ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

SCHOOL OF PUBLIC HEALTH

VALIDATION OF THE NUTRISCORE NUTRITIONAL SCREENING TOOL AMONG CANCER PATIENTS IN SELECTED REFERRAL HOSPITALS, ADDIS ABABA, ETHIOPIA, 2025GC: A FACILITY-BASED CROSS-SECTIONAL STUDY DESIGN.

By: Tselot Tarekegn (Bsc)

A Thesis submitted to the Department of Nutrition and Dietetics, School of Public Health, College of Health Sciences, Addis Ababa University in partial fulfillment of the requirements for Master's degree in public health nutrition.

June/2025

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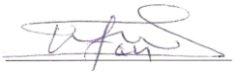
Tefera Darge(PHD)	Assistant professor		21 July 2025
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Abbreviations and Acronyms

ASPEN	American Society for Parenteral and Enteral Nutrition
CONUT	Controlling Nutritional Status
CRT	Chemo radiotherapy
DRM	Disease related Malnutrition
ESPEN	European Society for clinical Nutrition and Metabolism
FNA	Full Nutritional Assessment
GC	Gastric Cancer
HNC	Head and Neck cancer
ICU	Intensive Care Unit
IMRT	Intensity Modulated radiation Therapy
MAMA	Mid Arm Muscle Area
MST	Malnutrition Screening Tool
MUAC	Mid Upper Arm Circumference
NRS	Nutritional Risk Screening
ORD	Oncology related Disorder
OS	Overall Survival
PG-SGA	Patient Generated Subjective Global Assessment
QOL	Quality Of Life
SENPE	Spanish Society for Clinical Nutrition and Metabolism
SPMMC	St. Paul's Hospital Millennium Medical College
TASH	Tikur Anbessa Specialized Hospital
TSF	Triceps Skin Fold

Abstract

Background: Malnutrition is a common and critical issue in cancer patients, significantly affecting treatment outcomes and overall survival. Timely and accurate identification of malnutrition risk is essential for early intervention. Various nutritional screening tools exist, but many are either time-consuming, lack sensitivity, or are not tailored for outpatient cancer settings. The NUTRISCORE tool has been developed as a fast, accurate, and easy-to-use nutritional screening tool specifically designed for cancer patients. However, there is a need to validate this tool in different populations, as nutritional risk factors can vary by region, healthcare settings, and the demographic profiles of patients. In Ethiopia, where malnutrition and cancer treatment challenges are prevalent, a locally validated tool is crucial for the early detection and management of malnutrition in cancer patients.

Objective: This study aims to assess the validity of the nutritional risk screening tool NUTRISCORE against Full Nutritional Assessment (FNA) among adult cancer patients attending oncology outpatient departments for treatment in Tikur Anbessa Specialized Hospital and St. Paul's Millennium Medical College in Addis Ababa, Ethiopia.

Methods: A facility-based, cross-sectional study was conducted in the oncology department of TASH and SPMMC. The NUTRISCORE scale was validated against Full Nutrition Assessment (FNA). Sensitivity, specificity, positive predictive value, and negative predictive value were calculated. Reliability was measured using Cronbach's alpha. A total of 155 participants were selected through systematic random sampling. Data were collected via patient and caregiver interviews, physical examinations, and laboratory investigations using structured interview questionnaires. Data were collected using Kobo toolbox an electronic data collection and management tool, cleaned and edited accordingly and then exported to IBM SPSS statistical software for analysis.

Result: A total of 155 patients aged ≥18 years participated in this study and 67.1% were female. The sensitivity, specificity, Positive predictive value, Negative predictive value and Area under curve (AUC) of NUTRISCORE against FNA were 36.8%, 88%, 62.5%,71.5% and 0.770 respectively. The internal consistency of NUTRISCORE scale measured using Cronbach's α coefficient gave a value of α =0.739, indicating acceptable internal consistency.

Conclusion: In this study, NUTRICSCORE showed low level of sensitivity with an acceptable specificity. Thus further research is needed with a larger sample set to assess the validity (performance) of the NUTRISCORE screening tool.

Key words: Cancer patients, Malnutrition, NUTRISCORE, FNA

1. Introduction

1.1. Background

Malnutrition is a condition caused by an imbalance or deficiency of energy, protein, and other nutrients, leading to adverse effects on body composition and function. Disease-related malnutrition (DRM) is common among cancer patients, affecting 40–80% during their illness. DRM results from inadequate intake of energy, protein, and micronutrients, causing changes in body composition and impairing function, which negatively impacts clinical outcomes .And also increased physiological demands and increased expenditure in sick individuals, can further contribute to malnutrition. Factors influencing DRM include cancer type, stage, location, and treatment. Cancer patients often experience reduced physiological function, malnutrition, weight fluctuations, fatigue, and psychological distress.(1–3).

Cancer is a complex disease that results from multiple interactions between genes and the environment, and is considered to be one of the current leading causes of mortality globally. Metabolic and nutritional changes are capable of affecting the survival and recovery of cancer patients through malnutrition. In cancer patients, malnutrition negatively affects treatment tolerance (including anti-cancer drugs, surgery, chemo- and radiotherapy), increases side effects, and causes adverse reactions, treatment interruptions, postoperative complications and higher readmission rates. The incidence and prevalence of cancer cases are expected to increase in the coming decades accompanying the aging of the population. Early detection and treatment of malnutrition and its consequences are essential for patients with cancer to maintain their physical and mental well-being which ultimately can contribute to quality of life (QoL)(1–5).

It is estimated that 40 to 80% of all cancer patients are malnourished. Malnutrition is associated with numerous negative impacts. A systematic review conducted revealed a robust association between nutritional statuses and increased intermediate- and long-term mortality. A study indicates the severity of weight loss is an independent predictive factor for shorter overall survival; about 10%-20% of all cancer mortality is directly related to malnutrition rather than to the underlying cancer(1,2,4,6).

Nutritional assessment of cancer patients using validated screening tool is crucial to inform the subsequent management. Following a detailed and comprehensive nutritional assessment, a care plan should be implemented based on the patient's level of risk. The Oncology Evidence-Recent literature suggests the integration of nutrition screening/assessment in cancer care. Body composition assessment is recommended to be a determinant for interventions, treatments and outcomes. Furthermore, screening should be routinely

repeated throughout the treatment. It seems there is no consensus on the best method to perform this assessment, but SGA (Subjective Global Assessment) and PG-SGA (Patient Generated-Subjective Global Assessment) have been validated for nutritional assessment of adult oncology patients including study conducted in Australia(1,3,7).

The NUTRISCORE was recently developed for oncology outpatients as an expert consensus from different dietetic and nutrition units from the Catalan Institute of Oncology based on the Malnutrition screening tool. It incorporates questions about unintentional weight loss. Moreover, it includes specific oncologic parameters such as tumor location and anti-cancer treatment. The sum of all categories ranges from 0 to 11 points, whereas a total score ≥5 points call for action, which is a referral to a dietitian(3).

The ideal nutritional screening tool is expected to be 100% sensitive and specific. Nevertheless, due to the impossibility of it, the sensitivity has the advantage compared to the specificity, so the method must be highly sensitive and have a good specificity. This is because the need to correctly classify all patients who are at nutritional risk has a preference for the poor rating of well-nourished patients(8).

The nutrition assessment is a standardized process, beginning with the patient's medical history and condition which provide important information that informs the nutrition care plan. According to the American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines, a comprehensive nutritional assessment involves a thorough clinical examination (history and physical examination), anthropometric measurements, diagnostic tests, and dietary assessments. Additional clinical examinations or diagnostic tests may be necessary for different groups of populations and individuals with specific underlying pathology(9,10).The physician plays a crucial role in assessing the nutritional status of the patient. Using the instruments available to evaluate dietary intake along with appropriate biological testing and physical evaluation, the physician will receive insight to assess the diet and environmental factors that weigh in on the health status of the patient(11).

There is a lack of attention to the nutritional status of cancer patients in clinical practice. However, monitoring and intervention of nutritional status is crucial and not only affect the quality of life of the patient, but also the treatment response and clinical outcomes. Since no strategy particularly good at improving the nutritional status in cancer patients has yet been developed, it is recommended that treatments be tailored for each patient according to their nutritional assessment(12).

1.2. Statement of Problem

Nutritional screening tool has to recognize the risk of malnutrition, and predict whether it is likely to develop or worsen under the present and future condition of the patient. It should identify at-risk patients who are likely to benefit from a subsequent nutritional intervention (sensitivity, predictive validity). Hence, should incorporate all parameters relevant to the problem (content validity) and show low interrater variability (reliability). However, nutritional assessment is not currently used in clinical practice and procedures must be standardized to improve the efficacy of standard chemotherapy, targeted agents, or even checkpoint inhibitors that are potentially linked with the patient's nutritional status(3). Health professionals' awareness of the value of nutrition has a significant value in the effectiveness of patients' treatment care plans. A survey among oncologists indicated that most oncologists lack an awareness of, and do not understand, the impact of cancer-associated weight loss(4).

It is critical to conduct an early and appropriate nutritional evaluation, which can identify patients at risk for malnutrition, to provide timely nutrition support for improving treatment adherence, and tolerance and avoiding treatment interruptions(13). A multicenter study examining the prevalence of malnutrition in patients during cancer pointed out that treatment, old age, duration of hospital stay, and metastasis were related to with malnutrition. Furthermore, malnutrition was linked with higher infection rate and longer hospital stay(12). Malnutrition can affect about 50% of Head and Neck cancer patients at diagnosis and almost 90% during active treatment. It has been indicated that about 70% of weight loss in HNC patients corresponds to lean mass, this loss results in impaired muscle strength, declined physical activity and functional performance, it also increases the risk of recurrence and mortality(6,14).

Cachexia and anorexia have been referred to as "cancer's silent killer" , and clinical data suggest malnutrition accounts for about 20–30% of deaths rather than the Cancer itself. Malnutrition including muscle wasting, on the other hand, is identified as a common negative effect of anticancer treatments. Whether or not they are still undergoing anticancer treatments, malnutrition leads to low-performance status, impaired QoL, unplanned hospital admissions, and reduced survival in palliative care patients(15–17).

A study investigating the clinical significance of oncology patients' nutritional status assessment revealed the importance of early assessment of the nutritional status of cancer patients receiving oncology treatment.

It was recommended that a timely intervention for nutritional support of the patients being at risk for malnutrition and cachexia is vital (18,19).Oncologic outcomes and treatment-related toxicities have been closely correlated to nutrition status before, during, and after definitive therapies for multiple cancer sites. For example, the effects of nutritional deficits in head and neck cancers have been extensively studied, where malnutrition can harm morbidity, quality of life, and cancer-specific mortality. Continued poor nutrition in these patients with cancer can have detrimental effects on cure rates and increase the likelihood of post-treatment complications(20).

A study conducted in Spain showed that the prevalence of malnutrition is over 20%, with elderly patients being the most affected. The cost and the clinical implications of malnutrition make this disease a public health problem. Moreover an investigation into the presence of anxiety and depression indicated that symptomatology in oncological inpatients is high and there is an association between malnutrition and presenting anxious and depressive symptomatology in hospitalized cancer patients (21–23).

While performing nutritional assessment, it is important to understand that there is currently no “gold standard” and single best test to evaluate nutritional status. Information should be collected systematically, and an evaluation of nutritional status should be done based on the overall data collected. Different tools are applied in different populations and different settings and are yielding confusing results(3,10).

A study conducted at the Black Lion Specialized Hospital in Addis Ababa focused on validating the Subjective Global Assessment (SGA) tool among surgical patients, including those with gastrointestinal cancer found that the SGA tool is a reliable and valid method for nutritional screening among surgical patients in Ethiopia. However the study was conducted with 100 sample size which is acceptable for validation but may not be representative of the broader population .The specificity of the tool was found to be 73% suggesting that although the SGA performs reasonably well, there is still room for a better nutritional assessment tool.(24)

A study found the prevalence of malnutrition among cancer patients who receive chemotherapy is high (25).The absence of a validated, fast, and reliable nutritional screening tool in Ethiopian oncology settings leads to delays in the identification and management of malnutrition, potentially worsening clinical outcomes. Current tools used for nutritional assessment, such as FNA, though comprehensive, are resource-intensive and time-consuming, making them less practical in high-volume clinical settings. There is a need for a more efficient tool like NUTRISCORE, which can provide rapid, yet accurate screening, specifically

designed for use in cancer outpatient settings. Therefore this study aims to validate the NUTRISCORE nutritional assessment tool among cancer patients to fill the gap regarding screening tools for cancer patients.

