T.C.
YEDITEPE UNIVERSITY
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DEPARTMENT OF NUTRITION AND DIETETICS

DETECTION OF MALNUTRITION USING DIFFERENT SCREENING TOOLS IN GERIATRIC PATIENT GROUP: A CROSS-SECTIONAL STUDY

MASTER THESIS

Deniz ÖZYALÇIN

ISTANBUL, 2024

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Supervisor

Assoc. Prof. Dr. Binnur OKAN BAKIR

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	Title, Name-Surname (Institution)
Chair of the Jury:	Asst. Prof. Dr. Nihan ÇAKIR BİÇER (Fenerbahçe University Faculty of Health Sciences, Department of Nutrition and Dietetics)
Supervisor:	Assoc. Prof. Dr. Binnur OKAN BAKIR (Yeditepe University Faculty of Health Sciences, Department of Nutrition and Dietetics)
Member/Examiner:	Assoc. Prof. Dr. İrem KAYA CEBİOĞLU (Yeditepe University Faculty of Health Sciences, Department of Nutrition and Dietetics)

APPROVAL

This thesis has been deemed by the jury in accordance with the relevant articles of Yeditepe University Graduate Education and Examinations Regulation and has been approved by Administrative Board of Institute with decision dated ..... and numbered .....

Prof. Dr. Bayram YILMAZ

Director of Institute of Health Sciences

DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.

22.07.2024

Deniz ÖZYALÇIN

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LIST OF SYMBOLS AND ABBREVIATIONS

ASPEN : American Society for Parenteral and Enteral Nutrition

BW : Body weight

Ca : Calcium

CC : Calf circumference

CCK : Cholecystokinin

CNS : Central nervous system

CRP : C-reactive protein

DM : Diabetes

EFSA : The European Food Safety Authority

ERAS : Enhanced Recovery After Surgery

ESPEN : European Society for Clinical Nutrition and Metabolism

Fe : Iron

FGF21 : Fibroblast growth factor 21

GIS: Gastrointestinal system

GLIM : Global Leadership Initiative on Malnutrition

GLP-1: Glucagon-like peptide-1

GNRI : Geriatric Nutritional Risk Index

HT : Hypertension

IL-1β: Interleukin 1 beta

IL-6 : Interleukin 6

LOS : Length of stay

MNA : Mini nutritional assessment

MNA-SF : Mini nutritional assessment – short form

MUST : Malnutrition universal screening tool

NRS 2002 : Nutritional risk screening

POST-OP : Postoperative

PRE-OP : Preoperative

PYY : Peptide YY

REE : Resting energy expenditure

TNF- α: Tumor necrosis factor-alfa

WHO **:** World Health Organization

ABSTRACT

Özyalçın, D. (2024). Detection Of Malnutrition Usıng Different Screening Tools In Geriatric Patient Group: A Cross-Sectional Study. Yeditepe University, Institute of Health Science, Department of Nutrition and Dietetics, Master's Thesis, Istanbul.

This cross-sectional study aimed to detect malnutrition in hospitalized geriatric patients aged 65 years and older and to assess the consistency of the results obtained with different screening tools. The research was conducted with 130 patients hospitalized between January and April 2023 at American Hospital. Valid and reliable nutrition screening tools NRS-2002 (Nuritional Risk Screening-2002), MUST (Malnutrition Universal Screening Tool) and MNA-SF (Mini Nutritional Assesment-Short Form) were used to determine the malnutrition status of the patients. Data were collected through a data collection form, including medical history and socio-economic status. According to NRS-2002, 51.5% of the patients were at nutrition risk; according to MUST, 33.1% had a high malnutrition risk; according to MNA-SF, 39.2% were malnourished, and 40% were at malnutrition risk. The results of all three screening tests identified patients in the groups undergoing tumour surgeries and those with gastrointestinal system cancer as being at risk for malnutrition. We found a significant consistency between NRS-2002, MUST as well as MNA-SF ($p < 0.001$). It can be concluded that malnutrition risk is high in geriatric patients, and all three tests are usable to detect malnutrition in patients aged 65 and older who are hospitalized.

Keywords: Malnutrition, Geriatrics, NRS-2002, MUST, MNA-SF.

ÖZET

Özyalçın, D. (2024). Geriatrik Hasta Grubunda Farklı Tarama Araçları Kullanarak Malnütrisyonun Saptanması: Kesitsel Bir Çalışma. Yeditepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Beslenme ve Diyetetik Anabilim Dalı, Yüksek Lisans Tezi. İstanbul

Bu kesitsel çalışma, 65 yaş ve üzerinde olan geriatrik yaş grubunda , farklı branşlarda hastane yatışı bulunan geriatrik hastalarda malnütrisyonu saptamak ve bu tarama araçları ile elde edilen sonuçların tutarlılığını değerlendirmeyi amaçlamıştır. Hastaların malnütrisyon durumunu saptamak için, geçerliliği ve güvenirliliği olan NRS-2002 (Nütrisyonel Risk Skoru 2002), MUST (Malnütrisyon Universal Tarama Aracı) ve MNA-SF (Mini Nütrisyonel Değerlendirme-Kısa Form) beslenme tarama araçları kullanılmıştır. Araştırma, Ocak-Nisan 2023 tarihleri arasında Amerikan Hastanesi'nde yatışı olan 130 hasta ile gerçekleştirilmiştir. Çalışmaya katılanların tamamından ek olarak veri toplama formu ile hastalık özgeçmişi ve sosyo-ekonomik durum bilgileri alınmıştır. NRS-2002'ye göre hastaların %51,5'inin nütrisyon riski altında olduğu ; MUST'a göre hastaların %33,1'inin yüksek malnütrisyon riskine sahip olduğu; MNA-SF'ye göre hastaların %39,2'sinin malnütrisyonlu olduğu ve %40'nın malnütrisyon riski altında olduğu saptanmıştır. Üç tarama testine göre de tümör cerrahileri, gastrointestinal sistem kanserleri hastalık gruplarındaki hastaların malnütrisyon riskinin bulunduğu saptanmıştır. NRS 2002, MUST ve MNA-SF testleri arasında istatistiksel olarak anlamlı tutarlık bulunmuştur ($p<0,001$). Geriatrik hastalarda malnütrisyon riskinin yüksek olduğu ve hastane yatışı olan, 65 yaş ve üzeri hastalarda malnütrisyonu saptamak için üç malnütrisyon tarama testinin de kullanılabilir olduğu söylenebilmektedir.

Anahtar Kelimeler: Malnütrisyon, Geriatri, NRS-2002, MUST, MNA-SF.

1. INTRODUCTION AND AIM

Malnutrition is a condition involving insufficient or excessive nutrient intake, imbalance, or impaired utilization, leading to undernutrition, overweight, obesity, and noncommunicable diseases (diet-related) (1). Undernutrition appears in four primary categories: stunting, wasting, underweight and deficiencies in micronutrients. In history, nations with low and moderate economic levels have seen a significant prevalence of undernutrition and micronutrient deficiencies, whereas high-income countries were more prone to overnutrition. However, these malnutrition-related issues are now found globally (2). Malnutrition affects individuals of all ages, from infants to the elderly. With advancements in medical care and an increasing number of older adults with multiple health conditions, the prevalence of disease-related malnutrition among patients who have multiple comorbidities has emerged as a burgeoning issue (2).

Malnutrition is a condition characterized by a lack of proper nutrition intake or absorption, resulting in changes to the body's composition such as a loss of fat-free mass and body-cell mass. This leads to diminished physical and mental function and negatively affects clinical results (3).

Disease-related malnutrition is a complex syndrome resulting from inadequate intake of nutrients that do not fulfill the patient’s physiological requirements and from the disease-related systemic inflammatory response (4).

Nutrition screening tools in hospitals are designed to alert healthcare professionals, such as nurses, of potential or actual malnutrition risks. A variety of such tools have been studied, leading to confusion and uncertainty regarding the most accurate one. To date, a universally accepted definition of malnutrition has not been established (5).

The ‘Malnutrition Universal Screening Tool (MUST)’ and ‘Nutrition Risk Screening 2002 (NRS-2002)’ are recommended by ‘ESPEN (European Society of Parenteral and Enteral Nutrition)’. ESPEN advises utilising the ‘Mini Nutritional Assessment (MNA)’, either in complete or shorter version ‘MNA-SF’, for older individuals (3).

Besides the ongoing uncertainty surrounding the optimal screening methods, the timely implementation of screening and accurate identification of nutritional status pose significant concerns. Inaccurate screening is linked to adverse outcomes, including heightened mortality rates, increased susceptibility to infections, delayed healing, prolonged hospitalization periods, and escalated healthcare expenses. (6).

The purpose of this cross-sectional study is to detect malnutrition using different screening tests in hospitalized geriatric patient groups and to evaluate the consistency of the results obtained with these screening tools.

2. LITERATURE REVIEW

2.1. Definition of Malnutrition

Malnutrition is often described as a condition when there is a lack of proper intake or absorption of essential nutrients, leading to alterations in body composition, such as a decline in fat-free mass and bodily-cell mass. These alterations may result in reduced physical and cognitive abilities and adversely affect clinical results (3). However, this particular definition of malnutrition is just one among several that may be found in scholarly works, which can lead to a significant amount of confusion and misunderstanding (7).

Although malnutrition has spread globally, there is still no universally agreed-upon definition for it. This is mainly due to the fact that the definition as well as diagnostic criteria for detection of malnutrition have evolved throughout time (8).

Malnutrition, as per the definition provided by ESPEN, refers to a state when there is an insufficient intake or absorption of nutrients, which causes alterations in body composition like a reduction in fat-free mass and body cell mass. This syndrome can result in diminished physical and mental capabilities, as well as compromised clinical results in patients with disorders (9). The ‘Academy of Nutrition and Dietetics (Academy)’ and the ‘American Society of Parenteral and Enteral Nutrition (ASPEN)’ propose criteria based on the cause of a disease that take into account the duration and intensity of the body's inflammatory response in cases of acute or chronic sickness or injury (10). Both ESPEN and ASPEN have detailed equivalent criteria for diagnosing malnutrition, albeit they use distinct clinical signs. (10). According to the ESPEN recommendations, those who are at malnutrition risk identification should be conducted using validated screening tool criteria, then evaluated and treated accordingly. Two options were suggested for diagnosing malnutrition: a body mass index (BMI) below 18.5 kg/m² or a the term "unintentional weight loss" refers to a reduction in body weight that exceeds 10% of an individual's usual weight, regardless of time, or a loss of more than 5% over three months) along with either a reduced BMI (below 20 kg/m² for patients under 70 years old, or below 22 kg/m² for patients over 70 years old), or a low fat-free mass index (FFMI) below 17 kg/m² for males and below 15 kg/m² for females (11). ASPEN outlines six criteria for diagnosing malnutrition, with a minimum requirement of two criteria. The parameters under consideration include: decreasing intake of energy, reduction

in body weight, decrease in muscle mass, depletion of subcutaneous fat, diminished handgrip strength.and fluid retention (12).

To promote worldwide consistency in diagnosing malnutrition and to avoid any delays in diagnosis and treatment, several clinical nutrition organizations collaborated to create the GLIM criteria under the framework of the "Global Nutrition Leadership Initiative on Malnutrition (GLIM)" in 2019 (13).

