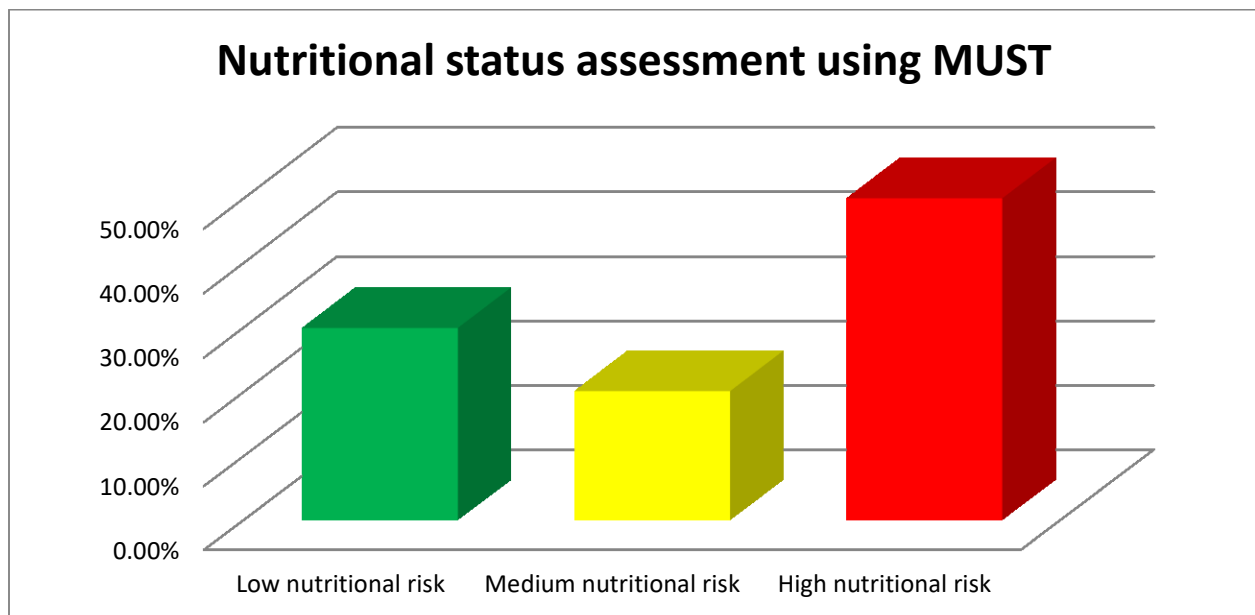


Figure 3: Nutritional status of cancer patients undergoing chemotherapy, classified using the MUST tool, at Asella Referral and Teaching Hospital, Oromia Regional State, Southeast Ethiopia, 2025.

5.6. Prevalence of undernutrition among cancer patients

Based on the Patient-Generated Subjective Global Assessment (PG-SGA), the overall prevalence of undernutrition among adult cancer patients receiving chemotherapy was **61.7%** (95% CI: **55.2–68.2**). Undernutrition was more common among females (**64.4%**) than males (**35.6%**).

Regarding cancer type, the highest proportions of undernourished patients were observed among those with **gastric cancer (31.1%)** and **esophageal cancer (28.8%)**. By clinical stage, undernutrition was most prevalent among patients diagnosed with **stage IV disease (44.4%)**, followed by those with **stage III (40.8%)**.

In relation to treatment type, patients receiving **chemotherapy alone** exhibited the highest prevalence of undernutrition (**74.2%**). Additionally, among patients identified as having metastatic disease, **87%** were classified as undernourished.