1.3. Rational and Significance of study

The validation of NUTRISCORE in Ethiopian cancer patients is significant because it could provide a quick, reliable nutritional screening too which can be an alternative to the more time-consuming Full-Nutritional Assessment (FNA). Moreover if validated, it would help healthcare providers in resource-limited settings like Ethiopia to identify malnourished cancer patients timely contributing to treatment effectiveness and safety by prioritizing nutritional interventions tailored to individual patients. It would also contribute to confirming the tool's applicability to the specific population and localization of nutritional screening tools for Ethiopians as there are numerous already existing validated tools in other countries. The findings could inform clinical practice guidelines for nutritional screening to be part of the cancer management.

In addition, this study underscores the need for ongoing research on nutritional screening tools in Ethiopia. For researchers and academics, it highlights the importance of conducting further validation studies across various clinical settings, cancer types, and disease stages. Such efforts will help establish context-specific effectiveness and strengthen the evidence base for integrating nutritional screening into routine cancer management.

2. Literature review

2.1. Magnitude of malnutrition among cancer patients

Cancer patients have a high risk of developing malnutrition especially in the advanced stages of the disease. When detected by several various screening tools Malnutrition has been reported to be present in 20–70% of cancer patients, depending on tumor entity, stage of disease and clinical setting. Metabolic abnormalities, namely systemic inflammation, have been reported in 34% of patients with colorectal cancer undergoing curative treatment, in 75% of unselected patients with cancer at hospital admission and in 55–85% of patients with advanced cancer. Importantly, treatment options and clinical outcomes in malnutrition will differ vastly(26).

Sarcopenia is characterized by a decrease in lean body mass with an influence on strength and physical function that may lower the quality of life. As cancer-related weight loss in obese patients cannot be identified by a low body mass index (BMI), sarcopenic obesity, defined as low lean body mass in obese patients, is frequently overlooked. In these patients, changes in body composition result in an increased metabolic risk, and it seems to be a significant predictor of treatment- related adverse events. Cancer cachexia is a complex multi-factorial syndrome that is caused by the combination of metabolic alterations, systemic inflammation and decreased appetite. It is characterized by an involuntary sustained weight loss and loss of skeletal muscle mass, with or without loss of fat mass that is irreversible by conventional nutritional support. In addition to the disease, antineoplastic treatments and/or surgery have a significant impact on patients' nutritional status. Moreover, chemotherapy (CT) leads more than 50% of patients to experience dysgeusia, nausea, vomiting, and mucositis, and radiotherapy (RT) -related complications are also common. It is also established that poor nutritional status increases surgical morbidity and post-surgical complications(1).

Furthermore, malnutrition can influence treatment outcomes, delay wound healing, worsen muscle function and increase the risk of postoperative complications. It can also impair tolerance and response to antineoplastic treatments, which can in turn lead to extended hospital stay, increase the risk for treatment interruptions, and possibly reduced survival. Because nutritional depletion increases the risk of worse outcomes, it is the main focus of a nutritional assessment in the ICU. Most of these risk factors involve either an increase in the patient's nutritional requirements or a decrease in the patient's nutritional intake. Factors affecting intake include what are termed 'nutrition impacting symptoms' such as nausea or pain, as

well as interruptions to nutrition when tube feeds are stopped or the patient is fasting for a test, and physical limitations such as impaired swallowing or poor dentition. These factors affect the risk that a patient could develop malnutrition(1,9,13).

The proportions of malnourished patients among those undergoing surgery for pancreatic biliary, esophageal, liver, stomach, colon, and lung cancer were 37%, 36%, 19%, 9%, 8%, and 6%, respectively. In addition, patients undergoing surgery for pancreatic biliary or esophageal cancer showed higher malnutrition rates than those undergoing surgery for the other cancers ($P < 0.05$). Meanwhile, among patients undergoing CRT, the proportions of malnourished patients were 67%, 65%, 44%, 37%, 24%, and 14% in esophageal, lung, stomach, pancreatic biliary, colon, and liver cancer, respectively. A study found that the effect of nutritional support in hospitals reduced the risk of mortality and improved functional and quality of life outcomes in cancer patients with increased nutritional risk for malnutrition(27,28).

2.2. Quality of Life and Nutritional Status

A systematic review indicated the close relationship between nutritional status and Quality of life (QoL). The review concluded that an adequate nutritional status positively influences QoL and, consequently, improves tolerance to treatments. The studies selected for this review used chemotherapy treatments as the main anti- neo-plastic agent. These studies highlighted the impact of nutritional support on the overall well-being and even the survival of patients. They suggested that optimizing nutritional intake, particularly protein, during chemotherapy may be a predictor of better outcomes(20,27).

A comparative analysis of QoL using EORTC QRQ-C30 found that malnourished patients had lower scores in global health status than well-nourished patients (36.67 vs. 65.27, $P < 0.0001$). When evaluating the functional scales, the analysis indicated that the scores of malnourished patients were lower than those of well-nourished patients ($P < 0.0001$). Similarly, it was confirmed that most of the malnourished patients had more advanced cancers (stages III–IV) and lower BMIs than well-nourished patients. Thus, because cancer stages and malnutrition are crucial factors in the QoL, the improvement in the quality of life depends on dealing with nutritional deficiencies(3,5).

The negative association between malnourishment and outcomes suggests that nutritional status should be taken into account during the decision-making process, and in case it is likely to be the result of a patient's intrinsic vulnerability, a less burdensome treatment option may be preferable to avoid toxicity and complications and increase the likelihood of treatment completion (6,29).

2.3. The need for nutritional assessment / Screening

Nutrition assessment is an extensive method of collecting relevant data to define nutritional status and identify nutrition-related problems. The assessment often involves patient history, medical diagnosis and treatment plan; nutrition and medication histories, nutrition-related physical examination including anthropometry, nutritional biochemistry, psychological, social, and environmental factors. Simple screening for malnutrition must be performed systematically and early in the course of the disease, i.e. at the time of the first visit at which the diagnosis is revealed and must then be regularly repeated at each visit to follow the course of weight. Nutritional assessment is critical given the morbidity, complications, and impaired quality of life induced by malnutrition. Nutritional assessment must be straightforward, effective, adapted, and reproducible to allow early and effective nutritional management (2,30).

The nutritional assessment process is an in-depth process that evaluates a patient's nutritional status using all available data and uses particular techniques to measure the patient's body composition, identify depleted protein stores, and also to assess function .Nutritional screening must assess four principles: (i) the current condition, (ii) its stability (recent involuntary weight loss), (iii) the potential for worsening (reduced food intake), and (iv) the negative influence of the disease (stress metabolism associated with severe disease).Functional assessments can also be useful to identify depletion and monitor progress in cases where the muscle stores are difficult to assess. Nutrition screening tools have been intended and designed to be a simplified, accessible way to help identify patients most at risk of malnutrition, who would benefit from further nutritional assessment and management by a dietitian. An ideal screening tool must be easy to conduct, rapid, non-invasive, not necessitate any calculations or laboratory data, easily interpretable, reproducible and inexpensive(3,9).

Despite consensus among international nutrition societies on the importance of systematic nutritional screening, it is still not routinely implemented in most healthcare institutions. As a result, studies indicate that over half of malnourished patients go undiagnosed and untreated. A systematic review identified 32 screening tools developed to assess nutritional risk, with 24 designed to evaluate nutritional status and identify patients who could benefit from nutritional support. Four tools focus on predicting clinical outcomes such as complications, morbidity, hospital stay length, and mortality, while another four serve both purposes. Additionally, several tools are specifically tailored to certain populations and care settings, highlighting the need for context-specific approaches to nutritional assessment(3).

A study examined the relationship between outcome variables of nutritional screening methods and tolerance to systemic treatment in patients with colorectal cancer. The finding emphasized the need for nutritional screening to anticipate tolerance to treatment, since significant relationships were found between malnourished patients with a greater probability of toxicity in antineoplastic treatments(20,27) Malnutrition is common in GC patients and can negatively impact prognosis and quality of life. Nutritional assessments indicated a higher risk of malnutrition in patients who underwent total gastrectomy, as evidenced by higher scores on ORD, NRS-2002, and PG-SGA(31).

Nutritional support in clinical practice is often limited due to the inadequate integration of nutrition into medical education, with studies such as Walsh's in the U.S. revealing that only 25% of medical schools include nutrition in their curriculum. This lack of expertise underscores the need to establish routine procedures for detecting malnutrition risk and providing timely support, as recommended by international guidelines, which advocate for validated tools that are brief, cost-effective, highly sensitive, and specific. In Ethiopia, nutritional assessment is not routinely conducted for cancer patients. A cross-sectional study at Hawassa University Comprehensive Specialized Hospital found a malnutrition prevalence of 48.1% among adult cancer patients receiving chemotherapy, with appetite loss and diarrhea significantly associated with their nutritional status(26,32).

Assessment of nutritional status using objective and subjective methods in Greece among patients with cancer revealed a high risk of malnutrition in patients with cancer. Poor nutritional status was positively associated with weight loss, Hgb, and MUAC and negatively associated with BMI, HGS, and TSF. Based on the PG-SGA assessment, 54.9% of the individuals were severely malnourished. The imminent risk was observed in 83.6% (NRS-2002) and 48.7% of participants were at increased risk of a 5% reduction in body weight within the next 6 months(17).

2.4. Nutritional Assessment and validation of screening tools in oncology

Numerous nutritional screening tools have been developed, but only a few have been validated in cancer populations. ESPEN guidelines recommend using four primary tools for cancer patients: Nutritional Risk Screening 2002 (NRS 2002), Malnutrition Universal Screening Tool (MUST), Mini Nutritional Assessment (MNA), and Malnutrition Screening Tool (MST). Recently, other tools like the Subjective Global Assessment (SGA), the Patient-Generated Subjective Global Assessment (PG-SGA), and the NUTRISCORE have gained prominence, especially in oncology populations.

2.4.1. Nutritional Risk Screening 2002 (NRS 2002)

The NRS 2002 is a validated ESPEN-recommended screening tool designed to identify hospitalized patients at risk of malnutrition who might benefit from nutritional intervention. It assesses nutritional status, disease severity, and age. A score ≥3 indicates nutritional risk. It has high content validity and good interrater reliability across healthcare professionals. In cancer patients, it has demonstrated satisfactory correlations with prognostic factors(31,33–35).

2.4.2. Malnutrition Universal Screening Tool (MUST)

The Malnutrition Universal Screening Tool (MUST) is widely used in both community and clinical settings. It evaluates BMI, unintentional weight loss, and the impact of acute disease. It has high content validity and reliability ($\kappa = 0.88–1.00$). However, in cancer populations, its sensitivity and specificity are low, although it remains a good predictor of length of hospital stay and mortality(36).

2.4.3. Mini Nutrition Assessment (MNA)

The MNA targets older adults and includes 18 items grouped into anthropometric, dietary, and subjective categories. A shorter 6-item version is also available. While originally validated in older adults, its use among cancer patients is poorly studied. It shows fair reliability ($\kappa = 0.51$) but lacks specificity in oncology due to some irrelevant criteria (35,37).

2.4.4. Malnutrition Screening Tool (MST)

A malnutrition screening tool was developed in 1999. It is a quick screening tool, easy to apply, and includes questions on appetite, food intake, and recent weight loss. The sum of both categories totals scores ranging from 1 to 5, whereby a ≥2 calls for action. The MST has been well-validated in both in- and outpatient populations. Patient-led MST screening was found to be a reliable and valid measure that can accurately identify ambulatory cancer care patients as at risk or not at risk of malnutrition after an assessment of its reliability and validity(38,39).

