T.C.
YEDİTEPE UNIVERSITY
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DETECTION OF MALNUTRITION PREVALENCE AMONG ADULT CANCER PATIENTS

MASTER THESIS

NUR ECEM BAYDI

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ONAY

Bu tez Yeditepe Üniversitesi Lisansüstü Eğitim-Öğretim ve Sınav Yönetmeliğinin ilgili maddeleri uyarınca yukarıdaki jüri tarafından uygun görülmüş ve Enstitü Yönetim Kurulu'nun 05../05../2017..... tarih ve 2017/08-09..... sayılı kararı ile onaylanmıştır.

Prof. Dr. Bayram YILMAZ

Sağlık Bilimleri Enstitüsü Müdürü

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.

NUR ECEM BAYDI

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LIST OF ABBREVIATIONS

BMI	Body Mass Index
MUAC	Mid Upper Arm Circumference
NCHS	National Center for Health Statistics
NRS-2002	Nutritional Risk Screening- 2002
SGA	Subjective Global Assessment
TST	Triceps Skinfold Thickness

ABSTRACT

Nur Ecem Baydı. Detecting Malnutrition Prevalence Among Adult Cancer Patients. Master Thesis. Istanbul, 2017. Malnutrition is a common complication seen among cancer patients. It may affect cancer treatment negatively. To detect malnutrition at an early level is important for the prognosis of the disease. Malnutrition screening is essential at diagnosis level to be able to protect patiens from malnutrition. If nutritional screening is skipped, malnutrition could not be overcome. In this study we aimed to detect malnutrition prevalence among adult cancer patients. The study was conducted at Acibadem Kozyatagi Hospital with 59 patients. Nutritional screening and assessment and measurements were applied in 48 hour after the patient was claimed to hospital. We used two tools for detecting malnutrition which are Nutritional Risk Screening-2002 (NRS-2002) and Subjective Global Assessment (SGA). We also took anthropometric measurements from patients which are body mass index (BMI), triceps skinfold thickness (TST) , and mid upper arm circumference (MUAC). Another aim of us was to look at the concordance between NRS-2002 and SGA, and concordance of those with anthropometric measurements. Both NRS-2002 and SGA found the same rate of malnutrition among those patients which is 41%. There was a good concordance between NRS-2002 and SGA (p: 0.02, $p<0.05$). We could not find a significant relationship between those tools and anthropometry.

Key words: malnutrition, cancer, NRS-2002, SGA, anthropometry

ÖZET

Nur Ecem Baydı. Yetişkin onkoloji hastalarında malnutrisyon prevalansının saptanması. Uzmanlık tezi olarak hazırlanmıştır. İstanbul, 2017. Kanser hastalarında malnutrisyon sıklıkla görülen bir komplikasyondur ve hastalarda tedavinin sonuçlarını olumsuz şekilde etkileyebilmektedir. Kanser hastalarında nutrisyonel durumun taranması başarılı bir tedavi takibi için önemlidir. Nutrisyonel tarama yapılmadığında malnutrisyon tespit edilemediği için giderilemez ve hastaya tedavi sürecinde olumsuz etkileri dokunabilir. Bu çalışmada Nutritional Risk Screening-2002 (NRS-2002) ve Subjective Global Assessment (SGA) ölçekleri ile hastalarda malnutrisyon prevalansının saptanması amaçlanmıştır. Çalışma Acıbadem Kozyatağı Hastanesi'ne yatışı yapılan yetişkin onkoloji hastaları ile yürütülmüştür. Çalışmada 59 kişi yer almıştır. Hastanın yatışını takip eden ilk 48 saat içinde ölçümleri yapılmıştır. Ayrıca hastalardan beden kitle indeksi (BKİ) , deri kıvrım kalınlığı (DKK) ve üst orta kol çevresi (ÜOKÇ) ölçümleri de alınmıştır. Çalışmanın amacı NRS-2002 ve SGA ölçekleri ile hastalarda malnutrisyon prevalansını saptamak, bunun yanı sıra bu iki ölçeğin kendi arasındaki tutarlılığı ve bunların antropometrik ölçümler ile arasındaki uyumuna bakmaktır. Hem NRS-2002 hem de SGA hastalarda aynı oranda malnutrisyon tespit etmiştir (%41). NRS-2002 ve SGA arasındaki ilişki anlamlı bulunmuştur (p:0.0, $p<0.05$). Bu iki ölçeğin antropometrik ölçümler ile arasındaki ilişki ise istatistiksel olarak anlamlı bulunmamıştır.

Anahtar sözcükler: malnutrisyon, kanser, NRS-2002, SGA, antropometri

1.INTRODUCTION

Disease related malnutrition is a common and frequent problem. Disease related malnutrition is related to high mortality and morbidity risks. 30% of patients admitted to hospital have malnutrition. Many of them have malnutrition before coming to hospital and malnutrition worsens during the hospital stay. It is very important to detect malnutrition to be able to overcome it (1). Malnutrition destroys immune functions and makes the patients more prone to infectious diseases. It is also related to prolonged hospital stay and increased financial costs (2-4). The main reason for disease related malnutrition is a decrease in energy intake and/or an increase in energy requirement as a complication of the disease (5). The evaluation of the patients' malnutrition risk is very important to decrease morbidity and mortality rates and to get the optimum results for the patients. The problem is still underestimated by some health care providers. Malnutrition increases morbidity by increasing complication and infection risks. And also because malnutrition direct people to use health care services, the expenditures on health care services increase and quality of life decreases (4).

2.LITERATURE REVIEW

2.1. Cancer

When some of the cells in the organism multiply in an uncontrolled way tumor forms. During this process some of the cells disappear or their biochemical functions change. This tranformation of the cell may be benign or malign. Benign tumors grow in the location where they originate, they do not skip another place and do not cause any morbidity or mortality. However, there is data about that benign tumors may transform into malign tumors. Malign tumors which are called as cancer skip to other places rather than the place they orginate and cause metastasis. Malign tumors may be fatal or may be related to the features, nutrition of the host and related to the type of the cancer and its treatment or not (6).

According to 2012 report of WHO, cancer is one of the diseases causing death in the world. The five cancer types prevelant among men is lung, prostate, colorectum, stomach and liver cancer. And in women breast, colorectum, lung, cervix and stomach are the leading ones. There are 5 nutritional and behavioral factors causing death from cancer. They are high body mass index, insufficient physical activity, insufficient fruit and vegetable consuption, alcohol and tobacco use (7).

The most important factor causing cancer is tobacco use. Generally cancer causing factors could be categorized in 4 classes: 1) Genetic factors 2) Physical factors such as ionizing radiation 3) Chemical factors such as arsenic, tobacco and aflatoxin 4) Biological factors such as viruses, parasites and bacteria (7). It is also known that stress and nutrition style may contribute to cancer formation, and cancer also effects the nutrition of the person (6). Increased body mass index and the increase in fat mass cause an increase in in adipokin levels. Adipokins are active biologic polypeptides and regulator proteins. And they are related to carcinogenic mechanisms causing an increase in cell proliferation and metastasis (6).

2.2. Malnutrition

There are many recommendations related to malnutrition and malnutrition assessment methods. Even if ‘malnutrition’ term has also a meaning of excessive weight, European Society of Parenteral and Enteral Nutrition (ESPEN) defines it as apparent insufficient nutrition. Also ESPEN recommends a definition which comprises the physical changes in body composition and clinical results. In another meaning, ESPEN focuses on ‘at which point insufficient nutrition starts to effect body functions and worsens clinical outputs (8).

According to ESPEN, insufficient nutrition is ‘the position in which insufficient dietary intake causes changes in body composition causing physical and mental retardation and deterioration of healing from diseases (9).

At clinical practice food supply is not the only factor causing malnutrition. Trauma and the increase in nutrient consumption as a result of inflammatory diseases are other factors. The malnutrition as a result of insufficient nutrient intake could be more easily fixed than the malnutrition at the catabolic phase of the diseases. The compensation of the tissue which have lost during catabolism is only possible when the inflammation could be controlled (8).

Taking into account those factors contributing to malnutrition, nutritional risk screening should comprise not only anthropometry but also the methods assessing the strength of the disease and bodily functions (8).

Malnutrition is defined by ESPEN in 2006 as ‘A state of nutrition in which a deficiency or excess (or imbalance) of energy, protein, and other nutrients causes measurable adverse effects on tissue/body form (body shape, size and composition) and function and clinical outcomes (10).

Also American Society for Parenteral and Enteral Nutrition (ASPEN) which is another authority defined disease related malnutrition in 2012 as following: An acute, subacute or chronic state of nutrition, in which a combination of varying degrees of overnutrition or undernutrition with or without inflammatory actvity has led to a change in body composition and diminished function (10).

In hospitalized patients malnutrition is seen in a rate of 20-60 % and the rate is 7-16 % in outpatient groups (11).

During Crimea War in 1859 Florance Nightingale wrote about malnutrition and she explained the case there were hospitalized soldiers starving despite there were enough food (2) .

Malnutrition and cachexia are the terms that can mix together. ESPEN clarifies the difference between them in that cachexia is marked by a serious loss of body fat and muscle. And there is an increased protein catabolism because of the disease. In disease related malnutrition mostly the combination of cachexia and insufficient energy intake is seen (12).