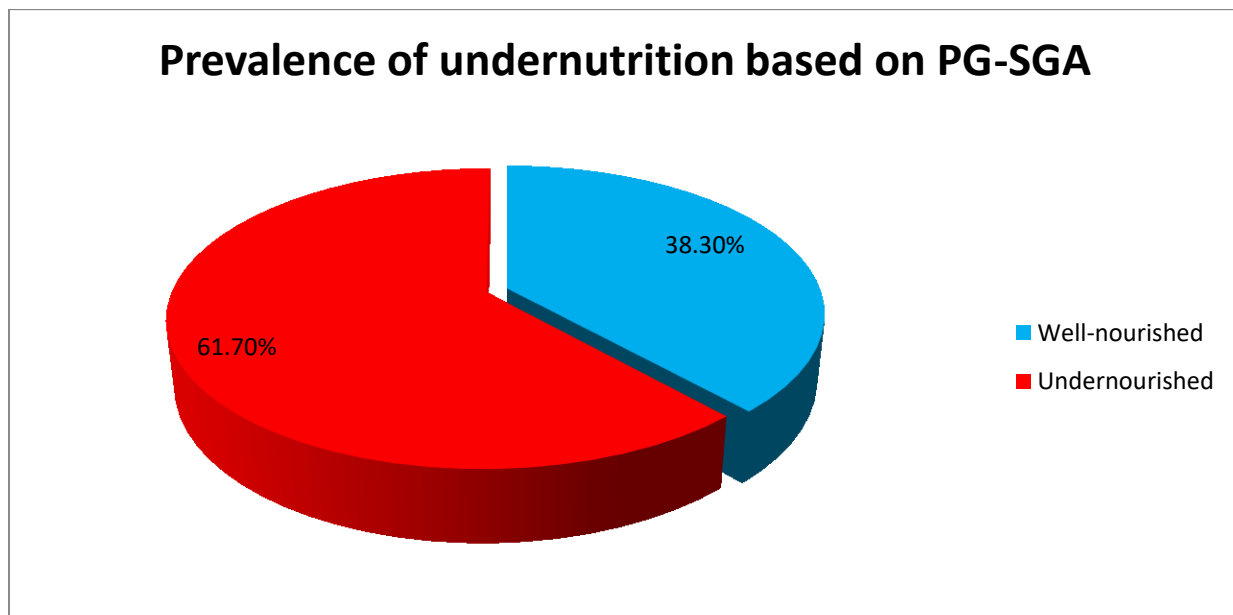


Figure 4: The prevalence of undernutrition among cancer patients receiving chemotherapy at Asella referral and teaching hospital, Oromia regional state, South-east Ethiopia, 2025

5.7. Factors associated with undernutrition among cancer patients

Binary logistic regression was initially conducted to identify candidate variables for multivariable analysis. In the bivariate analysis, residence, educational status, family size, smoking, khat chewing, cancer stage (III and IV), pain during swallowing, loss of appetite, loss of taste, nausea, vomiting, diarrhea, meal frequency, reduced eating habits, and irregular breakfast consumption were significantly associated with undernutrition.

In the multivariable logistic regression model, **stage of cancer, loss of appetite, vomiting, diarrhea, and meal frequency** remained significant predictors of undernutrition ($p < 0.05$). Patients diagnosed with **Stage IV cancer** had **4.79 times** higher odds of being undernourished compared with those in Stage I (AOR = 4.79, 95% CI: 1.30–17.71). Similarly, those with **Stage III disease** were **4.26 times** more likely to be undernourished (AOR = 4.26, 95% CI: 1.14–15.99).

Loss of appetite showed a strong association with undernutrition, with affected patients having **3.47 times** higher odds than those without appetite loss (AOR = 3.47, 95% CI: 1.14–10.50). Vomiting was another significant predictor, where patients who experienced vomiting had **7.71 times** greater odds of undernutrition (AOR = 7.71, 95% CI: 2.07–28.71). Similarly, patients who reported diarrhea had **4.10 times** higher odds of undernutrition compared with those without diarrhea (AOR = 4.10, 95% CI: 1.43–11.70). Meal frequency also had a significant effect. Patients consuming **fewer than three meals per day** were **2.83 times** more likely to be undernourished than those who ate three or more meals daily (AOR = 2.83, 95% CI: 1.20–6.66).