2.4.5. Subjective Global Assessment (SGA)

The SGA was developed in 1987. It identifies patients at nutritional risk and predicts clinical outcomes. The SGA tool is unique because it's not only an assessment or a screening tool as it combines medical history with clinical findings. In addition to issues addressed in other screening tools (weight loss, food intake) the SGA also includes: symptoms possibly influencing food intake, functional capacity, physical examination, and the opinion of the clinician in charge. The SGA targets chronic and advanced cases of malnutrition. The other version of the tool, patient-generated SGA (PG-SGA) is the result of items added and changed over time to more specifically meet the needs of cancer patients and involve them directly in the process. It is widely used for cancer patients as it has been validated in this population with high sensitivity (96%) and good specificity (83%)(31,33,35,38).

2.4.6. Patient-Generated Subjective Global Assessment(PG-SGA)

PG-SGA was derived from the SGA specifically for oncology. It is highly sensitive and specific, and widely used as a reference standard for validating other tools. It closely correlates with weight loss, hospital stay, and quality of life in cancer patients and is suitable for routine use(40,41).

2.4.7. NUTRISCORE

The NUTRISCORE was recently developed for oncology outpatients as an expert consensus from different dietetic and nutrition units from the Catalan Institute of Oncology based on the MST. It includes questions to measure unintentional weight loss. Additionally, it includes specific oncologic parameters such as tumor location and anti-cancer treatment. The sum of all categories ranges from 0 to 11 points, whereas total score ≥5 points calls for action, i.e., referral to a dietician(31,33,35,38).

A study that investigated the efficiency of NUTRISCORE China among cancer patients found that using the PG-SGA as a reference, the sensitivity, specificity, and area under the curve values of the NUTRISCORE were found to be 6.2, 99.8%, and 0.53, respectively. The sensitivity, specificity, and area under the curve values of the MST were 50.9, 74.9%, and 0.63, respectively. The kappa index between the NUTRISCORE and PG-SGA was 0.066, and that between the MST and PG-SGA was 0.262 ($P < 0.05$), indicating NUTRISCORE had an extremely low sensitivity in cancer patients in China when compared with the MST when the PG-SGA (42).A study conducted in Colombia also found that NUTRISCORE had lower sensitivity compared to MST. Using GLIM as a reference the sensitivity, specificity, and area under the

curve values of the NUTRISCORE were found to be 45%,97% and 0.85 respectively. in comparison the sensitivity, specificity, and area under the curve values of MST were 75%,94% and 0.9 respectively(43).

Another study assessed the nutritional status of patients by using three screening tools and concluded that compared to PG-SGA and MST, NUTRISCORE is a novel, fast, and valid nutritional screening tool for outpatients with cancer. Its simplicity and high level of accuracy in detecting nutritional risk support its applicability(44).

Full Nutritional Assessment (FNA)

This is a nutritional evaluation procedure adopted by the Nutrition Protocol of a hospital, based on the recommendations of the Spanish Society of Parenteral and Enteral Nutrition (SENPE). It includes: the patient's history and actual diagnosis, therapeutic procedures, physical examinations (weight, height, and BMI, plicometry for tricipital, bicipital, subscapular, and suprailiac skinfold, and bioimpedance. Furthermore, laboratory data are also recorded including serum determinations of albumin, total cholesterol level, total lymphocyte count, haemogram, pre-albumin, transferrin, iron, lipids profile, serum and urine ions (Na, K, Cl), hepatic, renal, and endocrine-metabolic function, 24 hour-clearance of creatinine and nitrogen(3,33,45). This tool is regarded as a reference standard due to its inclusion of seven key parameters that provide a thorough, multidimensional evaluation of a patient's nutritional status. These parameters are closely linked to malnutrition, clinical outcomes, hospital stay duration, and mortality rates. Malnutrition is diagnosed when three or more of these parameters yield abnormal results, establishing FNA as a robust and dependable standard for validating other nutritional screening tools(46).

As for the validation method, 12 studies performed concurrent validation seven carried out predictive validation, and two proposed both methods. In the selected studies, the most used instrument as a reference method for concurrent validation was the Patient-Generated Subjective Global Assessment (PG SGA) and for the predictive validation, the overall survival (OS) stands out. Only three studies used objective reference measurements for concurrent validation, they being dual-energy absorptiometry (DXA); anthropometric parameters and laboratory tests; and Prognostic Nutritional Index (PNI), respectively.

In the concurrent validation, of the studies that presented values of sensitivity, specificity, and predictive values, the instrument that best had such values was PG-SGA followed by NUTRISCORE. The

NUTRISCORE tool, which also presented high values, was developed using the MST as a base, and the items tumor location and cancer treatment were introduced, both of which have a huge effect on the nutritional status of the patient. A study focusing on nutritional screening for patients treated by radiotherapy found that nutritional screening tools (NRS-2002, PG-SGA and NRI) were unable to predict radiotherapy-associated adverse events(47).

In the absence of nutritional screening, malnutrition may be neglected, particularly in patients who are still within the considered adequate or overweight weight, but who have lost significant amounts of weight. Thus, the evaluation should be performed early in the treatment to guide the nutritional intervention, being repeated at appropriate intervals to monitor its effects(8).

To test the validity of a tool called CONUT a study evaluated the association and the degree of agreement among the obtained diagnosis with the first step of this tool and the one obtained with two different methods commonly used for assessing the nutritional status. Such methods were the Subjective Global Assessment and the Full Nutritional Assessment. Agreement levels between CONUT and SGA and FNA (k = 0.488, k = 0,669, respectively) are very acceptable in routine clinical examination40, being higher with FNA as this method includes not only retrospective nutritional data (as SGA does) but also objective parameters (anthropometry and blood tests), more following CONUT, based only on objective data. The high sensitivity (92,30%) and specificity (85%) of the tool, compared to the Full Nutritional Assessment, as our "gold standard", confirm CONUT as a valid screening method for early detection of hospital malnutrition(45).

Screening for nutritional risk as early as possible allows for the identification of patients at risk of becoming malnourished. Screening should be done as early as possible and recent literature suggests that it should be done at diagnosis or hospital admission; screening should be repeated in the course of treatment for referral for evaluation if needed. Evidence from various works of literatures supports the integration of malnutrition screening into cancer patients' care. The adequate tool for screening undernutrition should be brief and easy to fill, inexpensive, highly sensitive, and have good specificity. MUST (Malnutrition Universal Screening Tool) and NRS-2002 (Nutritional Risk Screening-2002) are considered suitable ; the MNA (Mini Nutritional Assessment) is a suitable tool for nutritional assessment in the senior population(1).

Table 1 : Summary Table: Performance Metrics of Nutritional Screening Tools in Cancer Patients

Tool	**Target Population**	**Sensitivity**	**Specificity**	**Reliability(κ)**	**Validity Notes**	Predictive Value for Clinical Outcomes
NRS 2002	Hospitalized patients	Fair to good	Fair to good	Validated by multiple professionals	Validated in cancer patients; correlates with prognostic factors.	Good predictive validity for nutritional risk
MUST	Adults in clinical/community	Low in cancer patients	Low in cancer patients	K=0.88–1.00	Fair to good validity, Reliable but less accurate in cancer patients.	Good predictive validity for hospital stay, mortality
MNA (Full)	Elderly population	80 (SD 13)	68 (SD 22)	K=0.51	Fair reliability; Less specific for oncology.	Limited data in cancer patients
MST	General inpatient and outpatient population	50.9 (China) / 75 (Colombia)	74.9 (China) / 94 (Colombia)	0.262	Performs better in outpatients;	poor predictor of outcomes.
SGA	Hospitalized patients	96	83	High interrater agreement	Validated in cancer outpatients; clinical judgment included.	Predictive of clinical outcomes; gold standard
PG-SGA	Ambulatory cancer patients	High	High	Not specified	Reference tool; correlates with weight loss, Qol.	Strong predictor of nutritional risk and outcomes
NUTRISCORE	Cancer out patients	Low to high	Low to high	0.8 in Spain	Easy and fast but poor sensitivity in some studies.	Limited data

2.5. The need for validation of nutrition assessment tools

Nutritional screening in hospitalized patients is often insufficient, relying on unreliable methods such as clinical observation and body mass index. However, the use of validated malnutrition screening tools significantly improves nutritional care and reduces the prevalence of malnutrition in these settings. These tools are essential for ensuring accuracy, reliability, and relevance in identifying individuals at risk of malnutrition. Malnutrition, which is particularly common in vulnerable populations like cancer patients, is associated with adverse health outcomes, including increased morbidity and mortality. It independently worsens clinical outcomes, diminishes quality of life, and negatively impacts overall health, underscoring the critical role of validated tools in its early detection and management(48,49).

The use of validated nutritional assessment tools enhances the accuracy of data collection, facilitates cross-study comparisons, and strengthens the ability to identify associations with influencing factors such as dietary habits. High-quality, reliable data generated from these tools can inform policies, improve service delivery, and optimize resource utilization. By enabling early detection of malnutrition, validated tools support timely nutritional interventions, which can lead to better patient outcomes, including shorter hospital stays and fewer complications. Tools specifically designed and validated for certain populations are particularly effective, as they address the unique nutritional challenges and risks faced by those groups(50,51).

Additionally, the absence of validation in nutrition assessment tools can lead to inaccurate interpretations of dietary habits and nutritional needs, potentially impacting patient management and health policy decisions. Invalidated tools may result in flawed assessments of nutrient intake, which could mislead healthcare providers about a patient's health status and dietary requirements. In contrast, validated tools offer standardization in clinical and public health practice, facilitating comparability across different studies and settings. This is especially important in resource-limited environments, where the use of optimized, validated tools ensures the accurate identification of at-risk individuals and allows for more effective allocation of limited resources(47,48).

2.6. Validation of Nutritional Assessment Tools in Ethiopia

Two studies targeted to test the validity of the MNA nutrition screening tool among elder patients in Ethiopia found that the full MNA tool was a valid and reliable tool to identify elderly individuals who are malnourished, at risk of malnutrition and well-nourished with modulation of cut-off points(54,55).

The mean MNA score was found to be 19.9 ± 4.5. Cronbach's α value of the full MNA tool was 0.7. The overall accuracy of the full MNA was 91% (95% CI, 87.5%–94.9%). The sensitivity and specificity of the full MNA tool using an established cut-off point were 87.9% and 89.6% respectively. Youden index analysis showed that the best cut-off point to detect the malnourished and those at risk of malnutrition using the full MNA was 16 (sensitivity 90.4% and specificity 86.8%). The reliability of the MNA-SF as measured by Cronbach's α was 0.5. The overall accuracy of the MNA-SF was found to be 93% (95% CI, 0.90–0.96). By using the Youden index the best cut-off point for MNA-SF to detect malnutrition was 7.5 (sensitivity 85.7% and specificity 89%). The similar study indicated the MNA tool can be used as a valid malnutrition screening tool for the Ethiopian elderly population by modifying the original cut-off point(54).

To minimize under- or over-diagnose and unnecessary costs, clinician practice guidelines (CPGs) should issue evidence-based decisions regarding nutritional assessment, perform systematic reviews of the evidence, and use systematic and transparent frameworks that consider benefits, harms, costs, feasibility, and other considerations specific to each situation. This is critical in developing countries where optimization of resources is needed and where equipment and trained personnel are not always available to evaluate all nutritional assessment criteria(34).

3. Objectives

3.1. General objectives

- To assess the validity of the nutritional risk screening tool NUTRISCORE against Full Nutritional Assessment (FNA) among adult cancer patients attending oncology outpatient departments for treatment in TASH and SPMMC in Addis Ababa, Ethiopia.

3.2. Specific objectives

- To determine the validity of NUTRISCORE in identifying malnutrition risk among cancer patients in TASH and SPMMC in Addis Ababa, Ethiopia in 2025 GC.
- To assess reliability of the items of NUTRISCORE assessment tool using Cronbach's alpha.

4. Methods and Materials

4.1. Study setting and period

This study was conducted from February to April 2025 GC at the oncology units of Tikur Anbessa Specialized Teaching Hospital (TASH) and St. Paul's Hospital Millennium Medical College (SPHMMC). These facilities are public hospitals that serve as referral centers, providing care to cancer patients from across the country.