GLIM suggests a two-step method. After identifying high-risk patients using a validated screening test in primary care, a second-stage technique has been proposed for diagnosing and grading the severity of malnutrition. During the second stage, it is advisable to assess patients for involuntary weight loss, low BMI, declined muscle mass, diminished food intake and digestion, as well as the extent of the disease/inflammation. Within these parameters, the proportion of loss of weight, low BMI, and decreased muscle mass are considered as phenotypic indicators, whereas decreased intake of food and digestion, as well as the severity of disease/inflammation state, are regarded as etiological factors. As stated by GLIM, a definitive diagnosis of malnutrition necessitates a combination of minimum one phenotypic criterion and one etiological characteristic (13).

2.2. Etiology of Malnutrition

The occurrence of malnutrition in older individuals is the result of a complicated and multifaceted genesis. Multiple factors, including lifestyle choices, diseases, and the natural aging process, are involved, and it is usual for these factors to interact with each other (14). Understanding risk factors is crucial for properly addressing malnutrition. However, the intricate origins of malnutrition remain incompletely comprehended (14).

In developed nations, disease is a prominent factor contributing to the development of malnutrition, with its occurrence being both sudden and progressive. Age is an inherent, unchangeable risk factor for malnutrition. Physiological changes associated with aging may progressively increase a person's susceptibility to malnutrition. These alterations encompass compromised taste and smell, reduced stomach flexibility and lower appetite. As individuals

get older, the likelihood of developing diseases increases significantly, which in turn greatly increases the possibility of worsening nutritional problems (14).

2.2.1. Modifiable Determinants of Malnutrition

Latest studies have focused on finding modifiable risk factors linked to clinical malnutrition (14). Addressing these factors is crucial for preventing and managing malnutrition. The latest meta-analysis explored the factors leading to malnutrition and highlighted marital status, hospital stays, and physical limitations as the primary predictors (15). In addition, some other systematic review assessed the level of evidence for thirty characteristics that might possibly be modified and are associated with malnutrition. However, it highlighted the lack of strong evidence for most of these factors, highlighting the need for well-designed prospective investigations of high quality(16).

2.2.2. Age-Associated Changes as Risk Factors

Variables which is physiological that might lead to malnutrition in older individuals include sensory deficits such as loss of taste or smell, slower gastric emptying, and changes in gastrointestinal motility, which can impair the functioning of the aging digestive system (17). The process of aging is directly associated with a rise in the time it takes for food to pass through the colon, an increase in the permeability of the intestines, and resulting changes in the composition of the intestinal microbiota. These changes involve a decrease in biodiversity, a rise in opportunistic infections, and a parallel decline in species linked with health, particularly those that synthesize short-chain fatty acids (18).

Recent studies have found that alterations in the microbiota are linked to the occurrence of appetite loss and frailty, which can worsen malnutrition (19). Nevertheless, additional research is need to completely clarify this relationship. Additionally, there is a reduction in gastrointestinal hormones like ghrelin, along with simultaneous negative alterations in anorectic signaling molecules such as neuropeptide Y, cholecystokinin (CCK). peptide YY (PYY), leptin, orexin A. These changes result in disrupted control of appetite in older individuals (20).

Undoubtedly, ghrelin serves as the main peptide responsible for stimulating hunger, whereas hormones like PYY and CCK have crucial duties in regulating the feeling of fullness. Peripheral hormones originating from the gut, combined with systemic levels of insulin,glucose, and fatty acids, collectively modulate appetite and hunger senses in the hypothalamus through a mechanism of feedback (20).

Moreover, diminished olfactory and gustatory abilities affect the system of reward in the central nervous system (CNS). As a consequence, individuals may find themselves unable to derive the same pleasure from flavorful foods (21). This impairment may ultimately result in a subsequent decrease in nutritional consumption.

Pathway dysregulations can be caused by the persistent increase in inflammation that is commonly noticed in older individuals. This is because raised levels of certain cytokines, like that interleukin-1 beta (IL-1β) also tumor necrosis factor alpha (TNF-α) can impact the regions in the central nervous system that regulate hunger (22). The condition of reduced appetite and feeling full quickly observed in older individuals is referred to as "anorexia of aging." This condition results in inadequate food consumption and increases the likelihood of both quantitative and qualitative malnutrition (23). Ageing itself is a predictable risk factor for anorexia in healthy elderly persons. Moreover, older persons commonly experience body weight dissatisfaction, which can result in intense dieting, loss of weight as well as eating disorders. This has been investigated as a potential cause of appetite decrease (24).

In the end, 'anorexia of aging' has been suggested as a distinct geriatric condition with significant and autonomous implications for the nutritional and functional status of elderly individuals (25).

There has been an increasing emphasis on regulating postprandial processes in older adults, specifically in relation to muscle protein synthesis. Studies have shown that the muscle protein synthesis response to dietary protein intake is reduced in elderly individuals after a meal (26), while the baseline muscle protein synthesis remains unaffected (27).

Furthermore, the diminished protein balance response to hyperinsulinemia in elderly individuals suggests a state of insulin resistance in protein metabolism. Anabolic resistance is a diminished ability of muscles to react to anabolic stimuli, such as protein intake and

resistance training, which is commonly observed in older individuals. This phenomenon is believed to contribute to the gradual development of sarcopenia (28).

Recent studies have also concentrated on the modulation of metabolic markers after a meal (postprandial). Researchers have conducted extensive research on the dynamics of postprandial insulin and glucose as a function of age (29). However, more recent research has also demonstrated modifications in the postprandial dynamics of 'fibroblast growth factor 21 (FGF21)' that are particular to different age groups, with older adults showing significantly higher values compared to younger adults (30). FGF21 has a crucial role in controlling glucose and lipid metabolism, acting as an important metabolic factor. Paradoxically, higher levels of this substance in older individuals have been linked to a greater risk of death and have been found to contribute to the decline of muscle and bone density. Additionally, it has been implicated in the development of cachexia anorexia syndrome in elderly people who are hospitalized (31). The modified control of FGF21 after a meal may help to explain the elevated readings. Furthermore, levels of adiponectin, which is a mediator of FGF21 functions, rise as individuals get older and are also linked to overall mortality in older people (32). Once again, researchers have discovered alterations in the way adiponectin responds after a meal in older individuals. These changes are positively associated with the reaction of FGF21 hormone (33).

Alterations in appetite regulation and postprandial metabolism in older individuals are associated with progressive modifications, as opposed to disease related processes, like catabolism, which can result in accelerated loss of weight and malnutrition. These alterations may not necessarily result in obvious malnutrition, however they might worsen existing nutritional problems and contribute to nutritional deficiencies (14).

2.2.3. Inflammaging as a Risk Factor for Malnutrition

Reactions to inflammation are normally self-limiting, carefully regulated, and desired under physiological conditions. Nevertheless, persistent inflammation has enduring detrimental impacts on the entire system. Emerging research suggests that the process of aging is associated by consistently increasing levels of inflammation, albeit to a small extent. The occurrence of sterile and quiet inflammation in aged individuals is commonly known as "inflammaging"(34). Inflammaging is a chronic state of low-level inflammation that is defined by elevated concentrations of pro-inflammatory markers and an imbalance in the cytokine network. Although the exact processes are not fully understood, this condition persists over time (34).

The crucial role of inflammation in initiating several age-related illnesses is generally acknowledged (14). Examples of conditions that can be associated with inflammation include Alzheimer's Disease (referred to as "neuroinflammation"), cardiovascular events, coronary artery disease, type 2 diabetes mellitus (referred to as "metaflammation"), (osteo) sarcopenia, frailty and also cancer. Thus, there is a significant possibility that inflammaging also has a role in causing a compromised nutritional state (41). However, further research is required to investigate this association. Elevated levels of pro-inflammatory cytokines in elderly adults have been linked to the development of cachexia, sometimes known as "geriatric cachexia" (42).

Cachexia is a well-documented condition characterized by inflammation and substantial loss of skeletal muscle mass as well as functioning (43). Inflammatory mechanisms directly facilitate the degradation of muscle protein through the activation of pro-inflammatory cytokines, including TNF-α, IL-6, and IL-1β. These molecules called cytokines boost the ubiquitin-proteasome signaling pathway, which promotes protein degradation, while also suppressing anabolic pathways (44). Moreover, the presence of inflammatory and associated immunological mechanisms in older adults is evidently linked to a heightened vulnerability to malnutrition, as demonstrated through evaluations such as the MNA (45).

The etiology of malnutrition is multifaceted, and various risk factors might contribute to or worsen its development, as shown in Figure 2.1. (2). It is crucial to have a deeper understanding of age-related alterations that affect the intake, absorption, digestion, and metabolism of nutrients. However, it is sometimes challenging to identify or alter many of these aspects. However, it is crucial to take these into account when assessing the risk of malnutrition and developing treatment options (14).

2.3. Pathogenesis of Malnutrition

Malnutrition can result from various circumstances, either alone or in combination. These factors include famine, diseases such as polypharmacy, impaired nutrient intake or absorption and disease-related inflammatory processes. Additionally, muscle wasting due to immobility (46) and older age or social isolation can also contribute to malnutrition (47).

The development of malnutrition, which is disease-related, is typically a complex process. However, both of chronic and acute inflammation have been identified as significant variables that contribute to a decrease in appetite, resulting in lower consumption of energy and protein (2). Endocrine alterations as well result in catabolism immobility and fatigue. (figure 2.1.)(2). Cytokines like tumor necrosis factor α (TNFα) and interleukin-6 (IL-6) influence the neural circuits responsible for regulating food intake, delay stomach emptying, and effect skeletal muscle catabolism. Both acute as well as chronic disorders can affect many endocrine systems, leading to catabolism. This involves an elevation in cortisol levels, inhibition of sex hormones, and resistance in peripheral tissues to growth hormone. Cytokines regulate the response of the ‘hypothalamic-pituitary-adrenal (HPA) axis’ and promote the secretion of stress hormones like cortisol and catecholamines. These substances, subsequently, intensify muscle breakdown (49). Incretin hormones, including glucagon-like peptide-1 (pro-glucagon ; GLP-1.), have a direct impact on malnutrition as they are released from the tissues of the gastrointestinal tract. There is evidence of interaction betwixt inflammatory cytokines, (notably IL-1β and IL-6) and GLP-1 and its analogues, resulting in reduced food intake and unintended weight loss. (50).

Moreover, illness-related factors like gastrointestinal dysfunction, caregiving challenges, and concerns regarding complications associated to feeding, like for example ; a risk of aspiration for enteral nutrition and sepsis risk for parenteral nutrition can exacerbate the persistent issue of chronic underfeeding (51). Patients who are hospitalized face the added challenges of acute illness, inflammation, immobility, and variations in the quality of hospital meals. Each of these factors can lead to the development of malnutrition (2).

