T.C
YEDİTEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF NUTRITION AND DIETETICS

INVESTIGATION OF THE CONSISTENCY OF THE SCREENING TOOLS USED TO DETERMINE MALNUTRITION PREVALENCE IN HEMODIALYSIS PATIENTS

MASTER THESIS

ASLIHAN ÖZKAN

İstanbul, 2022

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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.

20.05.2022

Aslıhan ÖZKAN

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LIST OF ABBREVIATIONS

ASPEN	American Association of Parenteral and Enteral Nutrition
BAPEN	British Association of Paranteral and Enteral Nutrition
BMI	Body Mass Index
BMR	Basal Metabolic Rate
BUN	Blood Urea Nitrogen
CRF	Chronic Renal Failure
CRP	C-Reactive Protein
DM	Diabetes Mellitus
ERA	European Renal Association
ESPEN	European Society of Clinical Nutrition and Metabolism
GFR	Glomerular Filtration Rate
HD	Hemodialysis
IGF	Insulin-Like Growth Factor
KDIGO	Chronic Kidney Disease Evaluation and Management Guideline
MNA	Mini Nutritional Assesment
MST	Malnutrition Screening Tool
MUAC	Upper Middle Arm Circumference
MUST	Malnutrition Universal Screening Tool
NHANES	National Health and Nutrition Examination Survey
NRS	Nutritional Risk Screening
PD	Peritoneal Dialysis
PEM	Protein Energy Malnutrition
REE	Resting Energy Expenditure

RRT	Renal Replacement Therapy
RT	Renal Transplantation
SGA	Subjective Global Assessment
SNAQ	Short Nutritional Assesment Questionnaire
TND	Turkish Society of Nephrology
TST	Triceps Skinfold Thickness
WHO	World Health Organization
MIS	Malnutrition Inflammation Score

ABSTRACT

Ozkan, A. (2022). Investigation Of The Consistency Of The Screening Tools Used to Determine Malnutrition Prevalence in Hemodialysis Patients. Yeditepe University, Institute of Health Science, Department of Nutrition and Dietetics, MSc thesis, İstanbul.

Patients receiving dialysis treatment due to end-stage renal failure have various metabolic and nutritional disorders. Malnutrition is a common complication in patients undergoing hemodialysis and can adversely affect the results of treatment. Therefore, it is vital to determine the presence and degree of malnutrition in hemodialysis patients by using various screening methods. Our study was conducted with 121 patients receiving hemodialysis treatment at Özel Ada Dialysis Center. The study was planned to determine the prevalence of malnutrition in this patient group with two screening tools, Nutritional Risk Screening-2002 (NRS-2002) and Subjective Global Assessment (SGA), and to examine the consistency between the two screening tools. Patients were included in the study voluntarily. After the patient approval, NRS-2002 and SGA tests were applied first and the presence and degree of malnutrition were determined according to the responses of the patients. Then, body weight, height, body mass index, skinfold thickness, and mid-upper arm circumference measurements were taken as anthropometric measurements of the patients and the consistency of these measurements between NRS-2002 and SGA was examined. According to our results, the presence of malnutrition was found to be 14% according to NRS-2002, while the presence of malnutrition was found to be 12.4% according to SGA. The relationship between NRS-2002 and SGA was found to be statistically significant ($p<0.05$). In the anthropometric measurements of the patients, while a statistically significant and inverse relationship ($p<0.05$) was found between the skinfold thickness and SGA, no relationship was found with NRS-2002 ($p>0.05$). In the mid-upper arm circumference measurements, a statistically significant and inverse relationship was found with both screening tools (NRS-2002 and SGA) ($p<0.05$). Due to the compatibility between the two screening tools, it is thought that using only one of them will be sufficient to detect malnutrition, and it will save time and cost.

Keywords:, hemodialysis, malnutrition, NRS, SGA

ÖZET

Özkan, A. (2022). Hemodiyaliz Hastalarında Malnutrisyon Prevelansının Saptanmasında Kullanılan Tarama Araçlarının Birbirleriyle Olan Tutarlılığının İncelenmesi. Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü, Beslenme ve Diyetetik Bölümü, Master Tezi, İstanbul.