Tikur Anbessa, the largest referral hospital in Ethiopia, was transferred to Addis Ababa University in 1998 by the Federal Ministry of Health, transforming it into a university teaching hospital.(56).Tikur Anbessa Specialized Hospital (TASH), located in Addis Ababa's Lideta Sub City, is a government-owned, university-affiliated referral and teaching hospital under Addis Ababa University's College of Health Sciences. It plays a vital role in training healthcare professionals, including students in medicine, nursing, pharmacy, dentistry, and paramedical fields. TASH employs a multidisciplinary team of specialists such as physicians, oncologists, surgeons, pathologists, and radiotherapists. The hospital is equipped with advanced diagnostic and therapeutic tools, including CT and MRI scanners and a cobalt radiotherapy unit. TASH is Ethiopia's primary cancer referral center, offering chemotherapy, radio-therapy, and palliative care. The oncology unit, which includes 19 beds, manages around 728 outpatient visits and admits 164 inpatients monthly. By 2014, TASH had 678 total beds, with 20 reserved for oncology. Currently, the hospital has a capacity of 800 beds, of which 60 are dedicated to oncology, including 30 for pediatric cancer care. This makes TASH a key institution for cancer treatment, early detection, and care in the country(57).

The oncology unit at St. Paul's Hospital Millennium Medical College (SPHMMC) was recently established as part of Ethiopia's initiative to expand cancer treatment centers to major cities, including Gondar, Mekelle, Hawassa, and Harar. Initially, the unit was staffed with one oncologist, 12 general practitioners, and 14 nurses. Once fully equipped, it is expected to house radiation machines, provide 250 beds, and handle all referral cases, including those redirected from Tikur Anbessa Specialized Hospital(58).

4.2. Study Design

This study adopted a facility-based, cross-sectional design for concurrent validation. The validation process involved comparing NUTRISCORE results with scores from the criterion instrument, Full Nutrition Assessment (FNA) score.

4.3. Population

4.3.1. Source population

All adult outpatients aged ≥18 years diagnosed with malignant neoplasm and attending the oncology centers at TASH and SPHMMC in Addis Ababa, Ethiopia, were included in the study.

4.3.2. Study Population

All systematically selected cancer patients aged 18 years or older who attend the oncology outpatient department for treatment were included at TASH and SPMMC during the specified study period in Addis Ababa, Ethiopia.

4.4. Eligibility criteria

4.4.1. Inclusion criteria

The studies included cancer outpatients aged 18 years or older who were able to provide informed consent and were attending the oncology outpatient department for evaluation, and treatment during study period.

4.4.2. Exclusion criteria

The study excluded patients with cognitive impairments or communication difficulties that hinder proper assessment, those in critical condition requiring immediate care or hospitalization, and patients unable to stand for weight measurement.

4.5. Sample size determination

A formula for calculating sensitivity, specificity, an area under curve and sample size for screening tests was using Buderer's formula(59).

Buderer's Formula for Sample Size Calculation

For **sensitivity**: $n_{se} = \frac{Z_{\alpha/2}^2 \times se(1-se)}{d^2 \times P}$

For **specificity**: $nSp = \frac{Z\alpha/_2^2 \times Sp(1-Sp)}{d^2 (1-P)}$

Where:

- **n** = required sample size
- **Zα/2** = Z-value for the confidence level (for 95% confidence, Z = 1.96)
- **Se** = expected sensitivity of the test
- **Sp** = expected specificity of the test
- **d** = desired precision (margin of error, often 5% or 0.05)
- **P** = prevalence of the disease or condition

In Spain, the NUTRISCORE nutrition screening tool demonstrated a sensitivity of **97.3%** and a specificity of **95.9%** in a study that compared it with the Malnutrition Screening Tool (MST), using the Subjective Global Assessment (SGA) as the reference(44). In contrast, in China, the tool showed a much lower sensitivity of **6.2%** but an extremely high specificity of **99.8%**), using the Subjective Global Assessment (SGA) as the reference (42)**.** The prevalence of malnutrition in cancer patients in Ethiopia is 58.2%(25).

Assumptions:

- Sensitivity of the NUTRISCORE tool: **97.3%** (0.973)
- Specificity of the NUTRISCORE tool: **95.9%** (0.959)
- Prevalence of malnutrition: **58.2%** (0.582)
- Desired precision: **5%** (0.05).

Based on these assumptions the calculated sample size:

For sensitivity: $nse = \frac{Z_{\alpha/_2}^2 \times se\ (1-se)}{d^2 \times P} = \frac{(1.96)^2 \times 0.973(1-0.973)}{(0.05)^2 \times 0.582} = 69.5 =$ **70**

For specificity: $nsp = \frac{Z_{\alpha/_2}^2 \times sp(1-sp)}{d^2 \times (1-P)} = \frac{(1.96)2 \times 0.959(1-0.959)}{(0.05)2 \times (1-0.582)} = 144.4 =$ **145**

Therefore, to validate the NUTRISCORE tool with a malnutrition prevalence of 58.2%, the study would require at least 145 patients. By adding a 10% non-response rate, the final sample size for the study was **161**, as a larger sample size ensures adequate power to assess both sensitivity and specificity. Using a larger sample size in diagnostic studies is essential to ensure accurate, precise, and generalizable estimates of sensitivity and specificity. Larger samples reduce sampling variability, providing more stable and reliable performance metrics for the diagnostic tool. Additionally, larger sample sizes enhance the study's power, minimizing errors and improving the precision of sensitivity and specificity estimates. (60).

4.6. Sampling procedure

This study utilized a systematic random sampling to select participants from the two hospitals. The study sites were selected purposefully due to their high patient load and their status as major oncology centers in the country. Tikur Anbessa Specialized Hospital (TASH) is the only cancer treatment center in the area that offers both radiotherapy and chemotherapy, while St. Paul's Hospital Millennium Medical College (SPHMMC) serves as the second center, providing chemotherapy services. Based on monthly outpatient records, approximately 530 and 560 cancer patients are seen at TASH and SPHMMC respectively, totaling 1,090 patients. The total study sample size of 161 participants was proportionally allocated, with 78 from TASH and 83 from SPHMMC. The sampling interval (**K**) was calculated using the formula **K = N/n**, resulting in an interval of approximately 7 for both hospitals (TASH: 530/78 ≈ 7; SPHMMC: 560/83 ≈ 7). Accordingly, every 7th eligible patient was systematically selected until the required sample size was reached. A sampling frame, developed from outpatient clinic records, was used to facilitate the application of systematic random sampling. This approach ensured proportional representation and enhanced the reliability and representativeness of the data collected. (Figure 1)

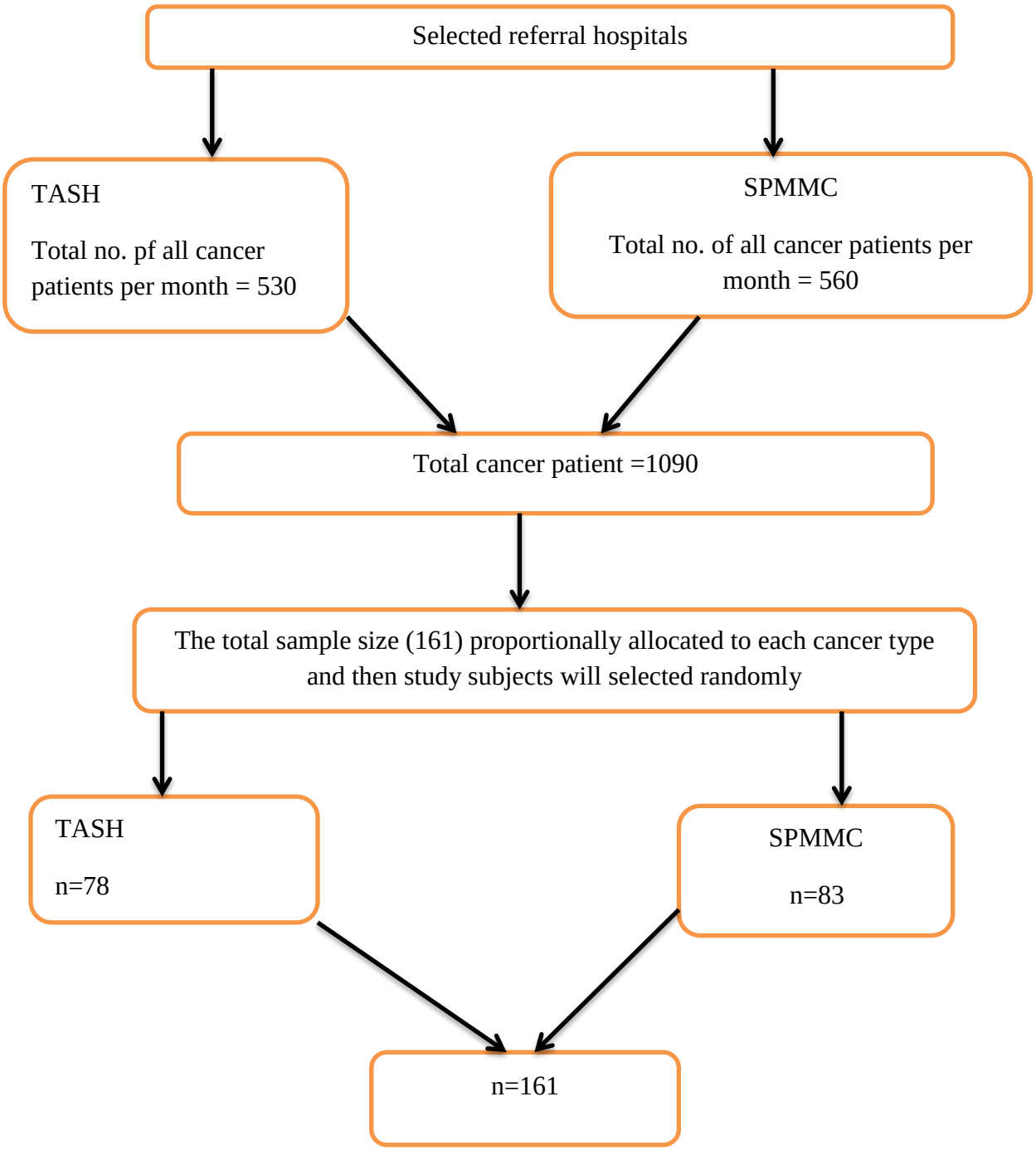


Figure 1 : Schematic presentation of sampling procedure- The sampling procedure involves a random sampling from two referral hospitals, Tikur Anbessa Specialized Hospital (TASH) and St. Paul's Millennium Medical College (SPMMC), with a proportional allocation of the total sample size of 161 participants based on patient flow and cancer type, ensuring representativeness and reliability.

4.7. Data Collection Methods

Data collection was conducted from February to April 2025, covering a three-month study period. Each participant was assessed using both the NUTRISCORE and FNA tools in a single session. To avoid redundancy, any components common to both tools were evaluated only once. Before participation, a written informed consent was obtained from all participants or their legal guardians, with a clear explanation of the study's purpose and any potential risks.

Data were gathered through patient and caregiver interviews, physical examinations, and laboratory investigations. Structured questionnaires were used alongside electronic data collection tools such as KOBO on secure devices. Anthropometric measurements, including weight, height, body mass index (BMI), and mid-upper arm circumference (MUAC), were taken using calibrated instruments. Triceps skinfold thickness was measured with a skinfold caliper, following standard procedures to assess physical nutritional status. Blood samples were collected by trained and experienced healthcare professionals and analyzed in the hospital laboratory to measure serum albumin and lymphocyte levels as part of the FNA.

Data was collected by two trained nurses. The data collection was supervised by trained supervisor and principal investigator. A three-day theoretical and practical training were given for two data collectors and one supervisor. The training included the objective and methodology of the study, data collection and interviewing approach, how to take anthropometric measurements, data recording and ethics during data collection.

All measurements were taken twice, and the average was used for the final analysis. If the discrepancies between the first and second measurements were greater than 1.0 cm for height, 0.5 cm for MUAC, or 0.5 kg for weight, the measurements were repeated. Additionally, for triceps skinfolds, discrepancies greater than 1 mm were addressed by re-measuring. All measurement scales were calibrated daily before data collection, and the data collectors ensured the scales read 0.00 before each measurement.

The Technical error of measurement (TEM) was calculated and it was found that the Intra observer technical error of measurements for height, weight and MUAC were found to be 0.19, 0.126 and 0.09 respectively. Inter observer technical error of measurement for height, weight and MUAC were found to be 0.22, 0.22 and 0.119 respectively; which were all within the acceptable range. In addition, the

coefficient of reliability was calculated for height, weight and MUAC which were all within acceptable range (≥ 96%)(61).