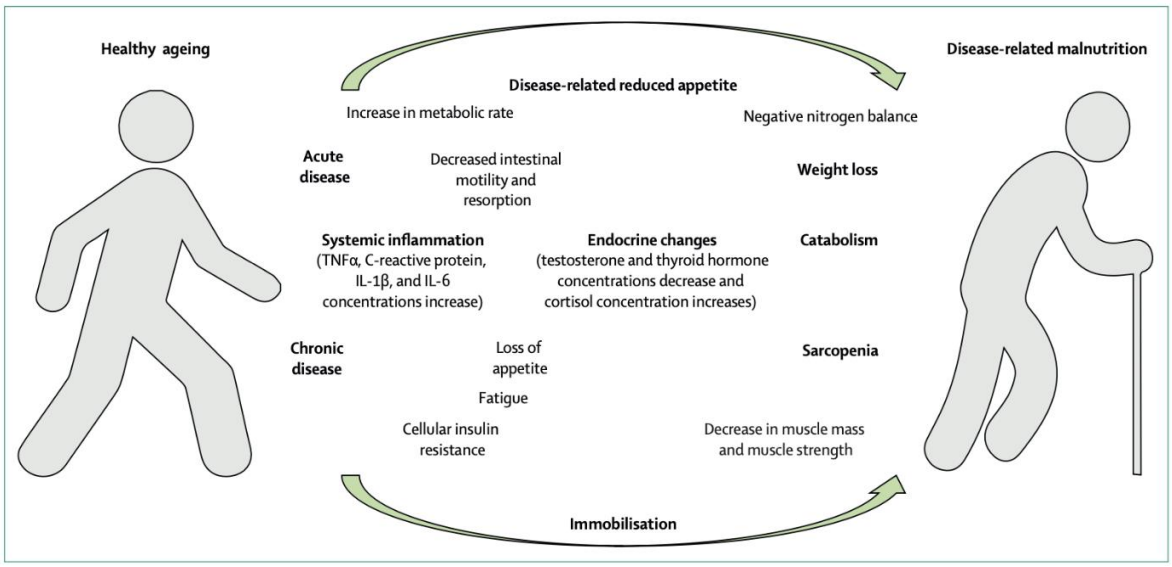

Figure 2.1. Pathophysiology of malnutrition (2)

The forms of malnutrition that are based on the causes of malnutrition are subcategories of the general diagnosis of malnutrition. Subcategories of malnutrition are essential for understanding the associated difficulties and for developing treatment strategies (3).

2.3.1. Disease-related Malnutrition (DRM) caused by Inflammation

Malnutrition is triggered by inflammation in chronic wasting diseases, like a heart failure also chronic renal failure, chronic obstructive pulmonary disease is a natural reaction. In these diseases, there is a significant increase in chronic inflammatory cytokines that are related to the disease (3). Chronic low-grade inflammation, driven by proinflammatory

cytokines like TNFα, C-reactive protein (CRP), IL-6, IL-1β, exerts detrimental effects on neural centers responsible for regulating appetite. These cytokines have a negative effect on appetite by stimulating the breakdown of skeletal muscle, slowing down the emptying of the stomach, and interfering with the activity of hormones that control appetite (2). Cancer cachexia is a severe manifestation of this range (3).

2.3.2. Disease-related Malnutrition (DRM) without Inflammation

Non-inflammatory malnutrition related to disease in elderly people can arise from illnesses that limit their ability to eat and swallow, like ischemic stroke, Parkinson's disorder as well as dementia. Anorexia of aging is a condition in which older persons experience weight loss due to insufficient appetite and food consumption. This can be attributed to non-inflammatory physiological changes (3). Physiological alterations include reduced sensory function (such as taste, smell as well as vision), difficulties with swallowing, skeletal muscle mass loss, heightened fat mass, alterations in endocrine function (For example, there is a impaired insulin action and reduction in the production of 'acylated ghrelin' by the stomach), and an increase in appetite-suppressing hormones like leptin, GLP-1 and CCK (52).

2.3.2. Malnutrition without Disease

Non-disease-related malnutrition, also known as malnutrition without disease, can be categorized into two types. The first type is hunger-related malnutrition, which is caused by a lack of food availability. This type of malnutrition is particularly widespread during pandemics or climatic occurrences like drought or wildfires. The second type is malnutrition caused by socioeconomic or as psychological factors, such as economic difficulties, social isolation, marginalization, cultural factors, food behaviors, insufficient knowledge about food and limited access to food (53).

2.4. Prevalence of Malnutrition in Hospital Setting

All age categories, from children to the elderly, are affected by malnutrition with varying prevalence rates influenced by factors such as age, geographic region, socio-economic status, and specific conditions such as edentulism. The nutritional condition of hospitalised patients is highly dependent on the setting of care. Without a doubt, the malnutrition prevelance increases in direct correlation with the level of care intensity, as seen in Figure 2.2. (54).

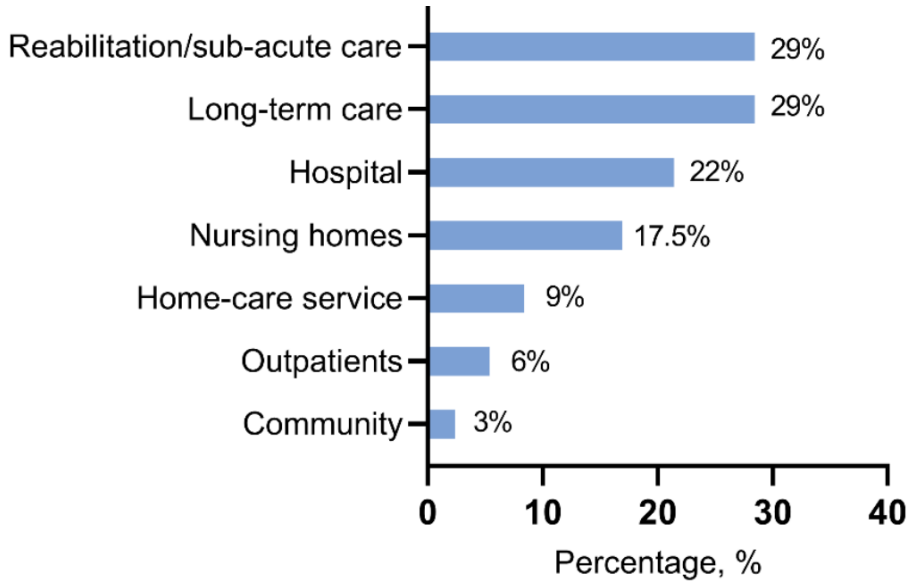

Figure 2.2. The distribution of malnutrition across different healthcare settings (54)

2.4.1 Prevalence of Malnutrition Based on the Setting of Care

Multiple studies have indicated that the prevalence of malnutrition in hospitalised patients varies between 20% - 50%, depending on the different tools for screening and diagnostic criteria used (55). Prevalence studies conducted in Turkey have revealed that a significant proportion of elderly individuals in various settings are either malnourished or at risk of malnutrition. Specifically, 13-28% of elderly individuals attending outpatient clinics or living in the community, 25–45% of elderly individuals admitted to hospitals, 20–60% of hospitalised elderly patients, and 30–70% of elderly residents in care facilities fall into this category (56). Geriatric people have a significantly higher frequency of poor nutritional condition in comparison to individuals who are younger, with rates of prevalence reaching

as high as 90% (57). A recent study found a malnutrition prevalence of 46% among hospitalized elderly patients. This was determined using the revised GLIM diagnostic criteria (54). Unexpectedly elderly people who are admitted to the hospital, there is a lack of concordance between how individuals perceive their own nutritional state and the actual objective measurement of their nutritional status (58).

Malnutrition acquired during hospitalization is prevalent among older adults. Several factors contribute to this, including disruptions to mealtimes, extended hospital stays (lasting more than 14 days), insufficient attention to the nutritional needs of older patients, medical procedures necessitating fasting, meal discontent and the effects of illness or treatment (59). Nevertheless, the overall standard of research carried out in both hospital and nursing home facilities is typically subpar, and there is a lack of evidence from long-term studies. Therefore, it is crucial to conduct large-scale, multicenter studies to investigate the risk factors in both hospital and nursing home environments (53).

2.5. Malnutrition Screening Tools for The Hospital Settings

The diagnostic procedure for detecting malnutrition employs a phased approach. Initially, nutritional screening is conducted to identify patients at high malnutrition risk. It is recommended by professional organizations to perform malnutrition screening within 24-48 hours of hospital admission and periodically thereafter. This practice aims to promptly and accurately identify patients who need a referral to a specialist for a thorough evaluation of their nutritional status and possible treatment (60). There are several different malnutrition screening tools that can be used to identify possible or present malnutrition when a patient is admitted to the hospital. These tools must possess a high level of usability in clinical settings, need little personnel training, and be suitable to all patients that are admitted. Nonetheless, conducting a comprehensive nutritional evaluation requires the expertise of proficient nutrition experts to determine whether a patient is afflicted with malnutrition or is at risk of it, as well as to ascertain the severity and underlying contributing factors (61).

It is crucial to uphold rigorous standards of validity, agreement along with reliability in malnutrition tools to precisely define the patients requiring treatment for malnutrition, without either under-referring or over-referring individuals (51).

When choosing a suitable screening tool, crucial to determine if the tool has undergone validation for the particular patient group (such as age as well as medical status) along with the specific location (such as hospital settings, institutional, or community setting) of interest (62).

Screening tools are used to quickly detect patients for the purpose of initiating nutritional treatment (62). The MNA, in both its long and short version, is the most extensively used and researched screening tool for older persons. Numerous screening measures have been developed specifically for this purpose, but the MNA stands out as the most prevalent (63). Nevertheless, the MNA's extensive coverage of various subjects has raised concerns about its specificity, as it is linked to a significant likelihood of "over-diagnosing" malnutrition in the elderly (63). One proposed solution to this problem is to supplement the MNA with the GLIM criterion (64).

2.5.1.Diagnostic Criteria for Disease-related Malnutrition and Nutritional Assessment

In the diagnostic procedure, the second stage entails using particular criteria to validate the malnutrition diagnosis in patients who are admitted to the hospital.The most recent iteration of these particular standards has been published by the GLIM. GLIM is a clear and direct method consisting of two stages to detect malnutrition related to illnesses. The initial phase entails doing a preliminary evaluation to identify individuals who are susceptible to malnutrition. Afterwards, a more thorough evaluation is conducted to detect malnutrition and ascertain its level of severity (65). GLIM was created with the purpose of ensuring a more precise malnutrition diagnosis, in contrast to the other approaches suggested before (66).

2.6. Nutritional Screening Tools

ESPEN recommends using NRS-2002 and MUST alongside the MNA for older adults. Both the full version of the MNA and its abbreviated form, MNA-SF, are applicable (3).

2.6.1 Nutritional Risk Screening (NRS)-2002

The NRS-2002 is a widely used nutritional risk screening tool in hospitals worldwide (67). Created by Kondrup et al., the NRS-2002 , is an effective tool used in hospital settings to accurately identify individuals who would get benefits from nutritional treatment (68). The NRS-2002 is a straightforward and rigorously tested tool that includes a preliminary evaluation with four specific inquiries. If any of these questions is answered affirmatively, a screening is conducted. This screening process follows that includes substitute measures of nutritional status, incorporating both static, dynamic parameters, along with information on the disease's severity (‘stress metabolism’). A final score ranging from 0 - 3 can be obtained for each parameter. Individuals who are 70 years of age or older are regarded to have a higher risk of certain conditions. This age group is assigned 1 point in the screening tool. If a patient's overall score is equal to or more than 3 points (≥3), it indicates that they are at potential malnutrition risk or currently malnourished. In such cases, it is necessary to provide nutritional intervention (61). The NRS-2002 has undergone extensive assessment and validation in multiple studies, involving randomised controlled trials, and has demonstrated high reliability when given by competent healthcare professionals (61).

2.6.2. Malnutrition Universal Screening Tool (MUST)

The MUST has been created to identify people with malnutrition in different care settings, including hospitals, nursing homes, and home care (61). The MUST is an accurate and reliable nutritional screening test suitable for all adult patients (69). Originally used in a community environment, this screening tool was created by the 'British Association for Parenteral and Enteral Nutrition (BAPEN)'. It was later expanded to include hospitalised patients. The assessment of overall risk for malnutrition involves three different parts: evaluation of current weight status using BMI, assessment of unintentional loss of weight, and consideration of the impact of acute illness resulting in no nutritional intake for a five-day period (69).