Overall, advanced disease stage, treatment-related symptoms (vomiting and diarrhea), loss of appetite, and inadequate meal frequency were independently associated with undernutrition among adult cancer patients receiving chemotherapy.

Table 5: Bivariate and multivariate logistic regression analysis of factors associated with undernutrition among cancer patients receiving chemotherapy treatment in Asella referral and teaching hospital oncology unit, Oromia regional state, southeast Ethiopia, 2025(n=214)

Variable	Category	Undernutrition		COR (CI=95%)	AOR (CI=95%)
		Undernourished	Well-nourished		
Residence	urban	47(35.6%)	26(31.7%)	1	1
	rural	85(64.4%)	56(68.3%)	1.90(1.08-3.335)	1.57(0.67-3.71)
Education	No education	53(40.2%)	23(28.0%)	1.72(0.95-3.12)	1.45(0.54-3.90)
	Formal education	79(59.8%)	59(72.0%)	1	1
Family size	≤5	54(40.9%)	45(54.9%)	1	1
	>5	78(59.1%)	37(45.1%)	1.76(1.01-3.06)	0.77(0.28-2.17)
Smoking	Yes	28(21.2%)	11(13.4%)	1.74(0.81-3.72)	0.43(0.08-2.39)
	No	104(78.8%)	71(86.6%)	1	1
Khat chewing	Yes	39(29.5%)	13(15.9%)	2.23(1.10-4.49)	1.74(0.38-8.05)
	No	93(70.5%)	69(84.1%)	1	1
Stage of cancer	Stage I	11(8.3%)	19(23.2%)	1	1
	Stage II	17(12.9%)	28(34.1%)	0.72(0.16-3.28)	1.39(0.39-4.91)
	Stage III	37(28.0%)	13(15.9%)	0.76(0.18-3.22)	4.26(1.14-15.99)*
	Stage IV	63(47.7%)	17(20.7%)	3.56(0.83-15.30)	4.79(1.30-17.71)*
	Not staged	4(3.0%)	5(6.1%)	4.63(1.12-19.16)	2.37(0.33-17.02)
Pain during swallowing	Yes	42(31.8%)	8(9.8%)	4.32(1.91-9.76)	0.83(0.25-2.77)
	No	90(68.2%)	74(90.2%)	1	1
Appetite loss	Yes	112(84.8%)	31(37.8%)	9.21(4.80-17.69)	3.47(1.14-10.50)*
	No	20(15.2%)	51(62.2%)	1	1
Loss of taste	Yes	37(28.0%)	6(7.3%)	4.93(1.98-12.30)	1.17(0.29-4.72)
	No	95(72.0%)	76(92.7%)	1	1
Nausea	Yes	103(78.0%)	31(37.8%)	5.84(3.18-10.73)	1.43(0.49-4.11)
	No	29(22.0%)	51(62.2%)	1	1
Vomiting	Yes	74(56.1%)	4(4.9%)	24.9(8.60-71.95)	7.71(2.07-28.71)*
	No	58(43.9%)	78(95.1%)	1	1
Diarrhea	Yes	67(50.8%)	7(8.5%)	11.0(4.74-25.75)	4.10(1.43-11.70)*
	No	65(49.2%)	75(91.5%)	1	1
Meal frequency	>3 times	97(73.5%)	29(35.4%)	5.06(2.79-9.18)	2.83(1.20-6.66)*
	≤3 times	35(26.5%)	53(64.6%)	1	1
Reduced eating habits	Yes	105(79.5%)	50(61.0%)	2.49(1.34-4.59)	1.06(0.44-2.58)
	No	27(20.5%)	32(39.0%)	1	1
Irregular breakfast	Yes	41(31.1%)	37(45.1%)	1.82(1.03-3.23)	0.744(0.30-1.84)
	No	91(68.9%)	45(54.9%)	1	1

The variables which have p value < 0.05 have true significant association with undernutrition, CI: confidence interval, ** p value