Son dönem böbrek yetmezliği nedeniyle diyaliz tedavisi alan hastalar çeşitli metabolik ve nutrisyonel bozukluklara sahiptir. Hemodiyalize giren hastalarda malnutrisyon sıklıkla görülen bir komplikasyondur ve tedavinin sonuçlarını olumsuz şekilde etkileyebilmektedir. Dolayısıyla hemodiyaliz hastalarında çeşitli tarama yöntemleri kullanılarak malnutrisyon varlığı ve derecesinin saptanması hayati önem taşımaktadır. Çalışmamız Özel Ada Diyaliz Merkezi'nde hemodiyaliz almakta olan 121 hasta ile yürütülmüştür. Çalışma, malnutrisyon varlığının belirlenmesinde sıklıkla kullanılan iki tarama aracı; Nutrisyonel Risk Taraması–2002 (NRS-2002) ve Subjektif Global Değerlendirme (SGA) ile bu hasta grubunda malnutrisyon prevelansının saptanması ve iki tarama aracı arasındaki uyumu incelemek için planlanmıştır. Çalışmaya hastalar gönüllü olarak alınmıştır. Hasta onayı ardından ilk olarak NRS-2002 ve SGA testleri uygulanarak hastaların verdiği cevaplara göre malnutrisyon varlığı ve dereceleri belirlenmiştir. Ardından hastaların antropometrik ölçümleri olarak ağırlık, boy, beden kütle indeksi, deri kıvrım kalınlığı, üst orta kol çevresi ölçümleri alınmış ve bu ölçümlerin NRS-2002 ve SGA arasındaki uyumuna bakılmıştır. Sonuçlarımıza göre NRS-2002'ye göre malnutrisyon varlığı %14 bulunurken SGA'ya göre ise malnutrisyon varlığı %12.4 olarak tespit edilmiştir. NRS-2002 ve SGA arasındaki ilişki istatiksel olarak anlamlı bulunmuştur ($p<0.05$). Hastaların antropometrik ölçümlerinde deri kıvrım kalınlığı ile SGA arasında istatiksel olarak anlamlı ve ters yönlü bir ilişki ($p<0.05$) bulunurken NRS-2002 ile herhangi bir ilişki tespit edilmemiştir ($p>0.05$). Üst orta kol çevre ölçümlerinde ise her iki tarama aracı (NRS-2002 ve SGA) ile istatiksel olarak anlamlı ve ters yönlü bir ilişki tespit edilmiştir ($p<0.05$). İki tarama aracı arasındaki uyum dolayısıyla malnutrisyonun saptanmasında birinin kullanımının yeterli olacağı, zaman ve maliyet yönünden kazanç sağlanacağı düşünülmektedir.

Anahtar kelimeler: hemodiyaliz, malnutrisyon, NRS, SGA

1. INTRODUCTION and PURPOSE

Chronic Renal Failure (CRF) is a progressive and irreversible impairment of kidney functions. Although drug and medical nutrition treatment is initially planned for the treatment of CRF, renal replacement treatments (RRT), namely hemodialysis (HD), peritoneal dialysis (PD), or transplantation, may be needed as a result of the progression of impaired kidney functions (2). According to the reports published by the Turkish Society of Nephrology, the total number of patients receiving HD and PD treatment in our country in 2015 was 73,660, while this number was 83,350 in 2020 (13% increase), and 75% of these patients receive HD treatment (3, 4).

Dialysis patients have various metabolic and nutritional disorders and protein-energy malnutrition is seen in the majority of these patients (5). Malnutrition can be defined as nutrient deficiency, excess, or imbalance that has negative effects on body components, functions, and clinical outcomes (6). Disease-related malnutrition is a common and frequent problem (7). Although the incidence of malnutrition varies according to the methods used in its detection, it was found to be between 10-50% in peritoneal dialysis patients and 18-75% in hemodialysis patients (8). The presence of malnutrition aggravates comorbidities and causes a worsening of the prognosis. Therefore, the presence or the determination of the risk of malnutrition is important for the prevention of malnutrition and successful follow-up treatment (6, 9).

According to the studies of the National Kidney Foundation, the most effective method in determining malnutrition is the clinical evaluation and the interpretation of biochemical findings together (10). Many screening tools are used in the detection of malnutrition. Nutrition Risk Screening (NRS-2002) and Subjective Global Assessment (SGA) are the most commonly used screening tools in the detection of malnutrition. NRS is the most widely used nutrition screening tool recommended by Europen Society for Paranteral and Enteral Nutrition (ESPEN) (11). The purpose of NRS is to determine the presence of malnutrition and the risk of malnutrition in patients. Such screening tools also provide information about the stage of the disease and physical examination status. Due to this broad approach/evaluation, they can also be seen as an evaluation method instead of screening tools (12). Since SGA also covers this broad approach, it is used as an evaluation method instead of a screening tool (13). As a result of the research have been made, it has been proven that SGA is a reliable evaluation test used in the detection of

malnutrition (13-14). While SGA was first used in the evaluation of patients who were operated on for kidney tumors or underwent transplantation, it was then used in patients receiving HD and peritoneal dialysis (PD) (15).

While the two aforementioned tests are generally used to determine the malnutrition status in cancer patients, a single test is generally used in dialysis patients and this may be expected to have possible wrong results.