2.6.3. Mini Nutritional Assessment Short Form (MNA-SF)

In 2009, the MNA-SF was confirmed as a separate screening tool, with the whole MNA serving as the basis for it (70). The MNA-SF provides an easy and efficient approach for identifying older adults those at malnutrition risk or already experiencing malnutrition (malnourished) . The MNA-SF, created by Nestlé in partnership with renowned geriatricians, is a well known screening tool for the elderly that has been validated (71). This screening tool can be administered at regular intervals both in community and healthcare settings, including hospitals and long-term care facilities. It is advisable to do MNA-SF assessments on a yearly basis in community settings and each three months in hospital or long-term care settings, or if there is an a change in the patient's clinical status (71). It has undergone thorough validation in international studies across several settings and shows a strong correlation with morbidity and mortality outcomes (72).

2.7. Management of Malnutrition in Hospital

Although malnutrition is widespread, the giving of nutritional treatment is insufficient, and preventive actions are frequently not implemented (73). According to recent survey data, 58% of the nursing personnel and 40% of the medical personnel are not capable of diagnosing malnutrition. The primary measures for preventing and managing malnutrition in hospitalised patients are early detection and consequent implementation of a multidisciplinary strategy (74).

The ESPEN recommendations for the management of malnutrition provide a range of intervention options for preventing or treating malnutrition. These techniques depend on broad suggestions, such as screening for malnutrition, providing supportive intervention, providing nutritional counseling, modifying meals, and giving oral food supplements. More severe cases may require enteral and parenteral nutrition (75). This is shown in figure 2.3. (75).

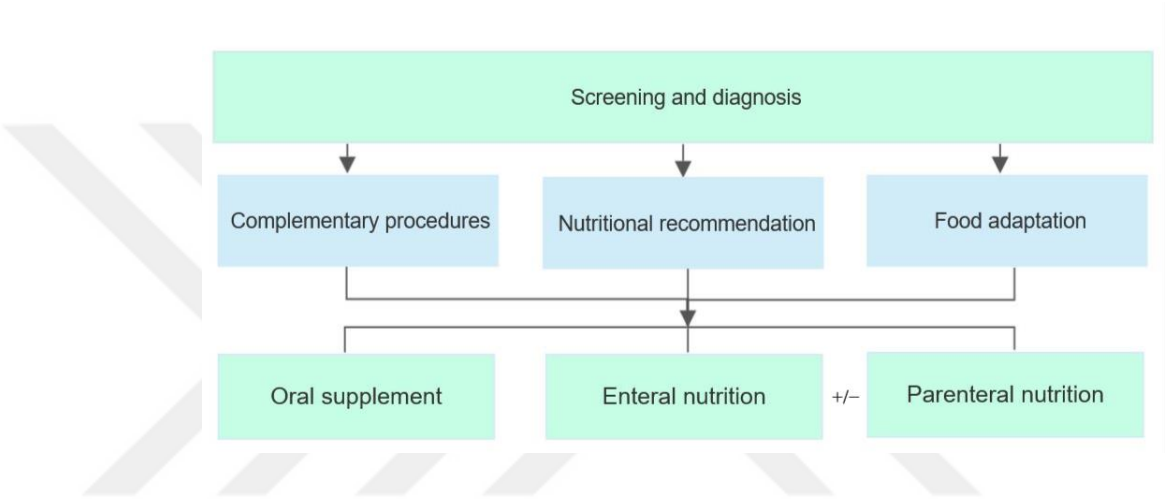

Figure 2.3. Management of malnutrition in patients admitted to the hospital (75)

2.8. Macro and Micronutrient Requirements in Older Patients

As people age, their resting energy expenditure (REE) typically declines, largely because of the loss of fat-free body mass. Studies on both healthy and ill elderly individuals have shown that REE averages approximately 20 kcal/kg of body weight per day. Taking into account standard levels of physical activity, which usually range from 1.2 to 1.8, the total energy expenditure is estimated to be between 24 and 36 kcal/kg. Sex and nutritional condition have a significant impact on basal energy needs due to their closely associated with lean mass. Specifically, the REE/kg BW is greater in males compared to women and it increases when the BMI lowers. The estimated energy requirements for elderly persons with a BMI of 21 kg/m² or below are between 32 and 38 kcal/per kg (75).

Among older adults who are ill, energy needs may be decreased as a result of less physical activity, but may also be increased due to the consequences of the disease (such as

inflammation, fever, and medication side effects). The minimal energy needs for older individuals who are ill are estimated to be between 27 and 30 kilocalories per kilogramme of body weight. Monitoring body weight closely, while considering factors such as water retention or losses, is crucial to ensuring the adequacy of energy intake and adjusting intake accordingly (75).

Increasing data from both clinical and epidemiological investigations indicates that older adults may necessitate higher quantities of protein in order to effectively maintain their lean body mass, bodily function, and overall well-being in comparison to younger ones. (76). Protein requirements may be increased in the presence of illness, such as inflammation, infections, and injuries. Nevertheless, it is challenging to determine the exact extent of this increase (76).

For older individuals with acute or chronic illnesses, it has been recommended to consume daily protein amounts ranging from 1.2 to 1.5 g/kg. Severe illness, injury, or malnutrition can elevate the recommended daily intake to 2.0 g/kg of body weight for each day (76).

Without more data, it is imperative to guarantee that elderly individuals, especially those who are more susceptible to malnutrition, such as frail and multimorbid individuals, consume a minimum of 1.0 g/kg of protein. These individuals often do not meet this level of consumption (77).

It is crucial to remember that protein requirements are increased by an insufficient energy intake. Therefore, it is crucial to guarantee both sufficient protein consumption and a suitable intake of energy when assessing protein status (75).

‘The European Food Safety Authority (EFSA)’ performed a comprehensive analysis of published works and proposed an appropriate amount of water intake, known as the Adequate Intake (AI), which is 2.5 litres per day for men and 2.0 litres per day for women, regardless of age. This water can be obtained via a combination of drinking water, beverages, and food sources (78). The individual's fluid requirements are influenced by factors such as energy expenditure, water excretion, and renal function. Consequently, individuals with larger body sizes may necessitate a greater amount of fluid. Needs may also be heightened

under circumstances of extreme heat (such as summer heat) or during times of intensified physical activity. Additional intake is necessary to counterbalance excessive losses caused by fever, diarrhea, vomiting, or severe bleeding (75).

The dietary guidelines for micronutrients in old people are identical to those for young adults. However, our understanding of the specific nutritional needs for extremely old, fragile, or unwell individuals is limited (75). As gastrointestinal diseases become more common, older individuals have a greater susceptibility to experiencing deficits in essential nutrients. These deficiencies are often caused by conditions such as atrophic gastritis and impaired absorption of vitamins B12, Ca (calcium) and Fe (iron). To address this issue, it is recommended that older individuals take supplements to correct these micronutrient deficiencies (75). If there are no particular deficiencies, it is recommended to provide micronutrients to healthy older individuals based on the guidelines set by the EFSA or the relevant national nutrition organisations (78). Additionally, patients receiving enteral or parenteral nutrition are highly susceptible to micronutrient deficiencies and subsequent malnutrition if meal replacements are not adequately supplemented (79).

2.9. The Current Topics in The Nutrition of Elderly Patients

Additional investigation is needed to explore innovative methods to the treatment and prevention of malnutrition in elderly individuals. These methods include the inclusion of supplementary micronutrients, dietary fibre and nutrients which is anti-inflammatory, alongside the conventional higher protein or energy strategy. These techniques encompass the Mediterranean diet, dietary patterns that enhance the microbiome, supplementation of omega-3 fatty acids, plant-based protein sources, products high in fibre, probiotics, and individualised medicine guided by biomarkers (80). Currently, there are several appetite stimulants available for the treatment of malnutrition in elderly people. Nevertheless, it is crucial to acknowledge that none of these stimulants have received formal approval for usage in older individuals as of today (53).

2.9.1. Effect of Nutritional Interventions in Hospitals

Meta-analysis and systemic review demonstrated that providing nutritional support was linked to a substantial drop of up to 53% in the rate of mortality and a 27% decline in the average mortality risk (81). Patients who were provided with nutritional assistance had significant decreases in non-elective hospital readmissions, as well as improvements in protein/energy consumption and gaining weight. Nevertheless, no notable disparities were detected in rates of infection, functional results, or length of hospital stay (LOS) (81). Subsequent investigations revealed that implementing nutritional treatments resulted in a decline of 25% in LOS ; 35.7% decrease in infection rates among hospitalised patients who were malnourished or at malnutrition risk (82).

A meta-analysis has demonstrated that giving oral nutritional supplements to elderly patients during and after their hospitalisation resulted in a 16% reduction in hospital readmissions (83).

3. MATERIALS AND METHODS

3.1. Participants

The cross-sectional research was carried out with 130 voluntary patients who were hospitalized at American Hospital between January 2023 - April 2023 were getting involved in the study after the ethical approval from the Koç University Clinical Research Ethics Committee (No : 2022.401.IRB1.152) (appendix 1).

We aimed to reach the entire population of 150 individuals; however, those with edema, ascites, and those who refused to participate were excluded, resulting in a final sample size of 130 participants.

3.2. General Plan of The Research

Elderly adult patients (≥65 years of age) with a written consent form at the time of hospitalization were evaluated in the study. This study used a cross-sectional design and included individuals who were hospitalised throughout different departments including oncology, gastrointestinal surgery, orthopedics, neurology, hematology.

Within 24 hours after hospitalization, malnutrition status was determined with the NRS-2002, MUST, as well as MNA-SF screening tools. The NRS-2002, derived from an examination of 128 research, aims to identify patients who are malnourished and have a high probability of benefiting from nutritional treatment. The process starts with an initial stage comprising of four unique inquiries. The overall score is determined from the combination of the nutritional assessment and the severity of the illness. In patients who are 70 years or older, an additional point is added (+1), taking into account their age. The NRS score below 3 signifies an absence of malnutrition risk, whereas an NRS value of 3 or more indicates a significant risk or presence of malnutrition, necessitating nutritional intervention (67). The NRS-2002 has undergone evaluation and validation in several investigations, which included randomised controlled trials, and has demonstrated its reliability. When compared to the diagnosis of malnutrition specialists (84), the suggested by ESPEN screening tool for

hospitalised patients (60) is quite sensitive and specific. MUST screening tool was created by the BAPEN (85). The screening tool classifies patients into various levels of malnutrition risk based on their BMI, presence of involuntary weight loss during the last 3-6 months, and patients who are acutely ill and have had or are expected to have no nutritional intake for more than 5 days. Patients with a low risk are assigned 0 points, those with a medium risk are assigned 1 point, and those with a high risk are assigned 2 or more points (85). MUST is a widely used screening tool for all categories of patients admitted to the hospital (86) and its reliability is almost identical to that of the MNA in detecting nutritional risk among geriatric populations (87). MNA-SF is the abbreviated version of the MNA that has been used in nutritional screening. A nutritional assessment is conducted using the full form. In comparison to the complete form of the MNA and conventional nutritional assessment, this concise form comprises six components that exhibit the highest degree of specificity, sensitivity, and consistency. Consequently, it is more efficient and straightforward to execute than the complete version. It encompasses the presence of acute illness, neuropsychological stress, BMI, ability to move, consumption of food issues, and a loss in body weight. The patient is either malnourished (below 7 points) or at risk of malnutrition if the cumulative score is 11 points or less (8-11 points) out of a total of 14 points (88). It is capable of predicting functional decline, is associated with poor clinical outcomes, and is a beneficial screening tool for elderly (89).