4.8. Operational definitions

- **Validation of NUTRISCORE nutrition screening tool:** Assessment of how accurately the NUTRISCORE tool identifies nutritional risk, using FNA as the reference standard(44).
- **Malnutrition by NUTRISCORE**: defined as a **score ≥5**, indicating the patient is at nutritional risk.
- **Nutritional Risk**: Classification as "at risk" or "not at risk" based on the NUTRISCORE tool.
- **Full Nutritional Assessment (FNA)**: A comprehensive method for evaluating nutritional status, defining malnutrition when at least three out of seven assessed parameters fall below the reference levels(62).
- **Unintentional Weight Loss**: Weight reduction occurring without deliberate effort or changes in lifestyle. It is categorized as: **<5%**: Mild weight loss ,**<10%**: Moderate weight loss, and >10 % severe weight loss(63).
- **Body Mass Index:** Calculated as weight in kilograms divided by the square of height in meters (kg/m^2), used to classify underweight (BMI <18.5), normal, or overweight.
- **Triceps Skinfold Thickness (TST)**: Measured in millimeters using a skinfold caliper on the back of the upper arm to estimate fat reserves.
- **Mid-Upper Arm Circumference (MUAC)**: A measurement of the upper arm's circumference used as an indicator of muscle mass and nutritional status.
- **Mid-Arm Muscle Area (MAMA)**: Calculated from MUAC and TST to estimate muscle mass, with lower percentiles indicating potential protein-energy malnutrition.
- **Serum Albumin**: A blood protein measured in g/dL. Low values (<3.5 g/dL) are associated with poor nutritional status and inflammation
- **Total Lymphocyte Count (TLC)**: Derived from complete blood count to assess immune function. A TLC <1500 cells/mm^3 was considered abnormal.

4.9. Data quality management

Before data collection, the clinicians involved in data collection underwent a three day comprehensive training. This training covered the objectives of the study, detailed instructions on administering NUTRISCORE and FNA, proper use of the questionnaires, and ethical considerations. Emphasis was placed on obtaining both written and oral informed consent, respecting participants' rights to refuse or withdraw from the study at any time, maintaining confidentiality, and ensuring appropriate interactions with participants. The training was conducted by principal investigators.

The questionnaire was prepared in English and translated into the local language, Amharic. It captured socio-demographic information and collected data on anthropometric measurements which were taken twice by data collector and once by supervisor- as well as biochemical, and clinical components for both NUTRISCORE and FNA. The data were monitored frequently during data collection and the questionnaire was reviewed for completeness and consistency during the interview and the frequency and percentage distribution of the participants' characteristics at the end of each day. A pre-test was conducted on 5% of the target population to evaluate the translated NUTRISCORE and FNA tools to assess their clarity, relevance, and ease of use in the local context. Feedback from the pre-test was used to refine the translations and ensure cultural adaptation.

4.10. Data processing and analysis methods

Data were collected by the kobo toolbox, and exported to IBM SPSS statistical software for analysis. The data were checked for missing values before analysis**.** Variables were transformed or consolidated into appropriate formats for analysis (continuous variables was changed to categorical variables). Descriptive statistics were used to summarize the frequency and percentage distribution of the participants' characteristics.

To evaluate the performance of NUTRISCORE, its specificity**,** sensitivity**,** positive predictive value (PPV)**,** and negative predictive value (NPV) were calculated. Cronbach's alpha was used to assess the internal consistency of the items of NUTRISCORE, providing a measure of its reliability. A Cronbach's alpha value of 0.60 was considered acceptable**,** 0.70 as adequate, and 0.80 or above as good internal consistency(64). Additionally, the Receiver Operating Characteristic (ROC) curve and the Area under

the Curve (AUC) were generated to assess the overall diagnostic performance of NUTRISCORE in comparison to FNA.

The NUTRISCORE results were categorized in to two subgroups .These subgroups are NUTRISCORE <5 – no risk of malnutrition, NUTRISCORE ≥5 at risk of malnutrition .For participants whose weight and height were measured, Body Mass Index (BMI**)** was calculated using these values.

The Full Nutritional Assessment (FNA) was used as the reference standard. It is defining malnutrition when at least three out of seven assessed parameters fall below the reference levels. These parameters typically include BMI, serum albumin, total lymphocyte count, MUAC, TSF MAMA and unintentional weight loss,

4.11. Ethical considerations

Before commencing the study, ethical clearance was obtained from the Research and Ethics Committee of the School of Public Health, Addis Ababa University**.** Additionally, permission letters to conduct the research and collect data were obtained from Tikur Anbessa Specialized Hospital and ST. paul Hospital**.** After receiving ethical approval, a formal letter of cooperation was sent to the Department of Oncology to review records for enrolment purpose.

During data collection, written informed consent was obtained from each participant after explaining the objectives of the study. To ensure anonymity, personal identifiers such as names were not included in the questionnaire. All necessary measures to uphold human rights were implemented, including securing informed consent, respecting participants' rights to privacy and confidentiality, and ensuring protection from any form of harm.

Participants were informed that their participation is entirely voluntary, and there was no obligation to take part. They were also be assured that any information they provide, whether orally or in writing, would be used solely for research purposes and kept strictly confidential. While blood samples were collected as part of the study, this process was minimally invasive and was performed by trained healthcare professionals in a sterile and controlled environment to minimize any risk of harm. Participants were reassured that the blood collection would cause no undue physical discomfort or

injury, and the amount of blood taken was within safe and accepted limits. Patients identified as being "at risk" of malnutrition during the study period were referred to the attending physicians and nurses for appropriate nutritional intervention. Additionally, they were informed that they could withdraw from the study at any time without any consequences.

4.12. Dissemination Plans

The results of this study will be submitted to the School of Public Health, Department of Nutrition and Dietetics, Addis Ababa University College of Health Sciences. Additionally, the findings will be disseminated through publication in reputable, peer-reviewed journals.

5. RESULTS

Among the 161 patients who were eligible for inclusion, 155 completed the study, yielding a response rate of 96.3%.

5.1. Socio-demographic characteristics of study participants

A total of 155 patients participated in the study. The majority of participants were female (67.1%)**,** while males accounted for 32.9%**.** The mean age of participants was 47.34 years (SD ± 13.32) ranges from 18 to 80 years. Most participants (54.8%) were middle aged adults (40-59 years).

In terms of marital status, the majority of respondents were married (65.8%), regarding occupation, 26.3% of participants were housewives, 21.8% were employed, and 14.1% were both unemployed and farmers. Concerning the primary caregiver, the most commonly reported caregivers were children (34.6%), followed by relatives (26.9%). (Table 2)

Table 2: Socio demographic characteristic of cancer outpatients in TASH and SPMMC, Addis Ababa Ethiopia, 2025.

Variables	Frequency	Percent
Sex		
Male	51	32.9
Female	104	67.1
Age		
18-39	42	27.1
40-59	85	54.8
≥60 years old	28	18.1
Marital status		
Single	23	14.8
Married	102	65.8
Widowed	18	11.6
Divorced	12	7.7
Occupation		
Unemployed	22	14.1
Business	20	12.8
Housewife	41	26.3
Farmer	22	14.1
Student	7	4.5
Employed	34	21.8
Retired	8	5.1
Other	2	1.3
Primary care giver		
Partner	29	18.6
Child	54	34.6
Relatives	42	26.9
Self	31	19.9

5.2. CLINICAL CHARACTERISTICS OF THE PATIENT

As a total of 155 cancer patients participated in the study the most common cancer diagnosis was breast cancer, accounting for 23.9% of cases, followed by cervical cancer (10.3%)**,** intestinal cancer (6.5%) and others ,Regarding the stage of cancer, the majority of patients were diagnosed at an advanced stage: Stage 4 was most common, reported in 54.2% of participants, followed by Stage 3 (33.5%).In terms of treatment modalities, the most frequently received treatment was chemotherapy (48.0%), followed by surgery (29.6%), radiotherapy (17.1%), and hormonal therapy (5.3%). Many patients received more than one type of treatment, indicating a multimodal approach to cancer management. (Table 3)

Table 3: Clinical characteristics of cancer outpatients at TASH and SPMMC hospitals, Addis Ababa, Ethiopia, 2025.

Variable	Frequency	Percent
Diagnosis category		
Breast cancer	37	23.9
Cervical cancer	16	10.3
Intestinal cancer	10	6.5
Prostate cancer	6	3.9
Esophageal cancer	8	5.2
Gastric cancer	8	5.2
Lung cancer08	8	5.2
Nasopharyngeal cancer	7	4.5
Rectal cancer	10	6.5
Ovarian cancer	3	1.9
Renal cell carcinoma	4	2.6
Thyroid cancer	7	4.5
Sarcoma	10	6.5
Others neoplasm	21	13.3
Stage of cancer at the time of data collection		

Stage 1	5	3.2
Stage2	14	9.0
Stage 3	52	33.5
Stage 4	84	54.2
Type of Treatment patient take		
Surgery	90	29.6
Chemotherapy	146	48.0
Radiotherapy	52	17.1
Hormonal therapy	16	5.3

5.3. Anthropometric Measurements

A total of 155 cancer patients had complete anthropometric data. The mean (± SD) body weight of the participants was 57.65 (± 11.09) kg, with values ranging from 35.00 kg **to** 94.30 kg. The average (±SD) height was 163.43(±7.85) cm, with a minimum of 143.15 cm and a maximum of 182.25 cm.

The mean (±SD)Mid-Upper Arm Circumference (MUAC) measurement among participants was 25.13 (± 4.20) cm, with values ranging from 14.00 to 38.90 cm. Based on MUAC classification, 32.3% of the patients were identified as undernourished (MUAC < 23 cm), with the majority being females (27; 17.4%) and males (23; 14.8%). The majority of participants **(**63.9%**)** fell within the normal nutritional range**,** while smaller proportions (3.9%) were categorized as over nourished**.**

The mean (±SD) Triceps Skinfold Thickness measurements among participants were 9.86 (± 5.54) mm, ranging from 2.00 to 27.10 mm**.** Based on TSF classification, a majority of the participants **(**61.3%**)** were found to have depleted fat stores (<10MM**)**, with nearly equal distribution between males 47(30.3%) and females 48(31%)**.** About 36.8% had normal fat stores (10mm-20mm**)**, predominantly females **(**53**)** compared to males **(4).** Only 1.9% of participants were classified as having high fat stores (>20mm**)**, all of whom were female.

The BMI calculation showed that 26.5% of the patients were underweight**,** with 22 males and 19 females falling into this category. Nearly half of the participants **(**48.4%**)** had a normal BMI, while 19.4% were

overweight, with a notable gender difference 26 females compared to 4 males. Additionally, 5.8% of participants were categorized as obese, all of whom were female.