In a cancer study, while the risk of malnutrition was 72% according to NRS, it was determined as 78% according to SGA, and a strong correlation was found between them (16, 17). In his study conducted with HD patients in 2017, Ergun stated that these patients mostly used SGA in the detection of malnutrition and that NRS was used very little, and conducted his study alone with NRS. As a result of the study, it was concluded that NRS is an effective method in determining malnutrition status, but it is not sufficient alone (18). In some studies, it was concluded that both tests should be used together (19, 78-80). In the light of this information, we wanted to observe the concordance between the two tests to determine whether the use of a single test is sufficient as well as the use of two tests together, and we planned our study accordingly. Our study was planned to examine the consistency of the screening tools (NRS and SGA) used to determine the prevalence of malnutrition in patients receiving HD treatment with the idea that time and cost can be benefited by a single test as long as the consistency between these tests is achieved, as the application of both tests will increase the time and cost.

2. LITERATURE REVİEW

2.1. Kidney Anatomy and Physiology

The kidneys are a pair of organs with an average weight of 150 g in people with a length of 11 cm, a width of 6 cm, and a depth of 4 cm located behind the peritoneum and on both sides of the spinal column. Figure 2.1.1 shows that, there is a layer of cortex containing glomerulus just below the fibrous capsule that protects its internal structures. The medulla layer forms the inner part of the kidneys and contains collecting channels (20).

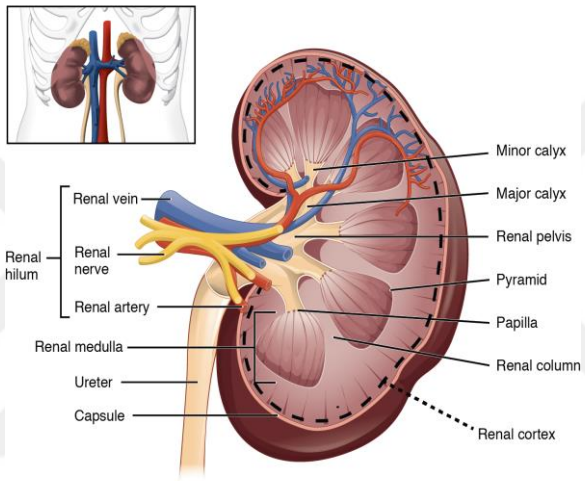

Figure 2.1.1. Anatomy of the kidney (20)

The capsule passes from the hilum to the ureter, renal artery, renal vein, lymphatic vessels, and nerves. When we look at the crosscut, we see that the kidney consists of several distinct stripes, and this is an outer strip, known as the cortex, which extends under the capsule and is the filtration site of the blood. The medulla, which can be described as the middle strip, is divided into 8-18 renal pyramids in a conical shape. Pyramids consist of thousands of thin channels that collect urine from nephrons and direct it towards the ureter. The apex of the pyramid, called the papilla, enters the collecting duct known as the minor calyx and merges to form the major calyxes. The pelvis forms the head of the ureter sent to the bladder to store and empty the urine.

Each kidney consists of approximately one million nephrons and these nephrons consist of Bowman Capsule, Proximal Tubule, Loop of Henle, Distal Tubule, and glomerular capillaries (Figure 2.1.2) (21).

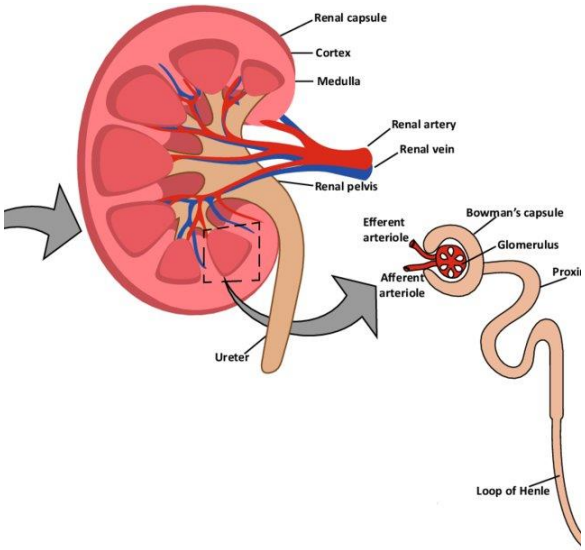

Figure 2.1.2. Nephron Structure (21)

Basically, the function of the kidney is glomerular filtration, tubular secretion, and reabsorption. One of the main functions is urine production by filtration of plasma from the glomerular capillary bed to the Bowman space. This process is called glomerular filtration, and the formed liquid is called glomerular filtrate. A human weighing 70 kilograms can produce 180 liters of urine per day. The rate of volume of liquid filtered from the glomeruli to the Bowman space is known as the glomerular filtration rate (GFR). While the filtrate is advancing along the tubule, some substances are absorbed back by diffusion or mediated transport. Tubular secretion allows substances to move from the peritubular capillary to the lumen. Like reabsorption, secretion function occurs by diffusion or transcellular carriers. Meanwhile, the most important substances secreted from the tubule are hydrogen ions and potassium (21).