NRS-2002, MUST and MNA-SF nutritional screening tools, which are valid and reliable, utilised to ascertain the patients malnutrition status. These screening tools only include verbal questions to determine nutritional status such as height, body weight, appetite status, and weight loss. In addition, information questioning demographic characteristics such as age, diagnosis, gender, educational status, socio-economic status was collected.

Inclusion Criteria

1- Conscious patients who provide verbal and written voluntary consent

2- Patients aged 65 years and older

Exclusion Criteria

1-Patients who do not have verbal or written voluntary consent

2-Patients under the age of 65

3- Patients who are not conscious

4- Patients with excess edema and ascites

The study encompassed 130 patients aged 65 years and older who had acquired a variety of diseases. 13 patients could not be included in the study due to the presence of edema and ascites, 5 patients rejected to participate in the study, and 2 patients were not conscious and did not have a companion.

2 out of 130 patients lived in a nursing home, they were not included in the comparative statistics.

Patients in an economic situation lower than their income and expenses were excluded from the comparative statistics due to their low numbers.

3.3. Statistical Analysis

Statistical analyses were conducted using the SPSS package programme (IBM SPSS Statistics 27). The data were analysed with frequency tables and descriptive statistics.

Parametric methods were utilised to measure values that conform to a normal distribution. The measurement data of three or more independent groups were compared using the "ANOVA" test, which is based on parametric approaches and utilises the F-table value. Tamhane pairwise comparison was used to compare variables between three or more groups, considering the non-homogeneity of the variances.

Non-parametric methods were utilised to analyse measurement results that did not adhere to a normal distribution. The measurement values of two separate groups were compared using the "Mann-Whitney U" (Z-table value) test, which is a non-parametric

method. The comparison of measurement values of three or more independent groups was done using the "Kruskal-Wallis H" test, which is also a non-parametric method.

"The Bonferroni correction" was utilised to conduct pairwise comparisons across variables that exhibited significant differences among three or more groups.

"Spearman" correlation coefficient was employed to analyse the associations between two quantitative variables that lack a normal distribution.

The level of internal consistency (reliability) will be determined by item-total correlations and Cronbach's Alpha coefficients. All statistical test were conducted with the confidence interval 95% and p values below 0.05 were considered as significant.

4. RESULTS

The mean age of the individuals included in the study was determined to be 76.88±8.33 years, with 51 individuals (39.3%) identified as being in the ≥80 age group. Out of the participants, 67 individuals (51.5%) were men, 73 individuals (56.2%) had a university or higher education level, 75 individuals (57.7%) had an income exceeding their expenses, and 70 individuals (53.8%) lived with their spouses. Additionally, 38 individuals (29.2%) had diagnoses of other cancers, and 78 individuals (60.0%) had a medical history of metabolic diseases (Table 4.1).

Table 4.1. Distribution of Descriptive Characteristics Related to the Study

Variable (n=130)	**n**	**%**
Age [$\bar{X} \pm$ S.D.→76.88±8.33 (year)]		
<70	32	24.6
70-74	28	21.5
75-79	19	14.6
≥80	51	39.3
Sex		
Women	63	48.5
Men	67	51.5
Education Level		
Literate-Primary School	13	10.0
High-school	44	33.8
University/Higher Education	73	56.2
Income Level		
Income equals expenses	53	40.8
Income exceeds expenses	75	57.7
Income falls short of expenses	2	1.5
Living Situation		
With family	20	15.5
With spouse	70	53.8
Alone	10	7.7
With caregiver	28	21.5
Other	2	1.5
Diagnosis		
All surgeries	17	13.1
Tumor surgeries	11	8.5
Gastrointestinal system cancers	18	13.8
Other cancers*	38	29.2
Respiratory diseases	24	18.5
Other diseases**	22	16.9
Medical History		
Metabolic Diseases (HT, DM)	78	60.0
Chest diseases	14	10.8
Neurological-psychiatric diseases	13	10.0

Oncological-hematological diseases	31	23.8
Surgical group	44	33.8
Cardiovascular diseases	32	24.6

*Other cancers : lung cancer, peritoneal neoplasm, soft tissue sarcoma, kidney cancer, head and neck cancers, hematologic cancers, breast cancer, endometrial cancer, prostate cancer.

** Other diseases : İleus, syncope, urinary infection, gastrointestinal hemorrhage, intracerebral hemorrhage, atrial fibrillation.

The descriptive findings regarding individuals' NRS 2002, MNA-SF, and MUST values are presented in the Table 4.2.

Table 4.2. Descriptive Statistics for NRS 2002, MNA-SF, and MUST Values

Scale (n=130)	**Mean**	**Standart Deviation**	**Median**	**Minumum**	**Maksimum**
NRS-2002	2.68	1.36	3.0	0.0	6.0
MNA-SF	8.53	3.20	9.0	1.0	14.0
MUST	1.16	1.47	0.5	0.0	6.0

According to the findings, the comparison of NRS 2002, MNA-SF, and MUST scores is shown in Table 4.3.

Table 4.3. Distribution of Scoring Categories

Variable (N=130)	**n**	**%**
NRS-2002		
Not Malnourished	63	48.5
Malnourished	67	51.5
MNA-SF		
Malnourished	51	39.2
At risk of malnutrition	52	40.0
Normal	27	20.8
MUST		
Not at risk	65	50.0
Moderate risk	22	16.9
High risk	43	33.1

The NRS-2002 categories, age categories, and sex did not exhibit any statistically significant correlations ($p>0.05$).

A statistically substantial relationship was found between NRS-2002 categories and the diagnosis of diseases ($p<0.05$). It was determined that 15 individuals (23.8%) without malnutrition were mostly in the all surgeries group, while 22 individuals (32.8%) with malnutrition were mostly in the other cancers group. It was observed that individuals with diagnoses of all surgeries and respiratory diseases were predominantly not malnourished, while those with diagnoses of tumor surgery, gastrointestinal system (GIS) cancers, and other cancers were predominantly malnourished (Table 4.4.).

Table 4.4. Examination of the Relationship between NRS-2002 Category and Age, Sex, and Diagnosis

NRS-2002	**Not Malnourished (n=63)**		**Malnourished (n=67)**		**Statistical analysis***
Variable (n=130)	**n**	**%**	**n**	**%**	**Probability**
Age					
<70	19	30.2	13	19.4	χ^2=2.111
70-74	13	20.6	15	22.4	p=0.550
75-79	8	12.7	11	16.4	
≥80	23	36.5	28	41.8	
Sex					
Women	33	52.4	30	44.8	χ^2=0.752
Men	30	47.6	37	55.2	p=0.386
Diagnosis					
All surgeries	15	23.8	2	3.0	
Tumor surgeries	2	3.2	9	13.5	χ^2=17.403
GIS cancers	6	9.5	12	17.9	**p=0.004**
Other cancers	16	25.4	22	32.8	
Respiratory diseases	13	20.6	11	16.4	
Other diseases	11	17.5	11	16.4	

*In the examination of the relationships between two categorical variables, "Pearson-χ2" cross-tabulations were utilized.

A statistically substantial correlation was identified between MUST categories and age groups ($p<0.05$). The reason for the substantial correlation between age groups in terms of MUST is that 45.5% of individuals in the <70 age group are at moderate risk.

Statistically, there is no substantial correlation between sex and MUST categories. ($p>0.05$).

A statistically substantial relationship was found between MUST categories and the diagnosis of diseases ($p<0.05$). According to the MUST parameter, individuals with the diagnosis of all surgeries, were not at risk, GIS cancers and other cancers were predominantly

at a moderate risk, and those with tumor surgery, respiratory diseases and other diseases were predominantly at high risk (Table 4.5.).

Table 4.5. Examination of the Relationship between MUST Category and Age, Sex and Diagnosis

MUST	**Low risk (n=65)**		**Medium risk (n=22)**		**High risk (n=43)**		**Statistical analysis***
Variable (n=130)	**n**	**%**	**n**	**%**	**n**	**%**	**Probability**
Age							
<70	15	23.1	10	45.5	7	16.3	χ^2=13.972
70-74	14	21.5	2	9.1	12	27.9	**p=0.030**
75-79	9	13.9	6	27.3	4	9.3	
≥80	27	41.5	4	18.1	20	46.5	
Sex							
Women	34	52.3	10	45.5	19	44.2	χ^2=0.779
Men	31	47.7	12	54.5	24	55.8	p=0.677
Diagnosis							
All surgeries	16	24.6	-	-	1	2.3	
Tumor surgeries	2	3.1	-	-	9	20.9	χ^2=51.978
GIS cancers	5	7.6	7	31.8	6	14.0	**p<0.001**
Other cancers	20	30.8	13	59.1	5	11.6	
Respiratory diseases	13	18.5	2	9.1	10	23.3	
Other diseases	10	15.4	-	-	12	27.9	

*In the examination of the relationship between two categorical variables, 'Pearson-χ2' cross-tabulations have been used.

There is no statistically significant correlation between MNA-SF categories and either age groups or sex. (p>0.05).

A statistically notable relationship was found between MNA-SF categories and the diagnosis of diseases (p<0.05). It was determined that 12 individuals (23.5%) with malnutrition were mostly in the respiratory diseases group, 19 individuals (36.5%) at risk were mostly in the other cancers group, and 8 individuals (29.6%) in the normal group were mostly in the all surgeries group. It was observed that individuals with the diagnosis of all surgeries were predominantly normal, while those with diagnoses of tumor surgery, gastrointestinal system (GIS) cancers, respiratory diseases, and other diseases were predominantly malnourished, and those with other cancers were predominantly at risk (Table 4.6.).

Table 4.6. The examination of the relationship between MNA-SF Category and Age, Sex, and Diagnosis

MNA-SF Variable (n=130)	**Malnourished (n=51)**		**At risk of malnutrition (n=52)**		**Normal nutritional status (n=27)**		**Statictical analysis* Probability**
	n	**%**	**n**	**%**	**n**	**%**	
Age							
<70	11	21.6	14	26.9	7	25.9	χ^2=3.011
70-74	12	23.5	8	15.4	8	29.6	p=0.807
75-79	7	13.7	8	15.4	4	14.9	
≥80	21	41.2	22	42.3	8	29.6	
Sex							
Women	24	47.1	27	51.9	12	44.4	χ^2=0.464
Men	27	52.9	25	48.1	15	55.6	p=0.793
Diagnosis							
All surgeries	2	3.9	7	13.5	8	29.6	
Tumor surgeries	7	13.7	3	5.8	1	3.8	χ^2=18.830
GIS cancers	10	19.6	5	9.6	3	11.1	**p=0.042**
Other cancers	10	19.6	19	36.5	9	33.3	
Respiratory diseases	12	23.5	9	17.3	3	11.1	
Other diseases	10	19.6	9	17.3	3	11.1	

* In the examination of the relationship between two categorical variables, 'Pearson-χ2' cross-tabulations have been used.

There is no statistically significant distinction in NRS 2002, MNA-SF, and MUST values across different age groups (p>0.05).

There is no significant statistical distinction in NRS 2002, MNA-SF, and MUST values based on sex (p>0.05).

There is no significant statistical distinction in NRS 2002, MNA-SF, and MUST values based on the education level (p>0.05) (Table 4.7.).