To be able to adequately detect malnutrition it should be clearly defined and conceptualized. A scientist group appointed by ESPEN made a consensus on a universal definition of malnutrition requiring one of the two options following: 1) The person must

have a body mass index (BMI) lower than 18.5 kg/m^2 or 2) The person must experience an unintentional weight loss more than 10% of the weight in any time or more than 5% of the weight over 3 months and there must be a diminished BMI (less than 20 kg/m^2 in young subjects and less than 22 kg/m^2 in the patients older than 70 years old) or a low fat free mass index (less than 15 kg/m^2 in females and less than 17 kg/m^2 in males) (9).

2.2.1. Malnutrition in Cancer

Malnutrition can bee seen in any period of cancer including the diagnosis level. Both cancer and its treatment may cause malnutrition in those patients (10). In case of malnutrition, treatment intolerance may occur and morbidity and mortality rates increase and quality of life diminishes (13). 50% of the patients have already lost 5% of their weight before diagnosis. There are studies reporting that 20% of the patients with cancer die because of malnutrition. If the patients that are with or at risk of malnutrition are recognized, negative outcomes related to malnutrition may be prevented (14).

Patients with cancer is the group having the poorest nutritional status among all hospitalized patients. Anorexia and cachexia are seen in those patients and their rates increase in the late stages of the disease. The reasons for malnutrition in cancer are: 1) Increased nutrient needs 2) Decrease in nutrient intake 3) Changes in digestion and absorption of nutrients 4) Changes in nutrient metabolism (4). Malnutrition may be both cause and result of the disease. Tumor type, its location and stage, and anticancer treatments effect malnutrition.

Malnutrition is oftenly seen in patients with head and neck cancer and the people with upper gastrointestinal system cancers (8).

Generally, malnutrition in cancer outpatients is as high as hospitalized ones (15).

2.2.1.1. Cancer Cachexia

Cancer cachexia is a clinical syndrome and characterized by harsh, chronical, unvoluntary and progressive weight loss. It can be seen with anorexia, asthenia and a quick fullness feeling. And its response to nutritional support is slow (8). A theory related to cancer cachexia is that; because the energy requirement of tumor locating organ is high, fat and protein stores of adipose tissue and skelatal muscle are expended (16).

ESPEN categorizes cancer cachexia at 4 phases according to weight loss percentage and having any of the symptoms which are anorexia, asthenia and a quick feeling of fullness (Figure 1). Followings are the phases:

Phase 1: Weight loss less than 10% and with no symptom

Phase 2: Weight loss less than 10% and having one or more of the symptoms

Phase 3: Weight loss more than or equal to 10% and with no symptom

Phase 4: Weight loss more than or equal to 10% and having one or more of the symptoms (8) .

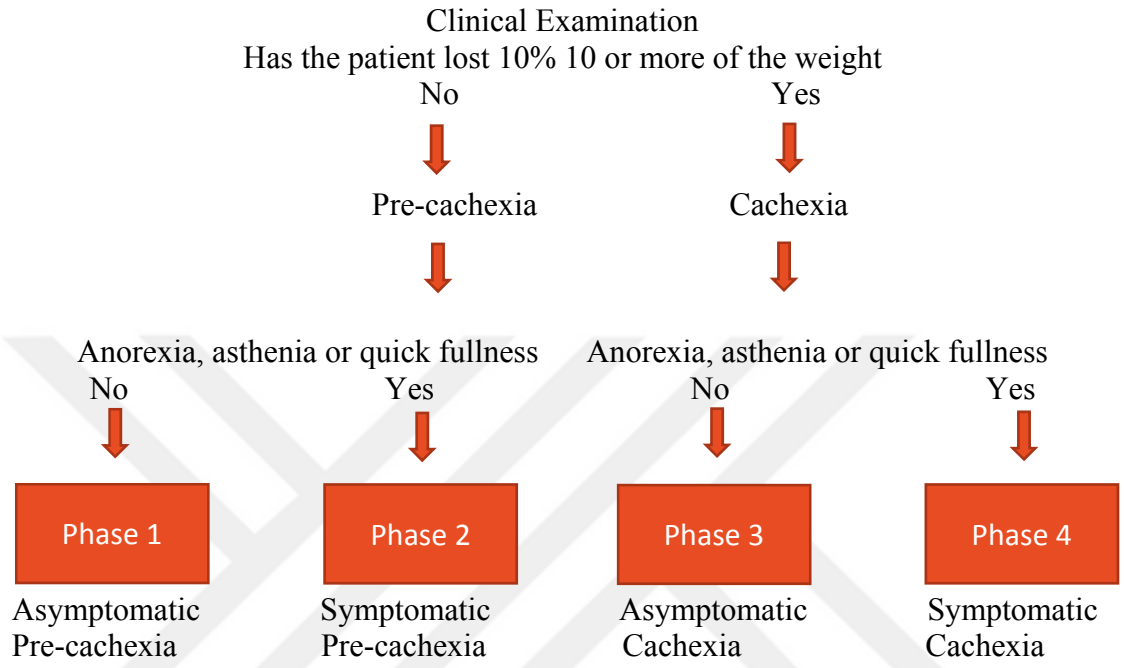

Figure 1. The phases of cancer cachexia

2.2.2.2. The Effects of Cytokines on Metabolism in Cancer

The results of cancer cachexia is connected to two mechanisms. One of them is the decrease in nutrient intake and the other one is the metabolic changes related to release of tumor specific cachexic factors and pro-inflammatory cytokines.

Cancer cells in human causes the production of some pro-inflammatory cytokines such as TNF-α (Tumor necrosis factor-alpha), IL-2 (Interleukin-2), IL-8 (Interleukin-8), IFN-γ (Interferon-gamma). Some of them is produced directly by the cancer cell, stiumulates a local inflammation and activate body's own inflammatory cells. Tumor specific factors contain proteolysis inducting factor (catabolism of proteins) and lipit mobilizing factors (lipit catabolism). Proteolysis inducting factor is a suplhate glycoprotein found in human urine and it is affected by some tumors such as pancreas, liver, ovary, colon, rectum and lung. It joins the catabolism of skeleton muscle. Also lipit mobilizing factor joins the specific mobilization of adipose tissue (8).

The metabolic effects of cytokines in cancer and primary metabolic changes in cancer is given at table 1 and table 2 respectively (8).

Table 1. The effects of cytokines on the metabolism of protein, carbohydrates, and lipits

Cytokine	Protein	Carbohydrate	Lipid
TNF	Increase in muscle proteolysis Increase in protein oxidation	Increase in glycogenolysis Decrease in glycogen synthesis Increase in glycogenesis	
IL-1	Increase in hepatic protein synthesis	Increase in glycogenesis	Increase in lypolysis Increase in fatty acid synthesis
IL-6	Increase in hepatic protein synthesis		Increase in lypolysis
IFN-γ			Decrease in lypogenesis

Table 2. The metabolic changes in cancer patients

Carbohydrate . Increased glycogenesis from aminoacid, lactate, glycerol . Increase in glycose use and turnover of it from other sources . Insulin resistance
Lipid . Increase in lypolysis . Increase in the turnover of glycerol and fatty acids . Decrease in lypogenesis . Temporary increase in plasma lipid levels
Protein Metabolism . Increase in catabolism of muscle protein . Increase in protein turnover in whole body . Increase in hepatic protein synthesis . Decrease in muscle protein synthesis

In addition to the factors contributing to cancer cachexia, the decrease in nutrient intake in head & neck cancer and gastrointestinal system cancer is not only because of anorexia, it is also caused by the mechanic problems during the passage of nutrients. This explains why those patients lose more weight than patients having other cancer types (8).

2.2.2.3. The nutritional Results of the Resection of Any Part of Digestive System

Another factor contributing to decrease of nutrient intake is treatment complications of oncology. Resection of digestive system parts, radiotherapy, chemotherapy may affect the patients' nutrition pattern in some ways. The effects of resection on nutrition are seen in table 3 (8).

Table 3. The nutritional results of the resection of a part of digestion system

Resected Parts	Nutritional Results
Tonque or pharynx	Need of tube feeding (disphagia)
Thoracic esophagus	Gastric stasis and fat malabsorption
Stomach	Dumping syndrome, anemia, fat malabsorption
Duodenum	
Jejunum (until 120 cm)	Biliary pancreatic insufficiency
Ileum (60 cm) or ileocecal valve	Decreased absorption of glucose, fat, protein
Small intestine (75%)	Malabsorption of B12, fat and biliary salts
Jejunum and ileum	Malabsorption of glucose, fat, lipids and diaarhea
Colon (subtotal or total resection)	
Pancreas	Total malabsorption
Liver	Water and mineral loss
	Temporary hypoalbunemia

2.2.2.4. Nutritional Complications Related to Radiotherapy

When a patient with head and neck cancer is treated with radiotherapy, the patient's salivary glands and oral cavity must be included in treatment area. Therefore, during this treatment taste buds may be destroyed or secretory function of salivary glands may lessen and oral mucositis may form. The symptoms seen in patients treated with radiation therapy are dry mouth (xerostomia) , distortion of sense of taste (dysgeusia) and oral mucositis. Those side effects affect the patients' nutritional intake (17). Other nutritional complications related to radiation and the treatment field of in is seen in table 4 (8).