5.4. Malnutrition

According to the Full Nutrition Assessment (FNA), 35.5% of the participants were classified as malnourished, while the remaining 64.5% were found to be not malnourished. In contrast, according to the NUTRISCORE, 123 participants (79.4%) were identified as "not at nutritional risk," while 32 participants (20.6%) were identified as being "at nutritional risk."(Figure 2)

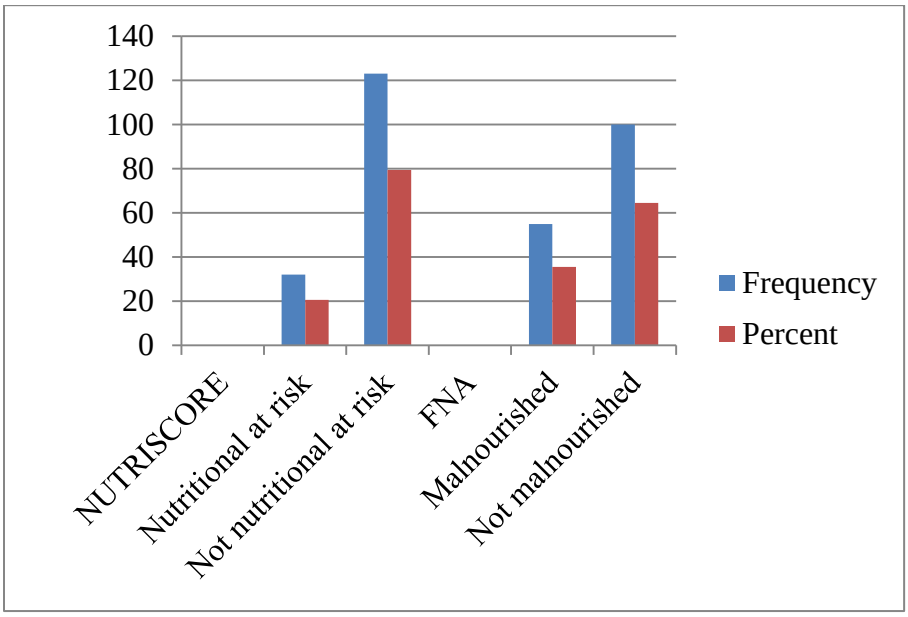


Figure 2: Frequency and prevalence of malnutrition in cancer outpatients according to different tools at TASH and SPMMC, Addis Ababa, Ethiopia, 2025

When stratified by gender, the prevalence of malnutrition according to the Full Nutrition Assessment (FNA) was slightly higher among female patients, accounting for 18.1% of malnourished cases, compared to 17.4% among male patients. (Table 4)

Table 4: Frequency and prevalence of malnutrition among cancer outpatients based on FNA according to gender at TASH and SPMMIC, Addis Ababa, Ethiopia 2025

FNA	Sex	
	Male	Female
Malnourished	27(17.4%)	28(18.1%)
Not Malnourished	24(15.5%)	76(46%)

Similarly, based on the NUTRISCORE, 12.9% of female participants were identified as being at nutritional risk, which was higher than the 7.7% observed among male participants (Table 5).

Table 5: Frequency and prevalence of malnutrition among cancer outpatients based on NUTRISCORE according to gender at TASH and SPMMC, Addis Ababa, Ethiopia 2025

NUTRISCORE	Sex	
	Male	Female
Nutritional at risk	12(7.7%)	20(12.9%)
Not nutritional at risk	39(25.2%)	84(54.2%)

The table 6 presents the distribution and prevalence of nutritional risk according to age groups based on the NUTRISCORE screening tool. The majority of proportion of nutritional risk was observed among patients aged 40–59 years (13.5%), followed by 18–39 years (4.5%). These findings suggest that middle-aged adults may be more nutritionally vulnerable

Table 6: Frequency and prevalence of malnutrition among cancer outpatients based on NUTRISCORE according to age at TASH and SPMMC, Addis Ababa, Ethiopia 2025.

NUTRISCORE	18-39 Years	40-59 Years	≥60 years
Nutritional at risk	7(4.5%)	21(13.5%)	4(2.6%)
Not nutritional at risk	35(22.6%)	64(41.3%)	24(15.5%)

Table 7 displays the malnutrition status by age as assessed by the Full Nutritional Assessment (FNA)**.** Consistent with the NUTRISCORE results, the majority of proportion of malnutrition observed in the 40–59 years group **(**21.9%**),** followed by the 18–39 years group (9.7%)**.** This pattern reinforces the need for focused nutritional screening and support for younger and middle-aged cancer patients.

Table 7: Frequency and prevalence of malnutrition among cancer outpatients based on FNA according to age at TASH and SPMMC, Addis Ababa, Ethiopia 2025

FNA	18-39 years	40-59 Years	≥60 years
Malnourished	15(9.7%)	34(21.9%)	6(3.9%)
Not Malnourished	27(17.4%)	51(32.9%)	22(14.2%)

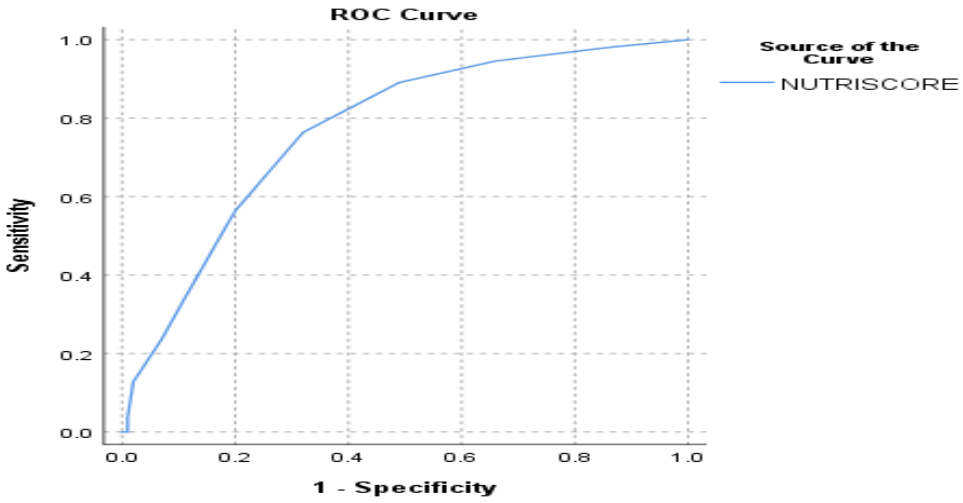
5.5. Concurrent Validity of NUTRISCORE

Using FNA as a gold standard, the validity of NUTRISCORE tool was assessed and it was found to have 36.4% sensitivity, 88.0% specificity, positive predictive value of 62.5% and negative predictive value of 71.5%. (Table 8)

Table 8: Sensitivity, Specificity, Positive Predictive value, Negative predictive value of NUTRISCORE compared to FNA among cancer outpatients at TASH and SPMMC, Addis Ababa, Ethiopia, 2025

Tool	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Youden Index
NUTRISCORE	36.4%	88.0%	62.5%	71.5%	0.244

The diagnostic accuracy of the NUTRISCORE was assessed through ROC curve analysis, with AUC of 0.770, which reflects a reasonable ability to distinguish patients at risk of malnutrition.



Figurer 3: Receiver Operating Curve (ROC) of NUTRISCORE among cancer outpatients at TASH and SPMMC, Addis Ababa, Ethiopia, 2025

5.6. Reliability of NUTRISCORE

To evaluate the internal consistency of the NUTRISCORE and its related items in assessing nutritional risk among cancer patients**,** Cronbach's alpha was computed and found an overall consistency of α = 0.739 which reflects acceptable internal consistency . The items related to weight loss and appetite show stronger correlations with the total score there by improving overall reliability. The clinical variables such as location/neoplasm and receiving chemotherapy showed weaker item-total correlations and led to slightly increase the overall alpha if deleted. In item-item correlation findings show that strongest positive correlation between weight loss and appetite loss(r=0.602) while the weakest correlations was found between the item Location/neoplasm and receiving treatment (chemotherapy) (r = 0.055).

Table 9: Cronbach's alpha coefficient of NUTRISCORE among cancer outpatients at TASH and SPMMC, Addis Ababa, Ethiopia, 2025.

Cronbach alpha = 0.739		
	Corrected item total correlation	Cronbach's alpha if item deleted
Involuntarily weight loss	0.675	0.633
Appetite loss	0.550	0.730
Location/ neoplasm	0.415	0.727
Receiving chemotherapy	0.406	0.744

6. DISCUSSION

This study aimed to validate the NUTRISCORE tool for identifying malnutrition among cancer patients at the two largest tertiary hospitals in Ethiopia, by comparing its performance with the Full Nutrition Assessment (FNA), which is considered as gold standard, but there is no ‘gold standard and single best test to evaluate nutritional status.

Among cancer outpatients, 35.5% were found to malnourished according to FNA while 20.6% were identified as at risk of malnourished according to NUTRISCORE. Using FNA as a gold standard , the validity of NUTRISCORE was determined a sensitivity of 36.4% , specificity of 88% , positive predictive value of 62.5% and negative predictive value of 71.5% .The internal consistency of NUTRISCORE assessed using Cronbach’s alpha coefficient was found to be $\alpha = 0.739$.

To assess NUTRISCORE validity in this study, the level of sensitivity and specificity compared to FNA was determined. When compared with FNA, NUTRISCORE had a sensitivity of 36.8% and a specificity of 88%. It can say that out of all patients 36.8% of them are truly at risk of malnutrition and correctly identifies 88% of them are not at risk of malnutrition. The PPV and NPV were 62.5% and 71.5% respectively, indicating 62.5% of them are actual positive cases and 71.5% of them are true ‘not at risk “results.

In the present study, the NUTRISCORE tool demonstrated a sensitivity of 36.8%, specificity of 88%, positive predictive value (PPV) of 62.5%, negative predictive value (NPV) of 71.5%, and an area under the curve (AUC) of 0.770. These results are notably lower than those reported in a study conducted in Spain, where NUTRISCORE achieved a sensitivity of 97.3%, specificity of 95.9%, PPV of 84.8%, NPV of 99%, and an AUC of 0.95(44). Similarly, a study conducted in China evaluating the performance of NUTRISCORE among cancer patients, using the Patient-Generated Subjective Global Assessment (PG-SGA) as the reference standard, reported a sensitivity of 6.2%, specificity of 99.8%, and an AUC of 0.53. In comparison, the Malnutrition Screening Tool (MST) in the same study showed a sensitivity of 50.9%, specificity of 74.9%, and an AUC of 0.63(42). The relatively low sensitivity of the NUTRISCORE observed in this study may be attributed to population differences (such as variations in disease stage, comorbidities, and health-seeking behavior), differences in reference standards (using FNA instead of PG-SGA), and the influence of cultural and dietary contexts in Ethiopia, including food

insecurity and limited access to specialized nutritional care, which may affect how malnutrition is manifested and detected.

In another study that conduct in Colombia used a NUTRISCORE to identify nutritional risk, the prevalence of malnutrition risk was reported as 26%. The tool demonstrated a sensitivity of 45% and a specificity of 97%, indicating poor overall test validity despite high specificity. Compared to that study, the present research found a slightly lower sensitivity (36.8%) and specificity (88%). While both studies suggest that NUTRISCORE has high specificity which is effective at identifying patients who are not malnourished and the low sensitivity observed in both settings highlights its limitation in correctly identifying all patients truly at risk of malnutrition. These findings suggest that, although NUTRISCORE may reduce false positives, it may miss a significant number of malnourished patients, thereby limiting its usefulness as a standalone screening tool in clinical settings(43).

Regarding reliability evaluating the internal consistency of the NUTRISCORE and its related items in assessing nutritional risk among cancer patients**,** Cronbach's alpha was computed and found an overall consistency of $\alpha = 0.739$ which reflects acceptable internal consistency . The items related to weight loss and appetite show stronger correlations with the total score there by improving overall reliability. The clinical variables such as location/neoplasm and receiving chemotherapy showed weaker item-total correlations and led to slightly increase the overall alpha if deleted. In item-item correlation findings show that strongest positive correlation between weight loss and appetite loss($r=0.602$) while the weakest correlations was found between the item Location/neoplasm and receiving treatment (chemotherapy) ($r = 0.055$).

The study could have the following limitations:

Firstly, due to its unavailability, serum pre-albumin was excluded from the Full Nutrition Assessment (FNA) tool in this study. Pre-albumin is commonly used in nutritional assessments because of its short half-life and high sensitivity to changes in protein-energy status. Instead, serum albumin was used as an alternative biomarker. However, the exclusion may have limited comprehensiveness and diagnostic accuracy of the FNA, which served as the reference standard in this study.

Secondly, the accuracy of patients' self-reported weight is uncertain. Because previous weights were frequently undocumented among cancer patients' baseline or usual weight often had to be estimated

from memory. Important details like baseline weight and history of weight loss were recalled subjectively, which may have introduced recall bias and compromised the precision of the nutritional assessment. To minimize the recall bias, an estimated weight calculation formula was used to approximate previous weight more objectively. And also this study did not specifically investigate subgroups like obese individuals or those with stable weight but underlying micronutrient deficiencies. Therefore, tools like NUTRISCORE, which primarily focus on weight changes and dietary intake, may not accurately identify malnutrition in these groups.

Thirdly, the distribution of cancer types among participants may have influenced the study findings. A disproportionately high number of breast cancer patients were included, and these patients were generally less likely to be malnourished and often scored "+0" (not at risk) on the NUTRISCORE tool. This could have led to an underestimation of the overall prevalence of malnutrition and may have affected the evaluation of NUTRISCORE's diagnostic performance.