Table 4.7. Comparison of NRS 2002, MNA-SF, and MUST scores based on the findings

Variable (n=130)	n	NRS 2002		MNA-SF		MUST	
		$\bar{X} \pm S.D.$	Median [IQR]	$\bar{X} \pm S.D.$	Median [IQR]	$\bar{X} \pm S.D.$	Median [IQR]
Age							
<70	32	2.09±1.53	2.0[2.8]	8.41±3.19	8.5 [4.8]	1.09±1.57	1.0
70-74	28	3.10±1.52	3.0[2.8]	8.89±3.05	8.5 [5.8]	1.25±1.45	[1,0]
75-79	19	2.63±1.06	3.0[1.0]	9.21±2.66	10.0[5.0]	0.89±1.10	0.5
≥80	51	2.84±1.15	3.0[2.0]	8.15±3.49	8.0 [5.0]	1.25±1.56	[2.0]
							1.0
							[1.0]
							0.0
							[2.0]
Statistical analysis*		χ^2=5.907		F=0.646		χ^2=0.330	
Probability		p=0.116		p=0.587		p=0.954	
Sex							
Women	63	2.49±1.33	2.0	8.51±3.20	9.0 [5.0]	1.06±1.47	0.0
Men	67	2.87±1.38	[1.0]	8.55±3.22	8.0 [5.0]	1.25±1.48	[2.0]
			3.0				1.0
			[2.0]				[2.0]
Statistical analysis		Z=-1.505		Z=-0.033		Z=-0.886	
Probability		p=0.132		p=0.974		p=0.376	
Education level							
Primary school	13	2.61±0.86	3.0	9.61±2.63	11.0	1.07±1.38	0.0
High-school	44	2.61±1.35	[1.0]	8.55±3.44	[4.5]	1.00±1.47	[2.0]
University/Higher	73	2.74±1.45	2.0	8.32±3.14	9.0 [5.0]	1.27±1.49	0.0
Education			[1.8]		8.0 [5.0]		[2.0]
			3.0				1.0
			[2.0]				[2.0]
Statictical analysis		χ^2=0.385		χ^2=1.681		χ^2=1.712	
Probability		p=0.825		p=0.432		p=0.425	

*In comparing three or more independent groups with data following a normal distribution, ANOVA test (F-table value) statistics were used. For data not following a normal distribution, the Mann-Whitney U test, using the Z-table value, was employed to compare measurement values between two independent groups. On the other hand, the Kruskal-Wallis H test, using the χ2-table value, was utilised to compare measurement values among three or more independent groups.

The NRS 2002 scores showed a statistically significant difference according to income level classes (Z=-2.805; p=0.005). It was determined that individuals with higher income than expenses had significantly higher NRS 2002 scores compared to those with equal income and expenses. There was no statistically significant variation in MNA-SF and MUST scores based on income level categories (p>0.05).

A statistically notable distinction in NRS 2002 points was found according to the individuals' living situation (χ^2=8.178; p=0.042). In Bonferroni-corrected pairwise comparisons to determine the source of the significant difference, it was found that there was a significant difference between individuals living alone and those living with family, spouse, or caregiver. The NRS 2002 scores of those living with family, spouse, or caregiver were significantly higher than those living alone. There was no substantial distinction in MNA-SF scores based on the individuals' living situation. (p>0.05). There was a statistically notable variation in MUST scores based on the participants' living circumstances (χ^2=8.101; p=0.044). In Bonferroni-corrected pairwise comparisons, it was found that there was a significant difference between individuals living alone and those living with family, spouse, or caregiver. The MUST scores of those living with family, spouse, or caregiver were significantly higher than those living alone.

According to the disease diagnosis, there was a statistically substantial distinction in NRS 2002 scores (χ^2=25.626; p<0.001). Substantial distinctions were identified in pairwise comparisons using Bonferroni correction among all surgeries and tumor surgeries, gastrointestinal system cancers, other cancers, respiratory diseases, and other diseases. The NRS 2002 scores of individuals with diagnoses of tumor surgeries, gastrointestinal system cancers, other cancers, respiratory diseases, and other diseases were significantly higher than those with all surgeries. Similarly, significant differences were found between tumor surgeries and other cancers, respiratory diseases, and other diseases. The NRS 2002 scores

of individuals diagnosed with tumor surgeries were significantly higher than those diagnosed with other cancers.

There was a statistically significant distinction in MNA-SF scores based on the diagnosis of the disease (F=4.235; p=0.001.). Substantial distinctions were identified in pairwise comparisons using Bonferroni correction among all surgeries and tumor surgeries, gastrointestinal system cancers, respiratory diseases, and other diseases. MNA-SF scores of individuals with diagnoses of tumor surgeries, gastrointestinal system cancers, respiratory diseases, and other diseases were significantly lower than those with all surgeries.

MUST scores showed a statistically significant difference according to disease diagnosis (χ^2=22.041; p=0.001). Substantial distinctions were identified in pairwise comparisons using Bonferroni correction among all surgeries and tumor surgeries, gastrointestinal system cancers, other cancers, respiratory diseases, and other diseases. The MUST scores of individuals with diagnoses of tumor surgeries, gastrointestinal system cancers, other cancers, respiratory diseases, and other diseases were significantly higher than those with all surgeries. Similarly, substantial distinctions were identified between tumor surgeries and other cancers. The MUST scores of individuals diagnosed with tumor surgeries were significantly higher than those diagnosed with other cancers (Table 4.8).

Table 4.8. Comparison of NRS 2002, MNA-SF, and MUST scores based on the findings

Variable (n=130)	n	NRS 2002		MNA-SF		MUST	
		$\bar{X} \pm S.D.$	Median [IQR]	$\bar{X} \pm S.D.$	Median [IQR]	$\bar{X} \pm S.D.$	Median [IQR]
Income level							
Income=expenses	53	2.28±1.41	2.0[1.5]	9.22±3.30	9.0 [5.0]	0.88±1.31	0.0
Income >expenses	75	2.93±1.26	3.0[2.0]	8.13±3.06	8.0 [5.0]	1.28±1.51	[1.0]
							1.0
							[2.0]
Statictical analysis *		Z=-2.805		Z=-1.933		Z=-1.364	
Probability		**p=0.005**		p=0.053		p=0.173	
Living situation							
With family(1)	20	2.65±1.18	3.0	8.65±2.56	8.0 [4.0]	1.15±1.34	0.5
With spouse (2)	70	2.84±1.51	[1.0]	8.51±3.42	8.5 [6.0]	1.37±1.55	[2.0]
Alone (3)	10	1.60±1.07	3.0	10.50±2.17	10.5[3.5]	0.10±0.32	1.0
With caregiver (4)	28	2.71±1.08	[2.0]	7.82±3.27	8.0 [5.0]	1.07±1.51	[2.3]
			1.5				0.0
			[1.0]				[0.0]
			3.0				1.0
			[1.0]				[2.0]
Statictical analysis		χ^2=8.178		χ^2=5.007		χ^2=8.101	
Probability		**p=0.042**		p=0.171		**p=0.044**	
Difference		**[3-1.2.4]**				**[3-1.2.4]**	
Diagnosis							
All surgeries (1)	17	1.52±1.23	1.0	11.05±1.95	11.0	0.11±0.49	0.0
Tumor surgeries (2)	11	4.18±1.40	[1.0]	7.45±2.50	[2.5]	2.18±1.32	[0.0]
Gastrointestinal	18	3.00±1.18	4.0	8.17±2.61	7.0 [3.0]	1.22±1.11	2.0
system cancers(3)	38	2.71±1.28	[2.0]	9.18±3.00	7.0 [4.3]	0.81±1.29	[1.0]
Other cancers(4)	24	2.67±1.31	3.0	7.50±3.61	9.0 [4.3]	1.58±1.84	1.0
Respiratory diseases	22	2.54±1.01	[2.0]	7.41±3.50	7.5 [6.8]	1.54±1.62	[2.0]
(5)			2.0		8.0 [7.0]		0.5
Other diseases (6)			[1.3]				[1.0]
			2.0				1.0
			[1.8]				[3.8]
			2.5				1.5
			[1.0]				[3.0]
Statictical analysis		χ^2=25.626		F=4.235		χ^2=22.041	
Probability		**p<0.001**		**p=0.001**		**p=0.001**	
Difference		**[1-2.3.4.5.6] [2-4.5.6]**		**[1-2.3.5.6]**		**[1-2.3.4.5.6] [2-4]**	

* The ANOVA test (using F-table value) was used to compare three or more independent groups in data that followed a normal distribution. For data not following a normal distribution, the Mann-Whitney U test (Z-table value) was used for comparing measurement values of two independent groups, while the Kruskal-Wallis H test (χ2-table value) has been used to compare at least three distinct groups.

A moderate, statistically substantial negative correlation was identified among NRS 2002 and MNA-SF (r=-0.715; p<0.001). As NRS 2002 scores increase, MNA-SF scores will decrease.

A high, statistically substantial positive correlation was identified among NRS 2002 and MUST (r=0.803; p<0.001). As NRS 2002 scores increase, MUST scores will increase.

A strong, statistically substantial negative correlation was identified among MNA-SF and MUST(r=-0.801; p<0.001). As MNA-SF scores increase, MUST scores will decrease (Table 4.9.).

Table 4.9. The examination of the relationships between measurements

Correlation* (n=130)		**NRS 2002**	**MNA**	**MUST**
NRS 2002	*r*	1.000	-0.715	0.803
	p	-	**<0.001**	**<0.001**
MNA	*r*	-0.715	1.000	-0.801
	p	<0.001	-	**<0.001**
MUST	*r*	0.803	-0.801	1.000
	p	<0.001	<0.001	-

* The Spearman correlation coefficient has been utilised to analyse the relationship between two quantitative variables having non-normal distributions.

5. DISCUSSION AND CONCLUSION

Before diagnosing malnutrition, it is necessary to fulfil the criteria to be classified as "at risk of malnutrition" based on a validated risk screening tool. The ESPEN accepts the following risk screening tools as suitable for implementation in hospital, elderly care, and community settings: The NRS-2002, MUST as well as MNA-SF (11).

According to the study findings, the percentage of nutritional risk varies greatly, with values ranging from 14.8% to more than 74%, as determined through the NRS-2002 tool. The justification for this study finding can be attributed to the wide range of clinical scenarios in which the examined patients were involved (90). The prevalence of malnutrition in our study was determined to be 51.5% based on the NRS-2002 screening tool.

Various investigations have demonstrated the prevalence rates of malnutrition in older patients admitted to hospital settings, which range from 32.9% to 56.2%. The wide range of figures (91) can be attributed to the variations in technique, definition of malnutrition, patient characteristics, and environment across several studies (91). Our findings indicate that 51.5% of elderly patients are at risk of malnutrition based on the NRS-2002 tool, 39.2% are malnourished, and 40% are at risk of malnutrition as determined by the MNA-SF tool. Additionally, 33.1% of elderly patients are at a high risk of malnutrition as determined by the MUST tool.

Several medical conditions, including chronic obstructive pulmonary disease, major abdominal surgery, malignant diseases, pneumonia, depression, dementia as well as delirium, significantly raise the malnutrition risk , with rates ranging from 42% to 86%. (91). In our study, based on three screening tests, we observe that patients undergoing tumor surgery, GIS cancers, and other cancers are predominantly malnourished or susceptible to malnutrition.

The educational level was assessed in 31 studies, of which 15 reported significant correlations with malnutrition or the risk of malnutrition, 2 of them shown a significant pattern and 14 studies did not show significant differences (92).

Multiple studies have demonstrated a negative correlation, indicating that individuals with lower levels of education are at a higher risk of malnutrition (93-95). Two research have shown that having a low level of education can protect against malnutrition (96,97). In fact, one of these studies found that a low education level is related to a higher risk to be overweight or obese (96). In contrast, another study found that older individuals with less education had more favorable nutritional profiles (98). Our analysis found no statistically significant variation in NRS 2002, MNA, and MUST values based on education level ($p>0.05$).