Table 4. Nutritional complications related to radiotherapy

The area with radiation	Acut effects	Late effects
Head and neck	Odinofaji Xerostomia Mucositis Anorexia Dysosmia	Ulseration Kserostomi Dental care Bone radiation necrosis Trismus
Thorax	Dysphagia	Fibrosis Stenosis Fistula
Abdomen and pelvis	Anorexia Nausea Vomiting Diarrhea Acute enteritis Acute colitis	Ulseration Malabsorption Diarrhea Chronic enteritis Chronic colitis

2.2.2.5. The Effetcts of Chemotherapy on Nutrition

Chemotherapy has some side effects affecting the patients' nutritional status such as diarrhea, early feeling of satiety, oral mucositis, vomiting, nausea, changes in smell and taste perceptions (18). The effects of some chemotherapeutic agents causing nausea and vomiting can be seen at table 5 (8).

Table 5. The chemotherapeutic agents related to nausea and vomiting

Drug	Severity and duration
Nitrogen mustard (mustine hydrochloride; mechlorethamine hydrochloride USP)	Occurs in all of the patients May be severe but decreases in 24 h
Chloroethyl nitrosoureas	Effects change, but sometimes may be severe
Streptozotocin (streptozotocin)	Occurs nearly in all of the patients Tolerance becomes better durin 5 day consecutive periods
Cis-platinum (cisplatin)	May be severe Tolerance becomes better with iv hidration and continious 5 day infusion
Imidazole carboxamide (DTIC; dacarbazine)	Occurs in all of the patients Tolerance becomes better during 5 day intermittent dose

The effects of weight loss on clinical features and outputs

Weight loss is the main characteristic feature of cancer cachexia and it is a prognostic factor in that there are a lot of studies showing that weight loss is a predictor of decreased survival. If the patients taking chemotherapy have malnutrition during oncological treatment, they usually experience rehospitalization, and they have longer hospitalization durations. 4-23% of the cancer patients die as aresult of undernutrition and progressed malnutrition (8).

There are studies showing that the patients with malnutrition and taking chemotherapy have less tolerance to chemotherapy (3,19).

In summary, cancer cachexia is a common symptom seen in patients with head and neck cancer and upper gastrointestinal system cancers oftenly. It is also usually seen many progressed diseases. Cancer cachexia is more than a simple hunger, cancer cachexia is not only related to the decreased nutrient intake, it is also related to cytokine cascade and the release of other tumor specific factors and the metabolic changes related to them (8).

Radiation enteropathy

Nearly 50 % of the cancer patients undergoes radiation therapy. Enteropathy occurs because of the cell death in epithelium of intestines and an inflammatory reaction as a

result of radiation. Even if technological developments in this field allow a more certain delivery of radiation waves other healthy tissues are still at risk of injury. Especially the patients undergoing radiation therapy for abdomianl cancers face bowel injury because of radiation therapy. It is called acute radiation enteropathy if enteropathy occurs in 3 months after the therapy, if it lasts more than 3 months after therapy it is called chronical radiation enteropathy (20).

Symptoms of acute radiation enteropathy includes; nausea, vomiting, diarrhea, abdominal pain. Chronical enteropathy symptoms are more complicated such as fibrosis of intestine walls and mucosa layer's athropy (20).

Abdominal radiation therapy may result in apparent gastrointestinal, gynecological, genitourinary and pelvic bone damage. The prevalance of radiation enteropathy is more common in the elderly, thin patients and in the patients having a accompanying disease such as diabetes and hypertension. Previous or continuing chemotherapy increases the risk of radiation enteropathy. It is predicted that 5-7% of the patients undergoing abdominal radiotherapy there will be a gastrointestinal complication requiring a surgical attempt. A categorization of radiation enteropathy stages is seen in table 6 (8).

Table 6. The categorization of the effects of radiation at gastrointestinal tract

Period	Onset and progress	Affected fields	Symptoms
Acute	On first days of treatment It may last one or two weeks	Mucosa	Nausea, vomiting, abdominal cramp, feces containing a little amount of blood
Subacute	In first year It may last one or two years	Mucosa and submucosa	Partial ileus, hemorrhage, abdominal pain
Chronical	Usually after 9-12-24 months, and sometimes after years	All of the intestinal layers	Ileus, intestinal perforation, hemorrhage

2.2.2.6. The effects of anticachectic agents in cancer

In catabolic cases and cancer cachexia the primary aim is to prevent nutritional worsening rather than fulling stores. Because it is only possible when malnutrition is caused by hunger rather than catabolism. In many cancer patients malnutrition is not only caused by

hunger but also caused by the catabolism, and artifical nutrition has a limited effect. So it may be beneficial to work on the agents interacting with mediators related to cachexia. There are some agents healing quality of life and nutritional parameters such as appetite stimulating agents, anticatabolic and anabolic agents (8).

1. Appetite stimulating agents

a) Progestagenic agents

It is not possible to recover from malnutrition in cancer by increasing nutrient intake because the malnutrition in cancer is not only related to anorexia or hypophagia. However the increase of appetite improves quality of life. The only appetite stimulating agent confirmed and on which studied densely is megestrol acetate. Despite it increases appetite in 70% of patients, only in 20% of the patients increased nutrient intake and increase weight is seen. There are some problems related to megestrol acetate and they are as following: Firstly the increase in weight is not muscle the increase is mostly fat deposition and oedema. It also decreases muscle mass by decreasing androgen level so many clinical studies claim that even if the medicine causes an increase in weight it does not help improve quality of life. Secondly, the optimal dose of use is not known. It is suggested that after a low dose two week trial period, dosage need to be increased (8).

b) Corticosteroids

Corticosteroids have a temporary effect on physically feeling good, appetite and performance (8). Oral corticosteroids are usually prescribed for appetite stimulation in cancer patients (21). It has also some side effects such as deterioration in vision (22), diabetes, Cushing syndrome in long term and insomnia, constipation, hyperglycemia in short term (21).

c) Cannabinoids

Dronabinol is a synthetic cannabinoid and it is used in the patients having nausea and vomiting related to chemotherapy. It is analgesic, causes feeling good, and it has a role in muscle relaxation and saving from insomnia (8). Cannabinoids prevent chemotherapy related nausea and vomiting in cancer patients . They also alleviate pain (22) and it has appetite stimulating property in cancer patients (23).

2) Anticatabolic agents

a) Non-steroidal anti-inflammatory drugs

Non-steroidal anti-inflammatory drugs may alleviate systemic inflammation and peserve body fat. Non-steroidal anti-inflammatory drugs inhibit cyclooxygenase 2 enzyme (COX-2) , which enhances inflammation. COX-2 enzyme has a catalyzing role in the formation

of prostaglandins from arachidonic acid (24). Prostaglandins have role in tumor cell proliferation, metastatic formation and cancer cachexia (8).

b) Omega 3 fatty acids

Omega 3 fatty acids are polyunsaturated fatty acids. The simplest of those is α-linolenic acid. ω-3 fatty acids could not be synthesized in humans. Therefore it is categorized as essential fatty acid. α-linolenic acid is metabolized into eicosapentaenoic acid (EPA) and EPA is metabolized into docosahexaenoic acid (DHA) . EPA and DHA are called as long chain omega-3 fatty acids. EPA is a omega-3 fatty acid and it decreases the release of pro-inflammatory cytokines. It also inhibites the effects of tumor specific cachecxic factors (1).

3) Anabolic agents

a) Anabolic steroids

Anabolic androgenic steroids increase mRNA reading in skeleton muscle androgen receptors, stimulate muscle protein synthesis and increase skeleton muscle mass (8). Anabolic steroids are derived from testosterone which is the male sex hormone. When testosteone levels increase in the body protein synthesis is stimulated. This case results in an increase in body strength and muscle size (25).

2.2.2. Nutritional Screening and Nutritional Assessment

Detecting malnutriton or malnutrition risk is crucial to be able to overcome it . The American Dietetic Association definition of nutritional risk screening is as ‘the process of identifying patients with characteristics commonly associated with nutritional problems who may require comprehensive nutritional assesment (13). Nutritional assesment on the other hand is defined as ‘ a comprehensive approach to defining nutritional status using medical, nutritional, and medication histories; physical examination, anthropometric measurement and laboratory data’ (1). After nutritional screening the ones at risk need a nutritional assessment .

Nutritional Risk Screening-2002 (NRS-2002) searches for decreased BMI, decreased nutrient intake and weight loss in the near future. It also takes into account the seriousness of the disease by looking at metabolic stress and the increase in nutritional needs in its subjective assessment part. However this subjective assessment of disease may not be enough for understanding the patient’s existing nutritional status. So a certain diagnosis of malnutrition may not be possible by using NRS-2002. However, it could be a good

tool for identfying the patients at malnutrition risk and for a subsequent nutritional assesment (1).