<0.05, ** p value <0.001, COR: Crude odd ratio and AOR: Adjusted odd ratio

6. DISCUSSION

This study assessed the prevalence of undernutrition and its associated factors among adult cancer patients receiving chemotherapy at Asella Teaching and Referral Hospital. The overall prevalence of undernutrition, as measured by the PG-SGA, was 61.7%, indicating a substantial nutritional burden among this patient population. This finding is comparable with studies conducted in the National Cancer Center in Korea, which reported a prevalence of 61% (45) and study conducted in Ethiopia at the Tibur Anbessa Specialized Hospital oncology unit where 58.2% of patients were undernourished (40). The findings of this study is lower than a study done in Southern Brazil, Institute of Integrative Medicine Prof. Fernando Figueira, a referral oncology center in Recife, Pernambuco, Brazil, Mashhad Iran, 84.2%, 75.1%, and 89.9% (29, 31, 53). Additionally, this finding is lower than cross-sectional study conducted in two hospitals in Dhaka, Bangladesh (67%)(33), and National Radiotherapy Oncology and Nuclear Medicine Centre of the Korle-Bu Teaching hospital (KBTH) in Accra, Ghana (94.3%)(36). This discrepancy might be due to socio demographic characteristics difference, study population, difference in expanded health service provision.

However, the prevalence observed in this study is higher than the pooled African estimate of 32.8% (33) and reports from Nairobi, Kenya, which documented a prevalence of 31%(37). Furthermore, the finding exceeds results from a cross-sectional study conducted at the Oncology Treatment Center of Hawassa University Comprehensive Specialized Hospital, where 48.1% of adult cancer patients undergoing chemotherapy were found to have some level of undernutrition(21). These discrepancies may be attributed to variations in study populations, cancer types and stages, treatment regimens, assessment tools, and socio-demographic differences. Additionally, differences in healthcare access, nutritional support services, and cultural dietary practices may have influenced the observed prevalence of undernutrition across different settings.

In this study, I found that the prevalence of undernutrition in men was 35.6% which is lower than Korean study 61% for hospitalized male patients (54), French comprehensive Cancer Centres 56.4%(41), Tehran male patients 54%(55) and also slightly lower than Tikur Anbessa Specialized Hospital 53.7%(38). The prevalence of undernutrition in female patient was 64.4% which was higher than Tehran study which was around 46% (55). In this finding, the prevalence

of undernutrition in advanced stage of cancer was 44.4% which is lower than the Malaysia study 56.9%(56), Tikur Anbessa Specialized Hospital finding 74.7% (38) and Korea undernutrition in advanced stage of cancer 55.6 %(54). This difference may be due to economic status of the participants and quality of treatment. Stage of cancer was significantly associated with undernutrition.

This finding shows that type of treatment under-nutrition was higher among patients on Chemotherapy (74.2%) followed by chemosurgery (22.0%) and then Chemo-radiation treatment (3.8%). Unlikely, another cross-sectional study conducted in Ethiopia at Tikur Anbessa Specialized Hospital illustrated that under-nutrition was higher among patient on chemo-radiation (73.1%) followed by chemosurgery (59.2%) and the chemotherapy (56.3%)(38). This difference is maybe due to availability of only chemotherapy and chemo-surgery treatment in Arsi Hospital cancer unit. The current study found that stage IV cancer patients were 4.79 fold more likely to have undernutrition than those with stage I, this was supported by study done in Malaysia(56) and Addis Ababa, Tikur Anbessa Specialized Hospital(38). It may probably due to poor quality of care cancer related undernutrition or pathophysiology of cancer cells which needs high calorie intake of food in advanced stage.