Living alone was found to increase the risk of malnutrition in the elderly by 1.8 times (99). Nevertheless, two studies with substantial findings demonstrated the opposite, indicating that a greater proportion of individuals with malnutrition resided in housing with others (100,101). In our study a statistically substantial distinction was detected in terms of NRS 2002 and MUST scores based on living alone or cohabiting.A significant difference was detected between those living alone and those living with their family, spouse and caregiver. It was determined that the NRS 2002 and MUST scores of those living with their family, spouse and caregiver were significantly higher than those living alone. There is no statistically substantial difference in terms of MNA scores according to living alone or cohabiting ($p>0.05$).

Out of the 20 studies reviewed, 13 found significant correlations between income level and the variables being studied, one indicated a significant trend, and 6 of them did not show any substantial differences. Out of the 13 studies that showed significant findings, 12 indicated a positive correlation between a low income level and an heightened risk of malnutrition (92). Conversely, a particular study found that increasing income levels are associated with increased rates of malnutrition(102).

In our study a substantial statistical difference was found in NRS 2002 scores based on income level groups ($p = 0.005$). It was shown that individuals with a larger income than expenses had considerably higher NRS 2002 scores compared to those with equal income and expenses. There was no statistically significant disparity in MNA and MUST scores based on income level categories ($p>0.05$). Due to the nature of the study, a limited sample size may not accurately reflect the overall population.

As a result of classification according to diagnoses, patients who underwent tumor surgery appear to have a high malnutrition risk based on the results of three screening tools. Although nutritional treatment is performed according to the 'ERAS (Enhanced Recovery After Surgery)' protocol in this patient group, the fact that the patients have a loss of weight before surgery and the patients' low oral intake in the postoperative period can be thought to be the reasons for the high risk of malnutrition. After total gastrectomy surgery, which is also a tumor surgery, weight loss may be observed as the oral intake of patients is increased depending on tolerance. On the other hand total parenteral nutrition is started in these patients from the preoperative period in order to minimize weight loss.

Poor nutritional status is a manageable risk factor for surgery that worsens post-op (postoperative) morbidity and increases the LOS (103). Prior nutritional counseling is necessary for all cancer patients during the pre-op (preoperative) phase. Patients who are malnourished necessitate a diet that is high in energy and protein, as well as immune-nutrition supplementation in gastrointestinal cancer surgery. In addition, they may benefit from probiotics or symbiotics for colon cancer surgery (104,105). Research reveals that only 37% of the included centers perform pre-op nutritional assessment as a routine procedure, which is lacking in common practice (106).

According to both MNA-SF and NRS-2002 tests, a high risk of malnutrition has been observed in the 'other cancers' group. This elevated risk in the 'other cancers' group may be attributed to diagnoses such as breast cancer, follicular lymphoma, as well as conditions like tongue cancer, laryngeal cancer, and endometrial cancer. The increased risk of malnutrition in head and neck cancers, such as laryngeal cancer, due to difficulties in swallowing and chewing, is also clinically observed. The NRS-2002 and Malnutrition Screening Tool (MST) have been commonly suggested for use in national screening programs and among patients with gastrointestinal cancer (107,108).

The results of a study that compared the MNA and NRS-2002 in hospitalized elderly patients indicated that both tools showed moderate agreement. This finding may suggest that both tools could be maintained in routine use in clinical and nutritional hospital practice(109).

In one research revealed that those with poor nutritional status had longer hospital stays, a lower BMI and calf circumference (CC), were more likely to be older, female and had hematological tumors as well as tumors in the neck, head, chest, and upper gastrointestinal tract (110). However, in our study, the rate of malnutrition among women was not found to be different from that of men.

Upon analysing the medical histories of the patients, we found that 60% (n = 78) of the patients who participated in our study had a medical history that included metabolic diseases like diabetes and hypertension. Likewise in one study conducted to assess the nutritional status of diabetic patients found an increased prevalence of malnutrition among the individuals who participated (111). Early diagnosis and implementation of nutritional interventions not only reduce hospitalization duration but also expedite the recovery trajectory and mitigate the onset of diabet-related complications.

A study was conducted on 141 elderly people who were admitted to a geriatric care hospital. The process of evaluating nutritional status was conducted with the following assessment tools: MNA, MNA-SF, Geriatric Nutritional Risk Index (GNRI), MUST and NRS 2002. As a reference standard, a "combined index" for malnutrition was also calculated. The nutritional risk in the elderly was found to be overestimated by MNA-SF. At a geriatric care hospital, the MUST screening tool has proven to be the most practical and valid method for predicting malnutrition in the old (112).

In the light of this findings that NRS-2002, MUST and MNA-SF tests are correlated and all three tests are usable to detect malnutrition in patients aged 65 and older who are hospitalized.

The reason for a higher malnutrition risk according to NRS-2002 compared to other screening tests may be the addition of an extra point specifically for individuals aged 70 and above in the NRS-2002 test, which is different from other tests.

Studies with larger sample sizes are needed. These findings provide an important basis for understanding the connections among nutritional status, various demographic and clinical factors. Such research can be a guide in directing nutrition programs and interventions to specific groups.

Older individuals who are hospitalized frequently have malnutrition. The optimal method for identifying older adults who require nutritional support is nutritional assessment; Nevertheless, it is a laborious process to finish. Nutritional screening tools can aid in promptly and early identifying malnutrition. However, to ensure a precise diagnosis of malnutrition, one should use them in conjunction with nutritional assessments.

An interdisciplinary approach should be carried out to develop and execute a nutritional treatment plan with the aim of enhancing the patient's condition.

Screening for malnutrition is essential for both prevention and intervention in older patients who are hospitalised, given the high prevalence of malnutrition in this group. The NRS-2002, MUST, as well as MNA-SF tests are compatible and effective tools for the screening of malnutrition.

In light of the rising prevalence of malnutrition, the goal of this cross-sectional study was to emphasize the importance of timely diagnosis and treatment of malnutrition, as well as to raise awareness by determining the malnutrition rate in different patient groups. The limitations of the study include its small sample size and its focus on individuals with a high socioeconomic status. Future research could consider taking additional anthropometric measurements, adding the caregiver's and the family's educational background to the socio-demographic questions, incorporating the GLIM criteria, conducting physical examinations, measuring body composition, performing functional assessments, and collecting laboratory findings to provide a more comprehensive perspective on malnutrition. Including patients from various healthcare institutions to increase the sample size can be proposed as a suggestion for future studies.

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7. APPENDICES

7.1. Appendix-1 Koç University Clinical Research Ethics Committee Decision

KLİNİK ARAŞTIRMALAR ETİK KURULU KARAR FORMU

ARAŞTIRMANIN AÇIK ADI	Geriatrik Hasta Grubunda Farklı Tarama Araçları Kullanarak Malnütrisyonun Saptanması: Kesitsel bir çalışma
VARSA ARAŞTIRMANIN PROTOKOL KODU	2022.401.IRB1.152

ETİK KURUL BİLGİLERİ	ETİK KURULUN ADI	KOÇ ÜNİVERSİTESİ KLİNİK ARAŞTIRMALAR ETİK KURULU

BAŞVURU BİLGİLERİ	KOORDİNATÖR/SORUMLU ARAŞTIRMACI UNVANI/ADI/SOYADI	Dyt. Deniz Özyalçın			
	KOORDİNATÖR/SORUMLU ARAŞTIRMACININ UZMANLIK ALANI	Beslenme ve Diyet Bölümü			
	KOORDİNATÖR/SORUMLU ARAŞTIRMACININ BULUNDUĞU MERKEZ	Amerikan Hastanesi			
	VARSA İDARİ SORUMLU UNVANI/ADI/SOYADI	-			
	DESTEKLEYİCİ	-			
	PROJE YÜRÜTÜCÜSÜ UNVANI/ADI/SOYADI (TÜBİTAK vb. gibi kaynaklardan destek alanlar için)	-			
	DESTEKLEYİCİNİN YASAL TEMSİLCİSİ	-			
	ARAŞTIRMANIN FAZI VE TÜRÜ	FAZ 1	☐		
		FAZ 2	☐		
		FAZ 3	☐		
		FAZ 4	☐		
		Gözlemsel ilaç çalışması	☐		
		Tıbbi cihaz k			
		İn vitro tıbbi yapılan perfo değerlendirme çalışmaları			
		İlaç dışı klinik araştırma	☒		
		Diğer ise belirtiniz			
	ARAŞTIRMAYA KATILAN MERKEZLER	TEK MERKEZ ☒	ÇOK MERKEZLİ ☐	ULUSAL ☒	ULUSLARARASI ☐

KLİNİK ARAŞTIRMALAR ETİK KURULU KARAR FORMU

ARAŞTIRMANIN AÇIK ADI	Geriatrik Hasta Grubunda Farklı Tarama Araçları Kullanarak Malnütrisyonun Saptanması: Kesitsel bir çalışma
VARSA ARAŞTIRMANIN PROTOKOL KODU	2022.401.IRB1.152

	Belge Adı	Tarihi	Versiyon Numarası	Dili
DEĞERLENDİRİLEN BELGELER	ARAŞTIRMA PROTOKOLÜ	21.11.2022	VI	Türkçe ☒ İngilizce ☐ Diğer ☐
	BİLGİLENDİRİLMİŞ GÖNÜLLÜ OLUR FORMU	21.11.2022	VI	Türkçe ☒ İngilizce ☐ Diğer ☐
	OLGU RAPOR FORMU			Türkçe ☐ İngilizce ☐ Diğer ☐
	ARAŞTIRMA BROŞÜRÜ			Türkçe ☐ İngilizce ☐ Diğer ☐

	Belge Adı		Açıklama
DEĞERLENDİRİLEN DİĞER BELGELER	SİGORTA	☐	
	ARAŞTIRMA BÜTÇESİ	☐	
	BİYOLOJİK MATERYEL TRANSFER FORMU	☐	
	İLAN	☐	
	YILLIK BİLDİRİM	☐	
	SONUÇ RAPORU	☐	
	GÜVENLİLİK BİLDİRİMLERİ	☐	
	DİĞER:	☐	

KARAR BİLGİLERİ	**Karar No:** 2022.401.IRB1.152	**Tarih:** 23.11.2022
	Yukarıda bilgileri verilen başvuru dosyası ile ilgili belgeler araştırmanın/çalışmanın gerekçe, amaç, yaklaşım ve yöntemleri dikkate alınarak incelenmiş ve uygun bulunmuş olup araştırmanın/çalışmanın başvuru dosyasında belirtilen merkezlerde gerçekleştirilmesinde etik ve bilimsel sakınca bulunmadığına toplantıya katılan etik kurul üye tam sayısının salt çoğunluğu ile karar verilmiştir. İlaç ve Biyolojik Ürünlerin Klinik Araştırmaları Hakkında Yönetmelik kapsamında yer alan araştırmalar/çalışmalar için Türkiye İlaç ve Tıbbi Cihaz Kurumu'ndan izin alınması gerekmektedir.	

7.2. Appendix-2 Informed Consent Form

BİLGİLENDİRİLMİŞ GÖNÜLLÜ OLUR FORMU

Sayın Katılımcı,

Katılımınızı talep ettiğimiz **" Geriatrik Hasta Grubunda Farklı Tarama Araçları Kullanarak Malnütrisyonun Saptanması : Kesitsel bir çalışma"** başlıklı bu araştırma, İstanbul Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü Beslenme ve Diyetetik bölümü yüksek lisans öğrencisi Diyetisyen Deniz Özyalçın tarafından yürütülen bir araştırmadır.