Subjective Global Assesment (SGA) is a very popular nutritional assesment tool. It includes parts questioning weight change, alterations in dietary intake, functional capacity of the person and gastrointestinal symptoms. It also questions if there is oedama and ascites. And it assesses fat and muscle stores of the person (1). As a result of this assessment it categorizes patients into three groups as; A: well noursihed, B: moderately malnourished, and C: severely malnourished.

2.2.2.1. Nutritional Risk Screening-2002

A good screening method should have a practical use in that the applier or clinician should apply that fastly and easily. It should also have validity, reliability. There are many screening methods. Those usually focus on current weight, height, weight loss in a near past, and nutrient intake. Malnutrition Screening Tool (MST), Short Nutritional Assessment Questionnaire (SNAQ) are some of them. Some of the screening tools also contains clinical position, the severity of the disease, physical examination, and therefore they could be seen as assesment method rather than screening method. SGA is an example for this. NRS-2002 is a tool supported by ESPEN (8).

NRS-2002 was developed by Kondrup and friends in 2002 (26). NRS-2002 is based on many scientific studies (27). It consists of two parts . One of the parts focuses on nutrition of the patient and other part shows the severity of the disease. As the first step, the tool questions if the BMI of the patient is under 20.5, there has been a weight loss in last 3 months, there is a decrease in nutrient intake in last week, and the patient's disease is severe or not. If any of those questions' answer is yes, the person applying the test passes to scoring part. Scoring part consists of two parts. One of them is related to nutrition and other part is related to severity of the disease. In the part related to nutrition body mass index, weight loss percentage and nutrient intake in near future is questioned. The person applying the test scores those between 0 and 3. 0 means there isn't any nutritional problem. And other scores are decided taking into account weight loss percentage, body mass index and nutrient intake in last week. In the part related to disease severity, the person applying the test has to score disease severity between 0-3. Score 1 indicates the patients having a chronic disease such as cancer and complications related to this disease. Score 2 indicates immobile patients as a result of a major abdominal surgery or infection. And score 3 is used for intensive care patients and the patients under ventilation support (1).

2.2.2.2. Subjective Global Assesment

Nutritional assessment is the step coming after nutritional screening. The patients who are detected to be at nutritional risk according to any nutrional screening tool, are assesed by a nurse experienced in clinical nutrition or dietitian in a more detailed form. This process is called nutritional assesment. Nutritional assessment should contain the following principles: - the assesment of nutritional balance – the assesment of body composition – the asssesment of inflammatory activity – the assesment of body functions (8).

ASPEN recommends to use clinical and biochemical parameters together to detect malnutrition. Based on this, SGA is a tool categorizing patients according to subjective records of patients and physical examination. It questions the patient's history containing weight loss, changes in nutrient intake, gastrointestinal symptoms and functional capacity. The physical examination part of SGA questions if there is an edema and/or ascite. It also looks at muscle and subcutane fat mass. Based on those criteria it categorizes patients into 3 groups which are A: well-nourished B: moderately malnourished C: severe malnutrition. SGA is a good tool in detecting malnutrition in impatient groups (6).

Nutritional balance

Detailed knowledge about nutritional intake is critical for assessing the patients nutrition. Diet history should assess energy, protein and micronutrient intake. The intake of the patient should be compared to the needs of the patient, and it should be assessed if nutrition of the patient will be better or worse (8). Questioning diet patterns gives us an idea about eating habits and probable nutritional deficiencies. The factors that may effect the patients' nutrient intake are 1) chewing and swallowing problems 2) gastrointestinal problems 3) changes in appetite and taste 4) meal times 5) nutrient intolerance and allergy 6) ability to eat without help 7) diet restrictions (such as vegetarianism or religious beliefs) (1).

Converting diet intake of the patients to nutrient intake requires using nutrient composition scales. The accuracy of those scales and bioavailability of those nutrients are limiting factors for assessing nutrient intake (6).

Body composition

Weight, height and BMI should be always assessed. There are also other anthropometric measurements that are not popular such as triceps skinfold thickness (TST) and mid upper

arm circumference (MUAC). Those should be used for immobil patients for whom measurement of weight and height is impossible (8).

The disease and inflammatory activity

The severity of the disease could be assesed by clinical examination, fever etc as well as the parameters showing the severity of the inflammation such as C-reactive protein, serum albumin, hemoglobin (8).

Functional assesment

The physical functions which could be affected by malnutrition could be good indicators. For example skeleton muscle function is affected by the decrease in nutrient intake and loss of muscle mass. Therefore keleton muscle function should be assesed. It could be assesed by assesing hand grip strength by using hand dynamometer (6).

2.2.2.3.The Techniques Used in Nutritional Assesment

Anthropometry

Anthropometry shows the anatomical changes related to nutrition (8). It is an indicator of protein and fat stores. When antropometric measurements are applied regularly they may assess the patient's nutrition well.

Body weight and height

Weight is the sum of fat, protein and water in the body. Oedema and ascites increase the water between cells. Therefore if there is oedema or ascites it will be hard to detect if there is a weight loss or not. In case of trauma, burn, infection, tumor it is hard to detect if there is a weight loss because of organ enlargement. If there is a quick weight loss in a fat person, or in a very thin elder person it is more suitable to calculate upper arm muscle field (6).

If there is an unintentional weight loss less than 5% in 3-6 months, it is a sign of mild nutritional change. If it is more than 10-15% it is an indicator of severe nutritional change (9).

Body mass index

Body mass index is calculated with the formula of weight (kg)/(height$^{2)}$(m^2). The categorization of body mass index is seen in table 7 (8).

Table 7. BMI classification

>30	Obesity
25-30	Overweight
20-25	Normal
18.5-20	Possible malnutrition
<18.5	Malnutrition

When BMI is lower than 12 in men and 10 in women it is rare to be alive of those patients. In elder patients height shortens, therefore BMI value of less than 22 indicates malnutrition. If the patient complains an unintentional weight loss in a near future, this also indicates malnutrition even if BMI is in normal ranges or the patients is obese (8).

In an elder, very thin or very ill person when the height could not be measured , knee height measurement is corrected according to gender and age and height is predicted (8).

World Health Organization (WHO) categorizes BMI as following: Underweight if the person's weight is less than 18.5, normal if it is between 18.5-24.9, overweight if it is between 25-29.9 and obese if it is equal to or more than 30 kg/m^2 (28).

Mid upper arm circumference

MUAC is a good indicator reflecting patients' nutritional status among other anthropometric measurements. It predicts lean muscle mass and it is widely used in nutritional asssessment and predict nutritional risks (29). There are studies implying that low MUAC level is correlated with increased mortality risks, and low quality of life (30). When it is impossible to measure the weight of the patients it is a useful method. MUAC reflects the sum of tissue, bone, muscle, water, fat mass. When MUAC and TST is used together, they predict muscle and fat mass better (8).

Triceps skinfold thickness

Body fat is a good indicator of nutritional state (31). The fastest and cheapest way of deciding body composition is to measure skinfold thickness. The assumption of measuring skinfold thickness is that subcutane fat mass thickness is a constant percentage of total fat mass in the body. Mostly skinfold thickness is measured at 4 different areas which are; triceps, biceps, subscapular and supra-iliac area. Measurement should be repeated at least three times and average of them should be taken (8).

The disadvantages of using skinfold is that 1) The measurement taken by different observers show differences 2) The caliper used by different observers may give different

results 3) The site that the measurement will be taken may differ from observer to observer (31).

5-15. percentiles of MUAC and TST according to age and gender reflect a moderate malnutrition , and values under 5. Percentile reflects a heavy malnutrition (8).

Laboratory tests

Laboratory tests are used in assessment of nutrition. Accuracy and precision is based on the preferred method. Personal differences, interpersonal differencers and laboratory differences effect te interpretition of those tests. The personal differences are diet, medicines, menstruation, exercise stres level and time. Race, age, gender are interpersonal differences (6).

Plasma proteins

Plasma proteins are important parts of visceral protein. Visceral protein is essential for oncotic pressure, tissue function, enzymatic processes. Albumin, transferrin, thyroxine-binding prealbumin and retinol-binding protein levels in blood help to assess nutrition. Low levels of those proteins is a sign of insufficient protein synthesis in the liver. Also many other factors may affect serum protein levels (6).

Albumin

The level of albumin in blood gives an idea about its synthesis in the liver. It has a half-life of 14-20 days. It is not a good indicator for malnutrition because it has a long half-life. Also its level in blood is affected by many other factors such as liver diseases and renal problems. In some catabolic cases, acute phase reactants cause a decrease in albumin levels. Therefore it is possible to mix low levels of albumin in this case with malnutrition (1). Physiological stress, increased metabolism rate, and some malign tumors cause an increase in albumin catabolism. Because half-life of albumin is long, serum albumin level could not assess acut nutritional changes (6).

Transferrin

It helps to carry iron in plasma. It has a short half life which is 8-10 days. It is affected by iron metabolism and it is not a good indicator for malnutrition (1). Even if it does not reflect malnutrition it is a good indicator of disease severity. It has a 18 day half life (8).

Creatinine

Creatinine occurs by degredation of creatin. It is an indicator of lean body mass. Ideal amount of it in urine collected in 24 hour is 23 mg/ ideal body mass (kg) in men, and 18 mg/ideal body mass (kg) in women (6).