In addition, patients who experienced loss of appetite were 3.47 times more likely to develop undernutrition compared to those without appetite loss. This finding is consistent with results from a study conducted by Kumar on cancer patients(57) and with a study carried out in Ethiopia at Hawassa University Comprehensive Specialized Hospital(21). Similarly, evidence from Italy indicates that loss of appetite is a major contributor to malnutrition among cancer patients(16). It may due to cancer therapy affect nutritional status through alterations on the metabolic system, change in taste of food and reduction in food intake result in damage to normal tissues. The presence of diarrhea in cancer patients was identified as a significant risk factor for malnutrition. This finding is consistent with studies conducted in the Republic of Korea and Addis Ababa, Ethiopia, which similarly reported that diarrhea is a major contributor to undernutrition among individuals with cancer (40, 54). This association may be explained by the fact that diarrhea leads to substantial losses of fluids, electrolytes, and essential nutrients, resulting in impaired nutrient absorption and increased metabolic demands. In cancer patients, treatment-related gastrointestinal toxicity further compromises digestive function, reducing the body's ability to

retain and utilize nutrients. Persistent diarrhea also decreases appetite and food intake, thereby exacerbating the risk of undernutrition.

Furthermore, this study found that patients who experienced vomiting had 7.71 times higher odds of developing undernutrition. This result aligns with findings from the study conducted at the Oncology Treatment Center of Hawassa University Comprehensive Specialized Hospital in Ethiopia(21). This association may be explained by the fact that vomiting leads to significant loss of nutrients and fluids, which disrupts normal digestion and reduces the body's ability to absorb essential vitamins and minerals. Recurrent vomiting also decreases dietary intake due to nausea, fear of eating, and treatment-related gastrointestinal irritation. Together, these factors contribute to a negative energy balance and increase the likelihood of undernutrition among cancer patients.

Similarly, behavioral factors, particularly meal frequency, were associated with nutritional status. Patients who consumed fewer than three meals per day were 2.83 times more likely to be undernourished than those who ate at least three meals daily. This is consistent with previous research showing that reduced meal frequency and disrupted eating patterns lead to inadequate energy and nutrient intake (43, 47). These deficits may occur because consuming fewer meals reduces overall energy and nutrient availability, making it difficult for patients to meet their daily nutritional requirements. Limited meal frequency also restricts opportunities for adequate intake, increasing the likelihood of undernutrition

7. STRENGTH AND LIMITATION

7.1 Strength

- ✓ There is high response rate in this study
- ✓ The data was collected from two sources: by interviewing patients and from their medical records is the strength of this study

7.2 Limitation

- ✓ Recall and social desirability bias
- ✓ Shortage of literatures in prevalence and risk factor of malnutrition among adult cancer patients receiving chemotherapy
- ✓ Causal relationships cannot be ascertained as the study used a cross sectional design

8. CONCLUSION AND RECOMMENDATION

8.1 Conclusion

In this study, the prevalence of under nutrition among adult cancer patients was high (61.7% by PG-SGA), and 70.1% were at medium or high nutritional risk based on MUST. The key factors significantly associated with undernutrition were advanced disease stage, inadequate meal frequency, loss of appetite, vomiting, and diarrhea. Undernutrition was also more frequently observed in certain subgroups, including females and patients with gastrointestinal cancers, but these did not remain statistically significant predictors.

8.2. Recommendation

- ✓ **Routine Nutritional Assessment:** Implement regular nutritional screening and assessment using validated tools such as PG-SGA and MUST for all cancer patients, especially those in advanced stages.
- ✓ **Symptom Management:** Provide effective management for chemotherapy-related gastrointestinal symptoms, including nausea, vomiting, diarrhea, and loss of appetite, to maintain adequate dietary intake.
- ✓ **Dietary Counseling:** Educate patients and caregivers on meal frequency, portion size, and nutrient-dense foods to improve calorie and protein intake during treatment.
- ✓ **Multidisciplinary Approach:** Integrate dietitians and nutrition specialists into oncology care teams to provide individualized nutritional interventions.
- ✓ **Further Research:** Conduct longitudinal studies to evaluate the impact of nutritional interventions on treatment outcomes, quality of life, and survival among cancer patients in Ethiopia and similar settings.