Geriatri Hasta Grubunda Farklı Tarama Araçları Kullanarak Malnütrisyonun saptanmasını incelemek amacıyla bir çalışma yürütmekteyiz. Bu çalışmayı yapmak istememizin nedeni; malnütrisyon yani yetersiz beslenme geriatrik hastalarda sıklıkla fark edilmeyen yaygın bir sorundur. Yetersiz beslenme, artan mortalite, komplikasyonlar ve hastanede kalış süresi ile olan ilişkileri nedeniyle yaşlı yetişkinler için birincil sağlık sorunudur.

Araştırma sırasında, size ait genel demografik özellikleriniz sorulacak ve boy,kilo,iştah durumu ve kilo kaybı sorgulanarak, malnütrisyon tarama araçları için bilgiler alınacaktır.

Bu çalışmaya 300 kişinin katılması beklenmektedir.

Araştırmada alınacak tüm bilgiler araştırma kapsamı dışında hiçbir kişi ile kesinlikle paylaşılmayacaktır. Elde edilecek olan bilgiler, Etik Kurul, kurum ve diğer sağlık otoritelerinin orijinal tıbbi kayıtlarına doğrudan erişimleri olacaktır. Fakat bu gönüllü onam formunun imzalanmasıyla bu bilgiler gizli tutulacaktır.

Bu çalışmaya katılmayı reddedebilirsiniz. Çalışmanın herhangi aşamasında da katılım onayınızdan vazgeçebilirsiniz. Araştırmaya katılımınız için sizden herhangi bir ücret istenmeyecek ve katılımınız karşılığında size herhangi bir ücret ödenmeyecektir. Sizden beklenen, bilgilendirilmiş onam formunu imzalayıp, bu araştırmaya katkı sağlamayı kabul ettikten sonra, sorulacak soruların cevaplanmasıdır.

Sorumlu Araştırmacı: Doç.Dr. Binnur OKAN BAKIR
Yeditepe Üniversitesi Beslenme ve Diyetetik Bölümü Öğretim Üyesi
0216 578 00 00-1657

Araştırma Yürütücüsü : Deniz ÖZYALÇIN
Yeditepe Üniversitesi Beslenme ve Diyetetik Bölümü Yüksek Lisans Öğrencisi
05415748616

Sayın Doç.Dr. Binnur OKAN BAKIR ve Deniz ÖZYALÇIN tarafından bilimsel bir araştırma yapılacağı belirtilerek bu araştırma ile ilgili yukarıdaki bilgiler bana aktarıldı.
Bilgilendirilmiş Gönüllü Olur Formundaki tüm açıklamaları okudum. Bana, yukarıda konusu ve amacı belirtilen araştırma ile ilgili açıklamalar, yukarıda adı belirtilen diyetisyen tarafından yapıldı. Araştırmaya gönüllü olarak katıldığımı, istediğim zaman gerekçeli veya gerekçesiz olarak araştırmadan ayrılabileceğimi biliyorum. Söz konusu araştırmaya, hiçbir baskı ve zorlama olmaksızın kendi rızamla katılmayı kabul ediyorum.

Ad, Soyadı:	Tanık	Araştırmacı
Tarih:	Ad Soyadı :	Ad, Soyadı:
İmza:	İmza :	İmza:

7.3. Appendix-3 Data Collection Form

HASTA VERİ TOPLAMA FORMU

YAŞ :

CİNSİYET :

TANI :

TIBBİ GEÇMİŞ :

SOSYO-EKONOMİK DURUM :

☐ Gelirim giderime eşit ☐ Gelirim giderimden fazla ☐ Gelirim giderimden az

EĞİTİM DURUMU :

NEREDE/KİM İLE YAŞIYORSUNUZ ? :

7.4. Appendix-4 Malnutrition Screening Tools

Nütrisyonel Risk Taraması (NRS 2002)

Hasta adı-soyadı:	Boy:	Kilo:	*BKİ:

Tablo 1: Başlangıç Taraması

1. BKİ < 20.5	☐ **Evet**	☐ **Hayır**
2. Son 3 ayda zayıflama	☐ **Evet**	☐ **Hayır**
3. Son 1 haftada besin alımınmda azalma	☐ **Evet**	☐ **Hayır**
4. Hastalığı şiddetli mi	☐ **Evet**	☐ **Hayır**

- Herhangi bir sorunun yanıtı **evet** ise son taramaya geçiniz.
- Tüm soruların yanıtı **hayır** ise hastayı yatış süresince haftada bir yeniden tarayınız.

Tablo 2: Son Tarama

NÜTRİSYON SKORU		HASTALIK ŞİDDETİ SKORU	
3 ayda % 5 zayıflama veya son 1 hafta besin alımı % 50-75 ise	**1**	Kalça kırığı, kronik hastalıkların akut alevlenmesi, vb	**1**
2 ayda % 5 zayıflama veya Son 1 hafta besin alımı % 25-60	**2**	Major abdominal cerrahi, şiddetli pnömöni, hematolojik malignite	**2**
1 ayda % 5 zayıflama veya Son 1 hafta besin alımı % 0-25	**3**	Kafa travması, yoğun bakımda Apache skoru > 10 üzeri hastalar	**3**

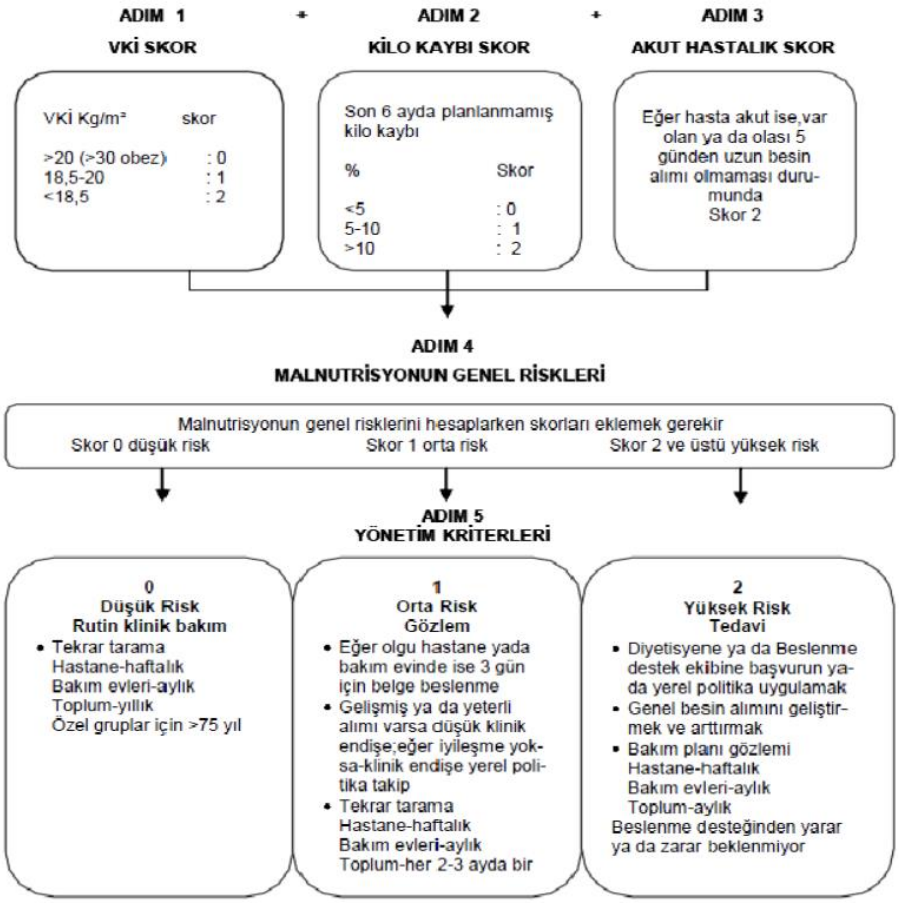
NÜTRİSYON SKORU		+	HASTALIK ŞİDDETİ SKORU		Toplam Skor =	

Hasta ≥70 yaş ise toplam skora 1 puan eklenir	Yaşa Uyarlanmış Toplam Skor=	

- **Skor <3: Hasta haftada bir taranmalı. Eğer majör operasyon planı varsa yine bir nütrisyon planı geliştirilmelidir**
- **Skor ≥3: Hasta nütrisyon riski altındadır ve bir nütrisyon planı başlatılır**

Tarih:	Değerlendiren:	İmza:

Malnütrisyon Üniversal Tarama Aracı (MUST testi)



Mini Nutritional Assessment

MNA®

Nestlé Nutrition Institute

Ad: Soyad:

Cinsiyet: Yaş: Ağırlık, kg: Boy, cm: Tarih:

Aşağıdaki soruları kutulara uygun rakamları yazarak yanıtlayın. Tarama puanı için rakamları toplayın.

Tarama

A Son üç ayda iştahsızlığa, sindirim sorunlarına, çiğneme veya yutma zorluklarına bağlı olarak besin alımında bir azalma oldu mu?
0 = besin alımında şiddetli düşüş
1 = besin alımında orta derece düşüş
2 = besin alımında düşüş yok ☐

B Son üç ay içindeki kilo kaybı durumu
0 = 3 kg'dan fazla kilo kaybı
1 = bilinmiyor
2 = 1-3 kg arasında kilo kaybı
3 = kilo kaybı yok ☐

C Hareketlilik
0 = yatak veya sandalyeye bağımlı
1 = yataktan, sandalyeden kalkabiliyor ama evden dışarıya çıkamıyor
2 = evden dışarı çıkabiliyor ☐

D Son üç ayda psikolojik stres veya akut hastalık şikayeti oldu mu?
0 = evet 2 = hayır ☐

E Nöropsikolojik problemler
0 = ciddi bunama veya depresyon
1 = hafif düzeyde bunama
2 = hiçbir psikolojik problem yok ☐

F1 Vücut Kitle İndeksi (VKİ) (Vücut ağırlığı-kg)/(Boy'un metre)^2 ☐
0 = VKİ 19'dan az (19 dahil değil)
1 = VKİ 19'la 21 arası (21 dahil değil)
2 = VKİ 21'le 23 arası (23 dahil değil)
3 = VKİ 23 ve üzeri ☐

EĞER VKİ DEĞERİ YOKSA F1 SORUSU YERİNE F2 SORUSUNU CEVAPLAYIN.
F1 TAMAMLANDIYSA F2 SORUSUNA CEVAP VERMEYIN.

F2 Baldır Çevresi (BÇ) cm
0 = BÇ 31'den az
3 = BÇ 31 veya daha fazla ☐

Tarama puanı ☐☐
(En fazla 14 puan)

12-14 puan: ☐ Normal nütrisyonel durum
8-11 puan: ☐ Malnütrisyon riski altında
0-7 puan: ☐ Malnütrisyonlu

Kaydet
Yazdır
Sıfırla

7.5. Appendix-5 Curriculum Vitae

Personal Informations

Name	Deniz	**Surname**	Özyalçın

Education

Degree	Department	The name of the Institution Graduated From	Graduation year
Doctorate			
Master	Nutrition and Dietetics	**Yeditepe University**	
University	Nutrition and Dietetics	**Yeditepe University**	2019
High school	-	**TEB. Ataşehir Anatolian High School**	2015

[#] All the grades must be listed if there is more than one (KPDS, ÜDS, TOEFL; EELTS vs),

Languages	**Grades ([#]) **
English	Advanced
German	Intermediate

Work Experience (Sort from present to past)

Position	**Institute**	**Duration (Year - Year)**
Dietician	Amerikan Hastanesi	2020-continued

Computer Skills

Program	**Level**
Microsoft Office	Good