The kreatin level in urine, reflects muscle mass. Kreatinin level in people with malnutrition is low (8). Its level is affected by meat consumption. Therefore the patient should not consume meat before the test and total urine in 24 hour should be collected correctly (6).

P**realbumin (Thyroxine-binding Prealbumin)**

It helps to carry thyroxine in blood. It has a half-life of 2-3 days. It is synthesized in the liver. Because it has a short half-life, it is very sensitive to detect malnutrition. Infection and trauma affect its levels. Therefore while assessing malnutrition, to be able to eliminate infection or catabolism factor some inflammatory indicators such as CRP should be assessed. If prealbumin decreases while CRP is stable malnutrition is possible (1).

Bioelectrical impedance analysis

It is a method to measure fat-free mass (FFM) and it is a method that is easily accessed to measure body composition. The mechanism of bioelectrical impedance analysis (BI) is based on a low-voltage current (32). The amount of voltage is not harmful for people. It measures the impedance via electrodes touching at hands and feet (8). As the current moves through the body, the conductivity lessens when the shape of the cell are rounder that currency face. Adipose tissue is composed of circular cells therefore conductivity lessens as fat mass increase in the body. Water, fat, muscle are the components of the body whose resistancy are different from eachother. There is a constant relationship between body composition and resistancy, therefore body composition could be measured by impedance (1).

3. SUBJECTS AND METHOD

The study was conducted between 7th of January- 7th of April in 2016 at Acibadem Kozyatagi Hospital. Study procedures were approved by the Research Ethics Committee of Acibadem University (Appendix) . The study was conducted with hospitalized adult cancer patients. Patients were excluded from the study if they were younger than 18 years old. The criteria for being included in the study was to have had any type of cancer in the past or recently. The patients were assessed nutritionally by using NRS-2002 (Appendix 2), SGA (Appendix 3) and anthropometry in 48 hours after being claimed to the hospital. Immobile and ajitated patients that is impossible to take anthropometric measurements and terminal stage patients were excluded from the study.

Before starting the study, informed consent was given to the patient or curator of the patient. The study was based on willingness, therefore only the patients who wanted to take part in the study were included.

After informed consent was signed by the patient or the curator, patients' weight and height were taken from patients' medical records. Patients' weight and height had been measured by nurses by using a digital scale (Seca 767) and their height was measured with a stadiometer attached to it. With the formula of kg/m^2, body mass index of patients was calculated by the researcher. Patients were categorized according to BMI classification of WHO.

Patients' MUAC was measured by using an inelastic tape. While the patient is lying on one side, the arm on another side was put on the body and palm was at open position. When the patient was at this position, the middle point between shoulder prominence (acromion) and elbow prominence (olecranon) was marked with a pen and the circumference of this point was measured with the tape and recorded. The values taken were in centimeters. Measurements were taken from right or left arm depending on the patient's desire because sometimes they could have pain or a vascular access at any arm. In this case other arm was preferred.

TST was another anthropometric measurement that was taken from the patients. TST was measured at one finger above from the midpoint between acromion and olecranon with Holtain Skinfold caliper. The measurement was repeated for three times and average of them was taken. MUAC and TST values were categorized according to National Center for Health Statistics (NCHS) (Appendix 4).

Patients were categorized as at nutritional risk (NRS-2002 score≥3) or without malnutrition risk (NRS-2002 score<3) according to NRS-2002. According to SGA;

patients were classified into three groups; SGA-A: well-nourished, SGA-B: moderately malnourished and SGA-C: severely malnourished.

In the analysis of the study SPSS V22.0 was used. In group comparisions chi-square test and variance analysis (one way ANOVA) was used. In realtionship analysis Pearson correlation coefficient was used.

4. FINDINGS

This study was conducted with 59 patients. There were missing data in the study in that MUAC and TST could not be measured for 12 patients because they delayed or refused the measurements, therefore only NRS-2002 and SGA was applied to those patients. Also one of the patient's MUAC and TST was measured but other anthropometric measurements could not be taken because the patient was immobile at that moment. 28 of the 59 patients included in the study were women (47.5 %) and 31 of them were men (52.5 %). The mean age of them was 56.05 (± 15.03). The youngest one was 18 and the oldest one was 83 years old. The cancer type of the patients included in the study were as following: 23 with hematologic cancer (39%), 11 with gastrointestinal cancer (19%), 8 with gynecologic cancer (14%), 7 with aspiratory system cancer (12%), 4 with breast cancer (7%), 3 with head and neck cancer (5%), 2 with skeleton system cancer (3%) and 1 with genitourinary system cancer (2%) (Table 8).

Table 8. Diagnosis of patients

DIAGNOSIS	NUMBER OF PATIENTS (n)	PERCENTAGE %
Hematologic cancer	23	39.0
Gastrointestinal system cancer	11	18.6
Gynecologic cancer	8	13.6
Aspiratory system cancer	7	11.9
Breast cancer	4	6.8
Head and neck cancer	3	5.1
Skeleton system cancer	2	3.4
Genitourinary system cancers	1	1.7

The average body mass index of patients was 25.12 ± 5.4. Patients were categorized according to BMI categorization of WHO. Table 2 shows the cut off points according to BMI and the number of patients in each category.

Table 9. BMI categorization of patients

BMI	Number of patients	Percentage (%)
< 18.50	5	8.6
18.50-24.99	23	39.7
25.00-29.99	20	34.5
≥ 30.00	10	17.3

Patients' MUAC and TST were categorized according to NCHS. 22.7 % of the patients was under 5th percentile of MUAC categorization and 6.8 % of them was under 5th percentile of TST categorization. The categorization of MUAC and TST could be seen in table 10 and 11 respectively.

Table 10. Mid upper arm circumference categorization of patients

Mid arm circumference percentile	Number of patients (n)	Percentage (%)
< 5. Percentile	10	22.7
5-10. percentile	3	6.8
10-25. percentile	8	18.2
25-50. percentile	7	15.9
50-75. percentile	6	13.6
75-90. percentile	7	15.9
>95. Percentile	3	6.8

Table 11 : Triceps skinfold thickness of patients

Triceps skinfold thickness percentile	Number of patients (n)	Percentage (%)
< 5. Percentile	3	6.8
5-10. percentile	2	4.5
10-25. percentile	1	2.3
25-50. percentile	5	11.4
50-75. percentile	9	20.5
75-90. percentile	10	22.7
90-95. percentile	4	9.1
>95. Percentile	10	22.7

Age was not significantly associated with BMI, NRS-2002, SGA, weight loss (in last 3 and 6 months) (Table 12). And when it comes to gender, statistically significant relationship was only found with SGA categories. According to SGA the number of well nourished women number is higher than men. And also the number of men with severe malnutrition is more than women (p: 0.011; $p < 0.05$) (Table 13).

Table 12: The relationship between BMI, NRS, SGA, weight loss and age

BMI	N	A.A. ±S.D.	P
<18.50	5	47,6 ± 16,18	0,289
18.50- 24.99	23	55,91 ± 16,69	
25.00- 29.99	20	55,2 ± 14,81	
≥30.00	10	63,1 ± 9,59	
NRS-2002	N	A.A.±S.D.	P
≥3	24	55,17 ± 16,8	0,760
<3	34	56,41 ± 14,04	
SGA	N	A.A.±S.D.	P
A	34	56,82 ± 14,71	0,656
B	9	57,56 ± 10,39	
C	15	52,8 ± 18,54	
Weight loss (in last 3 months)	N	A.A. ±S.D.	P
<%5	4	58,25 ± 10,24	0,178
%5-10	16	54,94 ± 12,65	
>%10	12	48,42 ± 19,2	
No weight loss	25	60,04 ± 14,5	
Weight loss (in last 6 months)	N	A.A.±S.D.	P
<%5	5	61 ± 10,79	0,456
%5-10	12	53,5 ± 14,14	
>%10	18	52,61 ± 17	
No weight loss	22	59,09 ± 15,05	

Table 13: The relationship analysis between BMI, NRS-2002, SGA, weight loss percentage and gender

BMI		Gender		P
		Male	Female	
<18.50	n (%)	2 (40)	3 (60)	0,868
18.50- 24.99	n (%)	10 (43)	13 (57)	
25.00- 29.99	n (%)	11 (55)	9 (45)	
≥30.00	n (%)	5 (50)	5 (50)	
SGA		Gender		P
		Male	Female	
A	n (%)	12 (35,3)	22 (64,7)	0,011
B	n (%)	3 (33,3)	6 (66,7)	
C	n (%)	12 (80)	3 (20)	
Weight loss (in last 3 months)		Gender		P
		Male	Female	
<%5	n (%)	1 (25)	3 (75)	0,164
%5-10	n (%)	7 (44)	9 (56)	
>%10	n (%)	9 (75)	3 (25)	
No weight loss	n (%)	10 (40)	15 (60)	
Weight loss (in last 6 months)		Gender		P
		Male	Female	
<%5	n (%)	2 (40)	3 (60)	0,249
%5-10	n (%)	4 (33)	8 (67)	
>%10	n (%)	12 (67)	6 (33)	
No weight loss	n (%)	9 (41)	13 (59)	

In our patient group gynecological cancers and breast cancer are most prevalant among women than men (p: 0,001; p< 0.05). Also, in our study group gastrointestinal system cancers and hematological cancers are the most prevalant ones among both in women and men (Table 14).