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10. APPENDEESIS

Annex I: Information sheet and consent form (English version) in verbal form

Dear Participant, my name is _____. I am here today to collect data for Ketema Bogale. He is an Arsi University, college of health science, department of Public Health student who wants to study prevalence of malnutrition and associated factors among adult cancer patients receiving chemotherapy in Asella referral and teaching hospital to generate information on it which may help the concerning bodies to take action based on the result from this study. The study will involve private life questions. So we need your help by answering the following questions. Whatever information you provide will be kept strictly confidential, and will not be shared with anyone other than the investigator. No need to mention your name. Do not worry about your answer. Participation in this survey is voluntary; you have the full right to refuse to answer. But your honest answer is advantageous for this study. And I wait for participation and truthfulness from you.

Is it your wish to participate?

Yes ☐ Please go to the next page.

No ☐ Thank you!

Date _____

Participant Signature _____

Annex II: English version Questionnaire

Instructions: There are a series of questions to be filled by data collectors.

Direction: - please encircle the numbers which client answer or information you get by patients' charts reviewing found on and correctly fills in the blank space provided.

Code number of the participant _____

S.NO	Question	Response	Remark
I. Household demographic and socio-economic data			
101.	Age of participant	_____yrs.	
102	Sex of participant	1. Male 2. Female	
103	Residence of participant	1. Urban 2. Rural	
102.	Religion	1. Orthodox 2. Muslim 3. Catholic 4. Protestant 5. Others (specify).....	
103	What is your ethnicity?	1. Amhara 2. Oromo 3. Tigre 4. Gurage 5. Others (specify)_____	
104.	Current marital status of participant	1. Un- married 2. Married 3. Divorced 4. Widowed	
105.	Education status of participant	1. No education 2. Informal education 3. Primary school(1-8) 4. Secondary school(9-10) 5. College and above	
106.	Occupation of participant	1. Housewife 2. Farmer 3. Government employee 4. Daily laborer 5. Merchant	

		6. Retired 7. Other (specify).....	
	How many family members you have	_____	
	Average monthly income(Ethiopian Birr)	_____	
Part II Life style of the participant			
201	Have you been experiencing consumption of alcohol	1. yes 2. no	If no for Q201 Skip to Q204
202	If you drink alcohol, how often did you use to drink Alcohol?	1. Monthly or less 2. 2 to 4 times a month 3. 2 to 3 times a week 4. 4 or more times a week 5. Other(Specify)_____	
204	How much glasses have you drink per week?	_____	
205	Have you been experiencing smoking habits	1. yes 2. no	If no for Q205, skip to Q208
206	If yes for Q203, how many times have you smoke per days?	_____	
207	How many cigarettes on average do you smoke per day?		
208	Have you been experiencing chewing Khat	1. yes 2. no	If no for Q208, skip to 301
209	If yes for Q208, how often?	1. Daily 2. On weekends 3. Social chewer 4. Others(Specify)_____	
Part III: Medical and related determinants of the participant			
301	Family history of cancer	1. yes 2. no	

302	Co-morbidity	1. yes 2. no	If no for Q302, skip to 304
303	If yes for Q302, what are those diseases?	_____	
304	Types of cancer	1. Breast 6. Other 2. Colorectal 3. Esophageal 4. Gastric 5. Cervical	
305	Stage of cancer	1. Stage I 2. Stage II 3. Stage III 4. Stage IV 5. Not staged	
306	Is cancer metastasized?	1. Yes 2. No	If no for Q306, skip to Q308
307	If yes, where does metastasis occur?	1. Local 2. Adjacent 3. Distant 4. Other(Specify) _____	
308	Types of treatment	1. Chemo-radiation 2. Chemotherapy 3. Chemotherapy and surgery 4. Others(specify it)	
309	Types of feeding	1. solid 2. semi-solid 3. liquid	
310	Do you have any problem during eating and chewing?	1. yes 2. no	If no for Q310, skip to Q312
311	If yes for Q310, what are those problems have you been experiencing	_____	
312	Do you have any pain during swallowing?	1. yes 2. no	