Additionally, the cross-sectional design of this study limits the ability to evaluate the predictive validity of the NUTRISCORE tool. While the study assessed how accurately the tool identifies current malnutrition status, it could not determine whether patients identified as "at risk" go on to experience nutritional decline or adverse clinical outcomes over time.

7. CONCLUSION

In this study, the NUTRISCORE tool demonstrated acceptable reliability and high specificity, its low sensitivity limits its effectiveness in accurately identifying all malnourished patients. The tool showed low sensitivity and moderate specificity, indicating that NUTRISCORE has limited validity for detecting malnutrition among cancer patients at Tikur Anbessa Specialized Hospital (TASH) and Saint Paul's Millennium Medical College (SPMMC).

8. RECOMMENDATIONS

For Clinicians and Frontline Healthcare Providers: Given that NUTRISCORE demonstrates high specificity but low sensitivity, it should not be used as the sole method for detecting malnutrition in cancer patients. Instead, it is best utilized as an initial screening tool to help exclude malnutrition in patients unlikely to be affected. However, all patients, especially those not identified as at risk by NUTRISCORE should undergo comprehensive nutritional assessments such as the Full Nutrition Assessment (FNA) to ensure accurate diagnosis and appropriate management.

For Hospital Management at TASH and SPMMC: Hospital leadership should prioritize staff training on multiple nutritional screening tools and establish standardized protocols for nutrition assessment. These protocols must incorporate tools with higher sensitivity to better identify malnutrition risk among high-risk cancer patient populations.

For the Ministry of Health and Policy Makers: Given the limitations of NUTRISCORE observed in this study, policymakers should reconsider its role within national nutritional screening guidelines for cancer patients. Emphasis should be placed on validating or adapting screening tools that are more sensitive and tailored to the Ethiopian cancer patient population to improve early detection of malnutrition.

For Researchers and Academics: this study underscores the need for further validation research of nutrition screening tools in diverse clinical settings across Ethiopia. Future studies should assess the performance of these tools across different cancer types and stages, ideally involving larger patient samples, to establish context-specific effectiveness and reliability.

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ANNEXES

Annex I. Participant Information Sheet/ Consent form for the Study

RESEARCH TITLE: VALIDATION OF NUTRISCORE NUTRITION SCREENING TOOL AMONG CANCER PATIENTS IN SELECTED REFERRAL HOSPITALS ADDIS ABABA, ETHIOPIA, 2025GC: A FACILITY-BASED CROSS-SECTIONAL STUDY DESIGN.

Researcher: Tselot Tarekegn

Dear Respondent:

You are invited to participate in a research study conducted as part of the requirements for a Master's Degree in Public Health, in collaboration with Addis Ababa University, School of Public Health. This study aims to assess the validity of NUTRISCORE in evaluating the nutritional status of cancer patients.

We are seeking participation from individuals aged 18 years and older who are visiting the oncology outpatient department. You have been randomly selected to contribute to this study. As part of the research, some blood samples will be collected; however, since blood analysis is routinely performed during your medical checkups, this will not pose any additional harm.

Your participation is entirely voluntary, and you are free to express any discomfort or withdraw from the study at any time. The findings from this study will contribute to developing policies to improve the nutritional management of cancer patients. If malnutrition is detected, you will be referred for further evaluation and treatment.

Please be assured that your identity will remain confidential, and all the information you provide will be used solely for research purposes. I welcome any question if you have any about the study and your participation. Should you have any questions about the research or any related matters, please contact the researcher at +2519035625249

Email: tselottarekegn123@gmail.com

Annex II. Consent sheet

I, the under signed, understand the nature of the study, benefits, my right to voluntary participation, confidentiality and withdrawal from the study without any victimization. I have had the opportunity to

ask questions and answered to my satisfaction. I hereby freely consent to take part in this study. Signature of the participant_____ Date_____ Supervisor Name _____ signature_____ Date_____/_____/____E.C. Name of interviewer Date _____/_____/_____E.C. signature_____

Your participation will be greatly appreciated. Yours Faithfully,

Annex III: English version Questionnaire

Part I: Socio demographic Characteristics

SN.	Questions	Coding categories	Skip questi
101.	Sex	1. Male 2. Female	
102.	Age in complete years	----------	
103.	What is your marital status	1. Single 2. Married 3. Widowed 4. Divorced 5. Other(specify)----------	
104.	What is your occupation	1. Unemployed 2. Business 3. Housewife 4. Farmer 5. Student 6. Employed 7. Retired 8. Other(specify)----------	
106.	Type of primary care giver	1. Partner 2. Child 3. Relatives 4. Living alone 5. Other(specify)----------	
107.	How many people are living in your home?	……	
108.	What is your monthly income?	…….	
110	Time since diagnosis	……(in days)	
111.	What type of cancer do you have?	1. Breast 2. Cervical	

		3. Intestinal 4. Prostate 5. Other(specify)----------	
112.	Types of treatment the patient take	1. surgery 2. Chemotherapy 3. Radiotherapy 4. Hormonal therapy 5. Immunotherapy	
113.	Stages of cancer at the time of data collection	1. stage 1 2. stage 2 3. stage 3 4. stage 4	

Part 2. Anthropometric data

Sn.	Questions	1st measurement	2nd measurement	Average
201.	Weight (Remark: If the difference between measurement 1st a 2nd is >0.5kg repeat the measurements again)	--------.--- kg	-----. --- kg	
	Height (Remark: If the difference between measurement 1st a 2nd is >1cm repeat the measurements again)	----- .—cm	---- .---- cm	
203.	MUAC in centimeters (Remark: If the difference between measurement 1st a 2nd is >0.5cm repeat the	------ . ----- cm	----. -- cm	

	measurements again)			
204.	Triceps skinfold in mm (Remark: If the difference between measurement 1st a 2nd is >1mm repeat the measurements again)	----.-- mm	---. – mm	
205	BMI	1. ≤18.5 kg/cm^2 2. 18.5-24.5 kg/cm^2 3. 25-29.9 kg/cm^2 4. ≥30 kg/cm^2		

Part 3: **NUTRISCORE Questionnaire tool**

SN.	Questions	Coding category	Skip question
301.	Have you lost weight involuntarily in the last 3 months?	0, No 2, I am not sure	
301.1	if yes, how much weights (in kilograms) have you lost?	1 …..1-5 2…..6-10 3…..11-15 4…...>15 2…..Unsure	
302.	Have you been eating poorly in the last week because of decreased appetite?	0. No 1. Yes	

303	Location/neoplasm	Nutritional Risk	score	Skip

	Head and neck Upper GI tract: esophagus, gastric, pancreas, intestine Lymphoma that compromised GI tract	High	+2	
	Lung Abdominal and pelvis: liver, biliary tract, renal, Ovaries and endometrial	Medium	+1	
	Breast central nervous system bladder, prostate colorectal leukemia, other lymphomas others	Low	+0	
304	Treatment	Yes(+2)	No(+0)	
	The patient is receiving concomitant chemo radiotherapy			
	The patient is receiving hyper fractionated radiation therapy			
	Hematopoietic stem cell transplantation			
		yes(+1)	No (+0)	
305	The patient is receiving chemotherapy			
	The patient is only receiving radiotherapy			
		Yes (+0)	No(+0)	
306	Other treatments or only systematic treatment			

Part 4. Full Nutritional Assessment Data

Parameter no.	**Parameters**	**Male**	**Female**	**References**
401.	Albumin			
402.	Total lymphocyte count			

403.	BMI			
404.	Triceps skinfold thickness			
405.	Mid- arm muscle area			
406	Mid- upper arm muscle circumference			
407	Unintentional weight loss previous month			

Annex IV: Amharic version questionnaire

የአማርኛ ቃለ መጠይቅ

በአዲስ አበባ ዩኒቨርሰቲ በ ካንሰር ህክም ና የትምህርት ክፍሌ የ ሁለተኛ ዲግሪ ተማሪ በሆነችው ጸሎት ታረቀኝ በምታጠናው ጥናት ሊይ እንድትሳተፉ ተጋብዛችኋል። ይህ ጥናት የካንሰር በሽተኞችን አመጋገብ በመገምገም ረገድ ኑትሪስኮር ያለውን ትክክለኛነት ለመገምገም ነው።

የኮንኮሎጂ ሕመማንን ክፍል ከሚጎበኙ ዕድሜያቸው 18 ዓመትና ከዚያ በላይ ከሆኑ ግለሰቦች ተሳትፎ ማድረግ እንፈልጋለን ። ለዚህ ጥናት አስተዋጽኦ እንድታበረክት በአጋጣሚ ተመርጠሃል ። የምርምሩ አካል እንደመሆኑ አንዳንድ የደም ናሙናዎች ይሰበሰባሉ፤ ይሁን እንጂ የሕክምና ምርመራ በምታደርጉበት ጊዜ የደም ምርመራ ስለሚደረግ ይህ ምንም ዓይነት ተጨማሪ ጉዳት አያስከትልም። ተሳትፎህ ሙሉ በሙሉ በፈቃደኝነት የሚደረግ ሲሆን በማንኛውም ጊዜ ማንኛውንም ችግር ለመግለጽ ወይም ከጥናቱ ለመውጣት ነፃ ነህ። ከዚህ ጥናት የተገኙ ግኝቶች የካንሰር ሕመማንን አመጋገብ ለማሻሻል የሚረዱ ፖሊሲዎችን ለማውጣት አስተዋጽኦ ያደርጋሉ። የተመጣጠነ ምግብ እጥረት መኖሩን ካየህ ተጨማሪ ምርመራና ሕክምና ማግኘት ትችላለህ።

እባክዎ ማንነትዎ በሚስጢራዊነት እንደሚቀጥል እርግጠኛ ሁን። የምታቀርበው መረጃ ሁሉ ለምርምር ዓላማ ብቻ የሚውል ይሆናል። ስለ ጥናቱ እና ስለ ተሳትፎዎ ማንኛውም ጥያቄ ቢኖራችሁ ደስ ይለኛል። ስለ ምርምሩ ወይም ከዚህ ጋር ተዛማጅነት ስላለው ማንኛውም ጉዳይ ጥያቄ ካለህ / ካለሽ እባክህ በ+2519035625249 ላይ በመደወል ተመራማሪውን አነጋግረው

ኢሜይል- tselottarekegn123@gmail.com

ክፍል አንድ-የማህበራዊና ሥነ- ባህርያት መገለጫ መጠይቅ

ተ.ቁ	ጥያቄ	ምላሽ	ዝለል
101.	ጾታ	1. ወንድ 2. ሴት	
102.	ስንት አመቶት ነው (በ ሙሉ አመት)	.....አመት	
103.	የጋብቻ ሁኔታ	1. ያላገባ 2. ያገባ 3. የሞተባት/የሞተበት 4. የተፋታ/የተፋታች	
104.	የስራ አይነት	1. ስራ የለኝም 2. ነጋዴ 3. የቤት እመቤት 4. ገበሬ 5. ተማሪ 6. ተቀጣሪ 7. ጡረታ 8. ሌላ ካለ ይገለጽ	
105.	እርስዎን በቅርብ የሚንከባከበዎት ማነዉ?	1. የትዳር ጓደኛየ 2. ልጆች 3. ዘመድ 4. ብቻየን ነኝ 5. ሌላ ይገለጽ	
107	ቤት ዉስጥ ስንት ሰዉ ይኖራል ?		
110	ምርመራ ከተደረገበት ጊዜ ጀምሮ ያለ ጊዚ	---------- (በቀናት ውስጥ)	
111.	እርስዎ ምን አይነት የ ካንሰር በሽታ ነው የታመሙት?	1. የ ጡት 2. የ ማህጸን በር 3. የ አንጀት	

		4. ፕሮስቴት 5. ሌላ ካለ ይገለጽ	
112.	የሕክምና ዓይነት	1. ሰርጀሪ 2. ኪሞቴራፒ 3. ራዲዮቴራፒ 4. የሆርሞን ሕክምና 5. የበሽታ መከላከያ ህክምና	
113.	የ ካንሰሩ ደረጃ ምን ያህል ነው ?	1. ደረጃ 1 2. ደረጃ2 3. ደረጃ3 4. ደረጃ4	