Table 14: Relationship analysis between diagnosis groups and gender

Diagnosis	Gender		P
	Male	Female	
Gastrointestinal system cancers	6 (55)	5 (45)	0,011*
Genitourinary system cancers	1 (100)	0 (0)	
Gynecological cancers	0 (0)	8 (100)	
Breast cancer	0 (0)	4 (100)	
Head and neck cancer	3 (100)	0 (0)	
Skeleton system cancer	2 (100)	0 (0)	
Aspiratory system cancer	4 (57)	3 (43)	
Hematological cancers	12 (52)	11 (48)	

*p<0,05

The association between diagnosis groups and NRS-2002 is significant (p:0.021; p<0.05) in that the patients at malnutrition risk are mostly the ones with gastrointestinal system cancer, aspiratory system cancer and hematological cancers. And also the patients that do not carry any malnutrition risk are the ones with gastrointestinal system and hematological cancers (Table 15).

Tablo 15: The relationship analysis between diagnosis groups and NRS-2002

Diagnosis	NRS-2002		P
	≥3	<3	
Gastrointestinal system cancers	5 (45)	6 (55)	0,021*
Genitourinary system cancers	1 (100)	0 (0)	
Gynecological cancers	0 (0)	8 (100)	
Breast cancer	0 (0)	4 (100)	
Head and neck cancers	2 (67)	1 (33)	
Skeleton system cancers	1 (50)	1 (50)	
Aspiratory system cancers	6 (86)	1 (14)	
Hematological cancers	9 (41)	13 (59)	

*p<0,05

When we look at the relationship between diagnosis groups and SGA results there is a significant relationship between them (p: 0,006; p<0.05) in that the patients with severe malnutrition are the ones with gastrointestinal system cancer and the well nourished ones are the ones with gynecolgic, breast, aspiratory and mostly hematological cancers (Table 16) .

Tablo 16: The relationship analysis between diagnosis groups and SGA

Diagnosis	SGA			P
	A n (%)	B n (%)	C n (%)	
Gastrointestinal system cancers	1 (9)	4 (36)	6 (55)	0,006*
Genitourinary system cancers	0 (0)	0 (0)	1 (100)	
Gynecological cancers	4 (50)	2 (25)	2 (25)	
Breast cancer	4 (100)	0 (0)	0 (0)	
Head and neck cancers	1 (33)	0 (0)	2 (67)	
Skeleton system cancers	1 (50)	1 (50)	0 (0)	
Aspiratory system cancers	4 (57)	2 (29)	1 (14)	
Hematologcal cancers	19 (86)	0 (0)	3 (14)	

*p<0,05

The relationship between MUAC, TST and NRS-2002 was not statistically significant (p:0,372, p:0,178 respectively, p>0.05) . The patients that do not carry any nutritional risk have higher mid arm circumference and triceps skinfold thickness, even if the relationship is not significant (Table 17). When the relationship between midarm circumference and SGA was analyzed there was not any significant relationship between them (p:0,369). The relationship between triceps skinfold thickness and SGA was significant (p: 0,000, p< 0.05). The patients who do not carry any malnutrition risk have higher triceps skinfold thickness values (Table 18).

Table 17: The relationship analysis between MUAC and NRS-2002

MUAC	NRS 2002		P
	≥3	<3	
<5.percentile	5 (50)	5 (50)	0,372
5-10.percentile	1 (33)	2 (67)	
10-25.percentile	4 (50)	4 (50)	
25 - 50.percentile	3 (43)	4 (57)	
50 - 75. Percentile	4 (67)	2 (33)	
75 - 90. Percentile	1 (14)	6 (86)	
90-95. percentile	0 (0)	0 (0)	
> 95.percentile	0 (0)	3 (100)	
TST	NRS 2002		P
	≥3	<3	
<5.percentile	1 (33)	2 (67)	0,178
5-10.percentile	2 (100)	0 (0)	
10-25.percentile	1 (100)	0 (0)	
25 - 50. Percentile	3 (60)	2 (40)	
50 - 75. Percentile	2 (22)	7 (78)	
75 - 90. Percentile	2 (20)	8 (80)	
90-95. percentile	3 (75)	1 (25)	
> 95. Percentile	4 (40)	6 (60)	

Table 18: The relationship analysis between SGA and MUAC with TST

MUAC	SGA			P
	A	B	C	
<5.percentile	3 (30)	4 (40)	3 (30)	0,369
5-10. percentile	2 (67)	1 (33)	0 (0)	
10-25. percentile	5 (63)	0 (0)	3 (37)	
25-50. percentile	6 (86)	0 (0)	1 (14)	
50 -75. percentile	3 (50)	1 (17)	2 (33)	
75 - 90. percentile	5 (71)	0 (0)	2 (29)	
90-95. percentile	0 (0)	0 (0)	0 (0)	
> 95.percentile	1 (33)	1 (33)	1 (33)	
TDKK	SGA			P
	A	B	C	
<5. percentile	0 (0)	3 (100)	0 (0)	0,000*
5-10. percentile	1 (50)	0 (0)	1 (50)	
10-25. percentile	0 (0)	1 (100)	0 (0)	
25 - 50. percentile	5 (100)	0 (0)	0 (0)	
50 - 75. percentile	4 (44)	0 (0)	5 (56)	
75 - 90. percentile	8 (80)	2 (20)	0 (0)	
90-95. percentile	3 (75)	1 (25)	0 (0)	
> 95.percentile	4 (40)	0 (0)	6 (60)	

NRS-2002 and SGA could be applied to 58 of 59 patients. When patients' NRS-2002 scores evaluated it was found that 41% of the patients is under nutritional risk (NRS-2002 score≥3) and remaining 59% should be screened once a week (NRS-2002 score<3) and they do not carry any nutritional risk. Table 19 shows the frequency and percentage of patients under nutritional risk or not. When those patients categorized according to their SGA results; the percentage of the patients is as following: 59% of the patients well nourished (SGA-A), 15% of the patients is moderately malnourished (SGA-B), and 26% of the patients have severe malnutrition (SGA-C) (Table 20).

Table 19. Prevalance of malnutrition according to NRS-2002

NRS-2002 Score	Number of patients (n)	Percentage (%)
≥ 3	24	41.4
<3	34	58.6

Table 20. Prevalance of malnutrition according to SGA

SGA	Number of patients (n)	Percentage (%)
A	34	58.6
B	9	15.5
C	15	25.9

When the relationship between BMI values and NRS-2002 is analyzed, there are differences in BMI values of patients according to NRS-2002 scores, in that the patients who do not carry any nutritional risk (NRS-2002 score<3) have higher BMI according to the ones at nutritional risk (NRS-2002 score≥3) (p:0.014, p< 0.05). Table 21 shows the relationship analysis between BMI values and NRS-2002. However, when the patients were categorized according to BMI classification of WHO, the result was statistically insignificant (p:0.163, p>0,05). 80% of the patients carrying nutritional risk was underweight (BMI<18.5), 48% of them was normal (BMI 18.50-24.99), 35% of them was overweight (BMI 25.00-29.99) and 22% of them was obese (BMI≥30.00) (Table 22).

Table 21. Relationship analysis between NRS-2002 score and BMI values of patients

BMI

NRS-2002 Score	Number of patients (n)	Arithmetic average	P
≥3	24	22.99 ± 5.03	0.014
<3	33	26.5 ± 5.22	

p<0.05

Table 22: The relationship analysis between BMI groups and NRS-2002

BMI	NRS 2002		P
	≥3	<3	
<18.50	4 (80)	1 (20)	0,163
18.50- 24.99	11 (48)	12 (52)	
25.00- 29.99	7 (35)	13 (65)	
≥30.00	2 (22)	7 (78)	

When it comes to the relationship between BMI and SGA there isn't any differences between the BMI averages of the SGA groups (A,B,C) (Table 23) . The highest BMI value is seen in the well-nourished group while the lowest value is seen in the patients

with severe malnutrition. When the relationship between BMI categories and SGA is analyzed there is not significant relationship (Table 24).

Table 23. The relationship analysis between SGA scores and BMI values of patients

	BMI		
SGA	Number of patients	Arithmetic average	P
A	33	25.87 ±5.09	0.291
B	9	24.93 ±6.47	
C	15	23.21 ±5.27	

Table 24: The relationship analysis between SGA scores and BMI categories of patients

BMI	SGA			P
	A	B	C	
<18.50	1 (20)	1 (20)	3 (60)	0,125
18.50- 24.99	12(52)	4 (17)	7 (30)	
25.00- 29.99	16(80)	1 (5)	3 (15)	
≥30.00	4 (44)	3 (33)	2 (22)	

The relationship between NRS-2002 and SGA is significant (p: 0.020, p<0.05) in that the patients under nutritional risk (NRS-2002 score≥3) are also have severe malnutrition (SGA score C) , and the ones that do not carry any nutritional risk according to NRS-2002 are the well nourished ones according to SGA (Table 25).