313	Do you have been experiencing recently loss of appetite?	1. yes 2. no	
314	Have been experiencing loss of taste?	1. Yes 2. No	
315	Do you feeling nausea?	1. yes 2. no	
316	What about vomiting?	1. yes 2. no	
317	Do you have constipation?	1. yes 2. no	
318	Do you have diarrhea?	1. yes 2. no	
Part IV: Feeding habit of participant			
401	Meal frequency(in past 24hrs)	1. one 2. two 3. three 4. four and above	
402	How much fluid do you take within 24hrs	1. less than litter 2. 1-3 litter 3. more than 3 litter	
403	Do you have any weight loss in the past 3 months	1. yes 2. no	
404	Do have been experiencing decreasing of eating habit	1. yes 2. no	
405	Do you had regular eating of breakfast habit	1. yes 2. no	
406	Are you in fasting state	1. yes 2. no	
Part V: Patients Generated subjective Global Assessment Form			

A.1	Weight change over 6 months 1.weight gain or no change or mild weight loss 2.modarete weight loss 3.severe weight loss	B.1	Subcutaneous loss of fat 1.little or no loss 2.:mild- moderate in all area; severe loss in some area 3severe loss in most area	
A.2	Weight change in past 2 weeks 1. weight is increasing 2. no change in weight 3. weight is decreasing	B.2	Muscle thinning 1. title or no loss 2. mild to moderate in all area; severe loss in some 3. severe loss in most areas	
A.3	Change in dietary intake 1.nio change or slight change for short duration 2.intake borderline and decreasing; intake poor and increasing; intake poor, no change Based on prior intake	B.3	Edema 1. little or no edema 2. mild to moderate edema 3. severe edema	
A.4	Duration and degree of change 1.less than 2wks, little or no change 2. more than 2wks; mild to moderate suboptimal diet 3.unable to eat or starvation	B.4	Ascites 1. no Ascites or only on imaging 2. mild to moderate or improving clinically 3. severe Ascites or progressive ascites	
A.5	Presence of GI symptoms 1. few or no			

	symptoms intermittently 2. some symptoms for > 2wks; severe symptoms that are improving 3. symptoms daily or frequency >2 wks			
A.6	Functional status 1. no impairment in strength, stamina and full functional capacity; mild to moderate loss and improving 2. mild to moderate loss of strength, stamina some of daily activities or severe loss but now improving 3. severe loss of function, stamina and strength			
A.7	Disease state and co-morbidity 1. no stress 2. low or moderate stress 3. high stress			
Nutritional status		Well-nourished	<17	1
		Malnourished	>17	2
Part VI: Malnutrition Universal Screening Tool (MUST)				
601	Body weight	_____		
602	Height	_____		
603	$BMI = \left(\frac{weight}{height (cm)^2} \right)$	1. > 20 2. 18.5-20 3. <18.5		
604	Weight loss in past 3-6 months (in kg)	_____ kg		
605	Patient is acutely ill and there has been or is likely to be no nutritional intake for >5 days	1. Yes 2. no		
606	Total Score (add the scores together to calculate overall risk)	1. score 0 2. score 1 3. score 2 or more		

DECLARATION

I, Mr. Ketema Bogale, declare that the work included in this research proposal is my own work carried out by me under the guidance of my advisors. The research has not been submitted for any other purpose to any other higher education institution/s.

I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my research submission and the sources used are duly acknowledged. I understand that any violation of academic integrity will be cause for disciplinary action by the University.

Name of the Student: Mr. Ketema Bogale (BSc)

Signature of the student: _____

Date: _____

CERTIFICATION

This is to certify that the above statement made by the mater of general public health candidate under our advisee is correct to the best of our knowledge as advisors. Hence, we attest the student can submit the thesis to the department for further evaluation by examiner/s.

Name: 1. Mr. Abdurehman Kalu (MPH, Assi't Professor) Signature: _____

2. Kabtamu Tolosie Signature: _____

Date: _____