ክፍል ሁለት : **ቁመት እና ክብደት መረጃ**

ቁጥር	ጥያቄ	የመጀመሪያ ልኬት	ሁለተኛ ልኬት	አማካኝ
201.	**ክብደት** በኪልግራም (ማሳሰብያ፡የመጀመሪያ ልኬትና ሁለተኛ ልኬት መካከል የ>0.5ኪግ ካለ ልኬቱን ደግሞ ይለኩ)	____ ____.____ **ኪ..ግ**	____ ____.____ **ኪ..ግ**	____ ____.____ **ኪ..ግ**
202.	**ቁመት** በሴንቲሜትር (ማሳሰብያ፡የመጀመሪያ ልኬትና ሁለተኛ ልኬት መካከል የ>1ሴሜ ካለ ልኬቱን ደግሞ ይለኩ)	_____._____**ሴ.ሜ**	_____._____**ሴ.ሜ**	_____._____**ሴ.ሜ**
203	**መካከለኛ-የላይኛው ክንድ ጡንቻ ዙሪያ** በሴንቲሜትር	_____._____**ሴ.ሜ**	_____._____**ሴ.ሜ**	_____._____**ሴ.ሜ**

	(ማሳሰብያ፡የመጀመሪያ ልኬትና ሁለተኛ ልኬት መካከል የ>0.5ሴሜ ካለ ልኬቱን ደግሞ ይለኩ)			
204.	**ትራይሴፕስ የቆዳ ክፈፍ ውፍረት በሚሊሜትር** (ማሳሰብያ፡የመጀመሪያ ልኬትና ሁለተኛ ልኬት መካከል የ>1ሚሜ ካለ ልኬቱን ደግሞ ይለኩ)	_____.____**ሚ.ሜ**	_____.____**ሚ.ሜ**	_____.____**ሚ.ሜ**
205.	**የክብደት እና ቁመት ንጽጽር**	1. ≤18.5 **ኪ.ግ/ሜ**2 2. 18.5-24.5 **ኪ.ግ/ሜ**2 3. 25-29.9 **ኪ.ግ/ሜ**2 4. ≥30 **ኪ.ግ/ሜ**2		

ክፍል ሶስት፡ የኒውትሪስኮር ላይ ያተኮረ መጠይቅ

ቁጥር	**ጥያቄ**	**ኮድ**	**ዝለል**
301.	**ባለፉት 3 ወራት ውስጥ ሳታስተውል ክብደትህን ቀንሰሃል?**	0. **አይ** 2. **አይደለሁም**	
301.1	**አዎ ከሆነ ስንት ክብደት (በኪሎ ግራም) ቀንሰሃል?**	1 …..1-5 2…..6-10 3…..11-15 4…...>15	

		2….. እርግጠኛ ያልሆነ	
302.	የምግብ ፍላጎትህ በመቀነሱ ምክንያት ባለፈው ሳምንት በቂ ምግብ አልበላህም?	0. አይ 1. አዎ	

303.	ቦታ/ኒዮፕላዝም	የተመጣጠነ ምግብ ነክ አደጋ	ውጤት	ዝለል
	ራስ እና አንገት የላይኛው ጂአይ ትራክት - ኢሶፋጉስ, የጨጓራ, ቆሽት, አንጀት ጂኢ ትራክት እንዲበላሽ የሚያደርግ ሊምፎማ	ከፍተኛ	+2	
	ሳንባ የሆድ እና የዳሌ ጉበት, ቢሊያሪ ትራክ, ኩላሊት, የእንቁላሎት እና የእንዶዶሪያል	መካከለኛ	+1	
	ጡት ማዕከላዊ የነርቭ ሥርዓት ፊኛ፣ ፕሮስቴት ኮሎሬክታል ሊኩሚያ፣ ሌሎች ሊምፎማዎች ሌሎች	ዝቅተኛ	+0	
304.	ሕክምና	አዎ(+2)	አይደለም(+0)	
	ሕመምተኛው የኬሞቴራፒ ሕክምና እየተደረገለት ነው			

	ታካሚው ከፍተኛ የጨረር ሕክምና እየተደረገለት ነው			
	ሄማቶፖ᎓ይቲክ ስቴም ሴል ንቅለ ተከላ			
305.		አዎ(+1)	አይደለም(+0)	
	ታካሚው የኬሞቴራፒ ሕክምና እየተደረገለት ነው			
	በሽተኛው የራዲዮቴራፒ ሕክምና ብቻ ነው			
		አዎ(+0)	አይደለም(+0)	
306.	ሌሎች ህክምናዎች ወይም ስርዓት ያለው ህክምና ብቻ			

ክፍል አራት፡ የፉል ኒውትሪሽናል አሰስመንት ዳታ

ቁጥር	ፓራምትር	ወንድ	ሴት	ማጣቀሻዎች
401.	አልቡሚን			
402.	ጠቅላላ ሊምፎይት ቁጥር			
403.	ቢኤምአይ			
404.	ትራይሴፕስ የቆዳ ክፈፍ ውፍረት			
405.	መሃል-ክንድ የጡንቻ አካባቢ			
406.	መካከለኛ-የላይኛው ክንድ ጡንቻ ዙሪያ			
407.	ሳያስቡት የክብደት መቀነስ ያለፈው ወር			

Principal Investigator

Curriculum Vitae: Tselot Tarekegn

Personal Information

First Name: Tselot Middle Name: Tarekegn Last Name : Amensisa

Age:26 years Sex: Female Marital Status : Single

Place of Birth: Harar, Harari Region, Ethiopia

Date of Birth: 31 July, 1998

Nationality: Ethiopian

Language: Amharic and English: speak, read, and write

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I. Academic Qualification

1 Bsc in Public Health

Period of study: September 2018- February 2022

Program: Degree

Institution: Arsi University College of health science, Asella, Ethiopia.

II. Work experience

- Lecturer :

  Duration of employment: since October 2022

  Institution: Arsi University College of health science, Asella, Ethiopia.
- Project Management and research assistant

  Duration of employment: May 2022- August 2024

  Place: At Delta research and consultancy PLC.

III. Skills

- Microsoft office (MS-word, PowerPoint…)

- Data collection, Report writing
- Ability to work independently or as a part of a team
- Team management skill
- Decision-making and problem-solving
- Communication skill

IV. Future Plans and Interests:

- To upgrade my level of education to the next higher level
- To be an expert on my area of study

V. Reference

- Mr. Ashenafi habtamu

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Primary Advisor

SHORT CURRICULUM VITAE

Gudina Egata (MPH PhD) **Associate Professor**	**School of Public Health, College of Health Sciences, Addis Ababa University** **E-mail: fenetg@gmail.com or gudina.egata@aau.edu.et** **Tel No: +251 911 641362** **Addis Ababa, Ethiopia**

1. Education Qualifications

- 2010 -2014: PhD in Public Health , Haramaya University and Addis Continental Institute of Public Health PhD Joint Program
  Ph.D Dissertation Topic: Acute Child Malnutrition in Eastern Ethiopia: Magnitude,seasonal variation and predictors
- 2003-2005: Master's Degree in Public Health, Department of Community Heath, Addis Ababa University, Addis Ababa, Ethiopia
  Master's Thesis Title: Level of knowledge of Reproductive Health and sexual behaviour among adolescents in Nekemte town, 2005
- 1989-2001: BSc degree in Public Health, Department of Community Health Program, Jimma University, Jimma, Ethiopia.
  Research Title: Determinants of Expanded Program on Immunization (EPI) coverage in Yebu town, Jimma zone, 2001.
- 1987-1989: Diploma in Comprehensive Nursing with distinction, Gondar College of Medical Sciences, Gondar, Ethiopia

2. Professional Experience and Positions Held

- Head, Department of Nutrition & Dietetics , School of Public Health ,College of Health Sciences ,Addis Ababa University since July 2021.

- Associate Professor and Researcher, School of Public Health, Department of Nutrition& Dietetics , Addis Ababa University since August 2019
- Lecturer and Associate Professor, School of Public Health, Haramaya University,Ethiopia and Associate Director, Post-graduate program coordinator- Nov 2017 – Aug 2019
- Lecturer and Assistant professor of public Health, College of Health and Medical Sciences, Haramaya University, and Associate Director, Post-graduate program coordinator-Dec 2013 – Nov 2017
- Lecturer, HIV and AIDS Pre-service Training Focal Person, Faculty of Health Sciences, Secretary of Academic Commission of Faculty of Health Sciences, Haramaya University-Dec 2005 – Jan 2014
- Graduate Assistant II and Assistant lecturer-College of Health and Medical Sciences,Haramaya University Sep 2001 – Dec 2005
- Nekemte School of Nursing, Eastern Wollega Zonal Health Bureau Instructor-Dec 1996– Aug 1998.
- District Health Bureau Manager, Planning, organizing, monitoring and evaluating Woreda's health activities Eastern Wollega Zonal Health Bureau Aug 1996 – Nov 1996
- Staff nurse, Maternal & Child Health (MCH) Coordinator, Treatment and care of patients, Coordinating MCH activities, Eastern Wollega Zonal Health Bureau - Mar.1989 – Sep. 1989.

3. OTHER TRAINING

- 2022 Attended Postdoctoral Fellowship training at Harvard T.H Chan School of Public healthfrom July /02/2022 to August/31, 2022.
- 2021 Training of Trainers (TOT) on Research Ethics Organized by Addis Ababa University
- 2017 Training on Applied Longitudinal Data Analysis, Kersa Demographic and Health Research Center (KDS-HRC), Haramaya University
- 2016 Training workshop on mentorship for Ethiopian Feld Epidemiology and Laboratorytraining program for Mentors, FMoH Ethiopia in collaboration with the African FieldEpidemiology Network (AFENET)
- 2014 Ph.D mentorship training, Addis Continental Institute of public Health, Addis Ababa incollaboration with College of Health and Medical Sciences, Haramaya University

- 2012 Training of Trainers (TOT) on Monitoring & Evaluation of Health Programs and Adult Training Methods, School of Public Health, College of Health Sciences, Institute of Population studies, Addis Ababa, Ethiopia and Ethiopian Public Health association (EPHA); Geographic Information System (GIS) & basic global positioning system (GPS) Haramaya University, Kersa Demographic & Health Survey and Health Research Center
- 2011 Training of Trainers (TOT) on Monitoring & Evaluation of Health Programs and Adult Training Methods, Addis Continental Institute of Public Health in collaboration with MEASURE Evaluation

4. Project experience

- From December 2022 to present Consultancy work with Frontier i for world Food program(WFP) serving as Principal Investigator (PI) of "Developing Social and Behavioral Change Communication (SBCC) Strategy for WFP Ethiopia Strategic Plan "which is in its final phase (project closure phase).
- From July 2023 to present consultancy work with Frontier i for UNICEF and UNFPA serving as Principal Investigator (PI) of "Strengthening Federal and Regional Levels Monitoring, Evaluation and Learning (MEL) system for the prevention of harmful practices and violence against children (VAC) in Ethiopia."
- Leadership, Management and Governance (LMG) practices and associated factors among Primary Health Care Managers in Selected areas of Eastern Ethiopia- 2017 - 2018 by international Institute for Primary Health Care – Ethiopia as Principal investigator(PI)
- Consultancy work for John Snow International (JSI) Ethiopia in collaboration with Addis Continental Institute of Public Health. An Analysis of the Core Functions, Issues and Challenges of Human Resource Management (HRM) for Urban Health Extension Professionals (UHE-ps) as co-investigator, 2014.
- Mini Project used to identify predictors of acute child undernutrition in selected districts of eastern Haragehe zone, Eastern Ethiopia 2010/11 by Care Ethiopia as Principal Investigator (PI).
- Consultancy work for Ethiopian Catholic church as Team Leader for Capacity building training for health managers working in Ethiopian Catholic Health Facilities,2010/11

5. Publication of Articles:

- More than 75 publications on the international peer reviewed journal as Author and Co-author

6. Association's Memberships

- American Society for Nutrition (ASN) since December 2023 .
- Ethiopian Public Health Associations (EPHA) since 2001 to present.
- Food and Nutrition Society (FONSE), Ethiopia since 2015