Table 25. The relationship analysis between NRS-2002 and SGA

	SGA		
NRS	A	B	C
≥3	9 (37.5)	5 (20.8)	10 (41.7)
<3	25 (73.5)	4 (11.8)	5 (14.7)

In the correlation analysis between methods, there is a negative and significant relationship between NRS-2002 scores and SGA. This shows us that patients who have

modarete or heavy malnutrition according to SGA (SGA B and SGA C respectively) also have malnutrition according to NRS-2002 (NRS-2002 score ≥3). There is also a positive and significant relationship between NRS-2002 and BMI, in that as the patients' BMI increased malnutrition risk according to NRS-2002 decreased (Table 26).

Table 26: Correlation analysis between tools

	Diagnosis	Age	BMI	WL[1](3m)	WL[2](6m)	NRS-2002	SGA	MUAC	TST
Diagnosis									
Age	-,037								
BMI	,185	,213							
WL[1](3 m)	**,484****	,116	,070						
WL[2](6 m)	,279*	,057	,042	**,829****					
NRS-2002	-,136	,041	**,286***	,086	,000				
SGA	**-,472****	-,104	-,204	**-,360****	-,146	**-,361****			
MUAC	,195	-,030	**,785****	,150	,122	,225	-,057		
TST	**,353***	-,115	**,462****	,278	,298	,101	,049	**,567****	

[1]Weight loss in last 3 months, [2]Weight loss in last 6 months, *p<0,05, **p<0,01

5. DISCUSSION

In our study the most prevalent cancer types were hematological and gastrointestinal system cancers. They were the most prevalent cancer types seen both in men and women. According to US National Cancer Institute reports the most prevalent cancer types seen in 2016 were breast, lung, bronchus, prostate, colon and rectum, bladder, melanoma, non-Hodgkin lymphoma, thyroid, kidney and renal pelvis, leukemia, endometrial and pancreatic cancers (33).

When we screened patients nutritionally by using NRS-2002, the nutritional risk prevalence among cancer patients was 41% according to NRS-2002. In another study conducted by a group of researcher with 1453 cancer patients, the patients' nutritional status were screened by using NRS-2002. According to the study 32% of those patients were under nutritional risk (NRS-2002 score ≥3) (34).

In our study, 41% of the patients were under nutritional risk according to NRS-2002, and 59% of them were well nourished (SGA-A) , 15% were moderately malnourished (SGA-B) and 26% of them were with severe malnutrition (SGA-C) according to SGA. The rate of malnutrition in the literature changes between 15% and 78% (1, 15, 35-38). According to a study conducted by Gundogdu and friends 107 patients with gastrointestinal system cancer were assesed by using NRS-2002 and SGA. The patients having a NRS-2002 score≥3 and the patients having a SGA score of B and C were accepted as under nutritional risk. According to the study 72% of the patients were under nutritional risk according to NRS-2002, and 78% of the were under nutritional risk according to SGA (38) . In previous studies trying to detect malnutrition prevalence in oncology patients by using NRS-2002 and SGA, malnutrition rates change between 15% and 78 % (1, 36-39). The changes in rates may be related to different patients with different diseases having different pathologies. The reason for a high rate of malnutrition that we have found in our study may be that the study was conducted in medical oncology treatment service in which the patients' complications increased.

When it comes to the concordance between NRS-2002 and SGA; in our study there was a significant relationship between NRS-2002 (NRS-2002 score≥3) and SGA (SGA B and C) in that the patients that do not have a nutritional risk are the well-nourished ones according to SGA (p:0.02, $p<0.05$). In a study conducted by Ozturk and friends 603 patients were assessed by NRS-2002 and SGA at hospital admission. There was a significant difference between NRS-2002 and SGA results as a result of chi-square test

($p<0.001$). There was a 66.2% concordance between the patients at malnutrition risk according to NRS-2002 and the patients with malnutrition or having malnutrition risk according to SGA. However, 33.8% of the normal patients according to SGA were at malnutrition risk (38). In another study conducted by Leandro-Merhi VA and Brage de Aqino 500 patients with cancer or digestive tract diseases were assesed by using NRS and SGA and anthropometric measurements. According to the study there was a good agreement between NRS-2002 and SGA, but agreement of those with anthropometry was poor (39). One of the aims of our study was to look at the concordance between NRS-2002 and SGA in detecting malnutrition. They both found the same rate of malnutrition in that the rate of patients with malnutrition according to NRS-2002 was 41% and 41% according to SGA (SGA B and C).

In other study investigating the role of SGA in nutritional assesment, 751 patients with gastrointestinal cancer were assessed by SGA and their anthropometric measurements were taken. According to the results 51.8% of the patients were well-norished (SGA-A), 44.2% of the patients were with mild/moderate malnutrition (SGA-B) and 4% of the patients were in the severely malnourished group (SGA-C). According to the relationship analysis between SGA and anthropometry the result was that the patients with severe malnutrition are the ones having lower BMI values, and TST levels and vice versa ($p<0.05$). In our study 59% of the patients were in SGA-A category, 15% of the patients were in SGA-B group and 26% of the patients were in SGA-C group. In contrast of this study we did not found any significant relationship between SGA categories and BMI values of the patients. And similar to the study there was a significant relatinship between SGA-category and triceps skinfold thickness (35). In our study we looked at the relationship of SGA categories with both BMI values of patients and BMI categories of WHO. When we looked at the relationship between SGA and BMI categories of WHO, we could not find a significant relationship. Also, in another study conducted by Almeida and friends, 300 surgical patients were assessed at hospital admission by NRS-2002, SGA, MUST, Nutritional Risk Score (NRI), BMI and % weight loss. The comparision was made by using BMI categories of WHO, and the lowest agreement betwen methods was the one between BMI and SGA (40). Also in another study conducted by Baccaro and Sanchez SGA and BMI were compared in detecting nutritional status of male patients admitted in a medical service. According to SGA 48.7% of patients was malnourished (SGA B and SGA C) . According to BMI results only 9.9 % of the patients were malnourished. There wasn't any association found between SGA and BMI (41) . We

concluded that the concordance between SGA and BMI was not good enough in predicting malnutrition.

We could not found any significant relationship between malnutrition level according to NRS-2002 and MUAC of the patients. In China, 142 surgical elderly patients' nutrition were assessed by using two tools one of which is NRS-2002 and anthropometry. According to the research as the level of malnutrition level of the patients increased according to NRS-2002, the mid-arm circumference of the patients decreased ($p< 0.05$) (42) . Another study aiming to detect the malnutrition prevalence in hospitalized patients also compared NRS-2002 and MUAC. According to the study there was not a statistically significant association between NRS-2002 and MUAC. The relationship between NRS-2002 and TST is not significant as it was supported by other some studies in the literature (14).

In our study there wasn't a significant relationship between MUAC and SGA groups. In a prospective cohort study conducted with 1022 adult impatients in Canada, patients were assessed by using SGA, NRS-2002, and anthropometry. MUAC was one of the anthropometric measuerements to detect malnutrition. MUAC did not differ between SGA groups (SGA-A, SGA-B, and SGA-C) (43).

When we look at the relationship between BMI and NRS-2002 in our study, there was not a significant relationship between them when the patients were categorized according to WHO's BMI classification (p: 0,163). However, there was a significant relationship between NRS-2002 scores and BMI values of the patients, in that the patients who do not have a malnutrition risk have higher BMI values compared to the ones having malnutrition risk. When it comes to SGA scores and BMI relationship there was not a significant relationship between them both when BMI was categorized according to WHO classification and BMI values.

In a study conducted by Borek and friends, 292 impatients with chronic kidney diseases were nutritionally assessed by using NRS-2002, SGA and anthropometric measurements. 119 (41%) of patients were at malnutrition risk according to NRS-2002. According to SGA the risk was 41% (120 of the patients) (SGA B and C). In the study only 8.4% of the malnourished patients had a BMI less than 18.5. Therefore in the study it was concluded that BMI was not competent to assess the nutritional status of impatient groups (44).

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ACIBADEM
ÜNİVERSİTESİ

SAYI: ATADEK-2015/15
KONU: Etik Kurul Kararı

30 Aralık 2015

Sayın Nur Ecem Baydı

Sorumluğunu yürüttüğünüz **"Yetişkin Onkoloji Hastalarında Malnutrisyon Durumunun Saptanması"** başlıklı proje 24.12.2015 tarih 2015/15 Sayılı Atadek Kurul Toplantısında görüşülmüş olup 2015-15/6 karar numarası ile tıbbi etik yönden uygun bulunmuştur.

Prof.Dr. İsmail Hakkı ULUS
ATADEK Kurul Başkanı

Tablo 8. Nütrisyon riski taraması (Nutritional Risk Screening 2002)

İlk Bölüm: Başlangıç taraması

1	BKİ < 20.5?	Evet	Hayır
2	Son 3 ay içinde kilo kaybı var mı?		
3	Geçen hafta içinde besinsel alımında azalma var mı?		
4	Şiddetli bir hastalık var mı? (yoğun bakım vb.)		

Evet: Eğer herhangi bir sorunun yanıtı evet ise, ikinci bölüme geçilir.
Hayır: Eğer tüm soruların yanıtı hayır ise, hasta haftalık olarak yeniden taranır. Eğer majör bir operasyon planlanıyorsa, olası risk durumlarına karşı "önlem niteliğinde" bir nütrisyon tedavi planı geliştirilir.

İkinci Bölüm: Son tarama

Nütrisyon durumundaki bozulma		Hastalığın şiddeti (gereksinimlerde artış)	
Yok **Skor 0**	Normal nütrisyon durumu	Yok **Skor 0**	Normal besinsel gereksinimler
Hafif **Skor 1**	3 ayda > %5 kilo kaybı ya da geçen haftaki besin alımı normal gereksinimlerin %50-75'inin altında	Hafif **Skor 1**	Kalça Kemiğinde Kırık* Özellikle akut komplikasyonları olan kronik hastalar: siroz*, KOAH*, *kronik hemodiyaliz, diyabet, onkoloji*
Orta **Skor 2**	2 ayda > %5 kilo kaybı ya da BKİ 18.5-20.5 + genel durum bozukluğu ya da geçen haftaki besin alımı normal gereksinimlerin %25-50'si	Orta **Skor 2**	Majör abdominal cerrahi*, inme*, *şiddetli pnömoni, hematolojik malignite*
Şiddetli **Skor 3**	1 ayda > %5 kilo kaybı (3 ayda > %15) ya da BKİ < 18.5 + genel durum bozukluğu ya da geçen haftaki besin alımı normal gereksinimlerin %0-25'i	Şiddetli **Skor 3**	Kafa travması*, kemik iliği transplantasyonu*, *yoğun bakım hastaları (APACHE > 10)*
Skor:	+	**Skor**	= Toplam skor
Yaş	≥ 70 yaş ise toplam skora 1 ekle	**= yaşa uyarlanmış toplam skor**	

Skor > 3: Hasta nütrisyon riski altındadır ve bir nütrisyon planı yapılır.

Skor < 3: Haftada bir taranmalı. Majör operasyon planlanıyorsa bir nütrisyon planı geliştirilmelidir.

NRS-2002 mevcut randomize klinik çalışmalara dayanmaktadır. * işaretli tanısı olan hastaların kategorizasyonunu doğrudan destekleyen bir çalışma var. İtalik gösterilen tanılar aşağıda verilen prototiplere dayanmaktadır. Nütrisyon riski, o andaki nütrisyon durumu ve bunun stres metabolizması nedeniyle artan gereksinimlere bağlı olarak bozulması riski şeklinde tanımlanır.

Nütrisyon destek planı şu hastalarda endikedir:
(1) şiddetli malnütrisyonda (skor = 3) ya da (2) ağır hasta (skor = 3) ya da (3) orta derecede malnütrisyon + hafif hasta (skor 2 + 1) ya da (4) hafif malnütrisyon + orta derecede hasta (skor 1 + 2)

Hastalığın derecesine ilişkin prototipler:

Skor= 1: Kronik hastalığı olup komplikasyonlar nedeniyle hastaneye yatan bir hasta. Halsiz-düşkün durumdadır ancak düzenli olarak yataktan kalkabilir. Protein gereksinimleri artmıştır ancak oral diyet ya da suplemanlarla karşılanabilir.

Skor= 2: Majör abdominal cerrahi gibi bir hastalık nedeniyle yatağa bağlı bir hasta. Protein gereksinimleri yüksek, klinik beslenme yöntemleri gerekli ve bu sayede açıkları kapatılabilir.

Skor= 3: Ventilasyon desteği altındaki yoğun bakım hastası. Protein gereksinimleri yüksek ve klinik beslenme yöntemleriyle karşılanamıyor.

Tablo 7. Subjektif global değerlendirme

A. Öykü

1. Ağırlık değişimi

   Geçen 6 ayda genel kayıp : ..... kg %kayıp.....

   Geçen 2 haftada değişim : ..... Artış ..... Değişim Yok ..... Azalma

2. Normale göre besin alımında değişim

   Değişim yok .....

   Değişim : ..... Gün ..... Hafta

   Tip : Suboptimal katı diyet..... Tam sıvı diyet .....

   Hipokalorik sıvı ..... Açlık .....

3. Gastrointestinal semptomlar (2 haftadır süren)

   Yok ..... Bulantı ..... Kusma ..... İshal ..... İştahsızlık .....

4. Fonksiyon kapasitesi

   Disfonksiyon yok .....

   Disfonksiyon :..... Gün ..... Hafta

   Tip : Suboptimal çalışma ..... Ambulatuar ..... Yatalak .....

5. Hastalık ve nütrisyonel gereksinimlerle olan ilgisi

   Birincil tanı : .....

   Metabolik gereksinim : Stres: Yok ..... Düşük ..... Orta ..... Yüksek .....

B. Fizik Muayene (her biri için belirtin: 0 = normal, 1+ = hafif, 2+ = orta, 3+ = ağır)

Cilt altı yağ kaybı (triseps, göğüs) .....

Kas kitlesi kaybı (kuadriseps, deltoidler) .....

Ayak bileği ödemi ..... Sakral ödem ..... Asit .....

C. Subjektif Global Değerlendirme Puanlaması

İyi beslenen	A .....
Orta derecede malnütrisyonlu	B .....
Ağır malnütrisyon	C .....

- A: %5 kilo kaybı olanları veya %5'ten fazla kayıp fakat son zamanlarda kazanç veya iştah düzelmesini gösterir.
- B: Son dönemde düzelme olmaksızın %5 ile %10 arası kilo kaybı, düşük alım ve subkütan dokunun ılımlı kaybını gösterir.
- C: Ciddi subkütan doku kaybı ve sıklıkla ödem ve %10'dan fazla kilo kaybı ile beraberdir.

Tablo 6: 18-74 Yaş Grubu Erkeklerde Triseps Deri Kıvrım Kalınlığı, Üst Orta Kol Çevresi, Üst Orta Kol Kas Çevresi ve Kas Alanı Referans Değerleri – NCHS

Triseps Deri Kıvrım Kalınlığı (mm)

Yaş (yıl)	X̄ (cm²)	Persentiller 5	10	25	50	75	90	95
18-74	12.0	4.5	6.0	8.0	11.0	15.0	20.0	23.0
18-24	11.2	4.0	5.0	7.0	9.5	14.0	20.0	23.0
25-34	12.6	4.5	5.5	8.0	12.0	16.0	21.6	24.0
35-44	12.4	5.0	6.0	8.5	12.0	15.5	20.0	23.0
45-54	12.4	5.0	6.0	8.0	11.0	15.0	20.0	25.5
55-64	11.6	5.0	6.0	8.0	11.0	14.0	18.0	21.5
65-74	11.8	4.5	5.5	8.0	11.0	15.0	19.0	22.0

b. Üst Orta Kol Çevresi (cm)

Yaş (yıl)	X̄ (cm²)	Persentiller 5	10	25	50	75	90	95
18-74	31.8	26.4	27.6	29.6	31.7	33.9	36.0	37.3
18-24	30.9	25.7	27.1	28.7	30.7	32.9	35.5	37.4
25-34	32.3	27.0	28.2	30.0	32.0	34.4	36.5	37.5
35-44	32.7	27.8	28.7	30.7	32.7	34.8	36.3	37.1
45-54	32.1	26.7	27.8	30.0	32.0	34.2	36.2	37.6
55-64	31.5	25.6	27.3	29.6	31.7	33.4	35.2	36.5
65-74	30.5	25.3	26.5	28.5	30.7	32.4	34.4	35.5

Tablo 7: 18-74 Yaş Grubu Kadınlarda Triseps Deri Kıvrım Kalınlığı, Üst Orta Kol Çevresi, Üst Orta Kol Kas Çevresi ve Kas Alanı Referans Değerleri – NCHS

Triseps Deri Kıvrım Kalınlığı (mm)

Yaş (yıl)	X̄	Persentiller 5	10	25	50	75	90	95
18-74	23.0	11.0	13.0	17.0	22.0	28.0	34.0	37.5
18-24	19.4	9.4	11.0	14.0	18.0	24.0	30.0	34.0
25-34	21.9	10.5	12.0	16.0	21.0	26.5	33.5	37.0
35-44	24.0	12.0	14.0	18.0	23.0	29.5	35.5	39.0
45-54	25.4	13.0	15.0	20.0	25.0	30.0	36.0	40.0
55-64	24.9	11.0	14.0	19.0	25.0	30.5	35.0	39.0
65-74	23.3	11.5	14.0	18.0	23.0	28.0	33.0	36.0

b. Üst Orta Kol Çevresi (cm)

Yaş (yıl)	X̄	Persentiller 5	10	25	50	75	90	95
18-74	29.4	23.2	24.3	26.2	28.7	31.9	35.2	37.8
18-24	27.0	22.1	23.0	24.5	26.4	28.8	31.7	34.3
25-34	28.6	23.3	24.2	25.7	27.8	30.4	34.1	37.2
35-44	30.0	24.1	25.2	26.8	29.2	32.2	36.2	38.5
45-54	30.7	24.3	25.7	27.5	30.3	32.9	36.8	39.3
55-64	30.7	23.9	25.1	27.7	30.2	33.3	36.3	38.2
65-74	30.1	23.8	25.2	27.4	29.9	32.5	35.3	37.2