At the same time, kidneys allow metabolic wastes (urea, uric acid, and creatinine) and foreign substances formed in the body to be removed from the blood and excreted with the urine. The distal tubule has the function of regulating the water and inorganic ion balance (acid-base balance) in particular. In addition, erythropoietin, which controls erythrocyte production in hormone and enzyme production, has many important physiological roles such as activation of 1,25-OH vitamin D, which is important in renin and calcium balance, which affects blood pressure and sodium balance by controlling angiotensin production (21, 22).

2.2. Chronic Renal Failure

Chronic Kidney Failure (CRF) is a kidney dysfunction that increases its prevalence day by day and occurs due to progressive and irreversible nephron loss (Figure 2.2.1) (23).

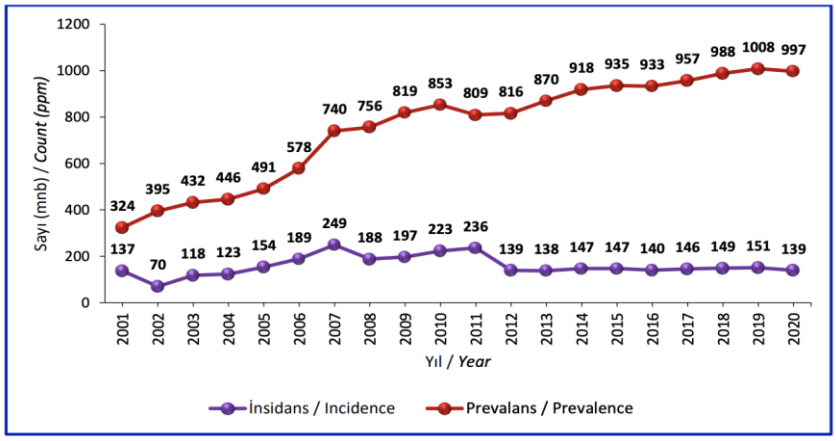

Figure 2.2.1. Prevalence of KBY in Turkey (23)

Although its prevalence varies between countries, it constitutes 10% of the world population and it is stated that the majority of patients are in the third stage (24-25). Globally, the average prevalence of chronic HD is 298.4 per million population and this prevalence is below the global average in Africa, the Middle East, NIS countries, Russia and South Asia, and it is above the global average in Eastern and Central Europe, Latin America, North America, North and East Asia, OSEA and Eastern-Central-Western Europe. Incidence rates are higher in upper-middle-income countries than in high-income countries; and these rates are below the global average in Eastern and Central Europe, North and Eastern Asia, and Western Europe, and above the global average in North America and OSEA (23).

The prevalence of CRF in Turkey is increasing day by day. While the number of patients receiving RRT in 2015 was 73,660, it was stated as 83,350 in 2020.

In Turkey, according to the Registry of the Nephrology, Dialysis and Transplantation report of 2020, the number of patients who underwent renal replacement therapy for the first time in 2020 was 11,596, and 9081 of these patients received HD

treatment. According to the report, the prevalence of CRF in our country was 996.8 per million population, while its incidence was determined as 138.7/1 (3, 4).

In a study conducted in the United States, CRF treatment constitutes 24% of annual health expenditures (28). In 2010, 2.6 million people worldwide with end-stage renal failure or impairment received dialysis or organ transplantation; this number is estimated to increase to 5.4 million by 2030 and to be the 5th leading cause of death by 2040 shows in table 2.2.1 (27).

2.2.1. Diagnosis and Classification in Chronic Renal Failure

Measurement or calculation of glomerular filtration rate is the most reliable test used in the evaluation of renal functions in health and disease (29). In the updated Chronic Kidney Disease Assessment and Management Guide (KDIGO), CRF is defined as a kidney function disorder that continues for more than 3 months, measured by Glomerular Filtration Rate (GFR) levels. For diagnosis, GFR should be less than 60 ml/min/1.73 m2 (26). The The classification of CRF should help to plan the treatment method based on the development of complication risk. The recommended prognosis in the KDIGO guideline in given in Figure 2.2.1.1 (30).

Figure 1.1 | Classification of CKD

- Low risk (if no other markers of kidney disease, no CKD)
- Moderately increased risk
- High risk
- Very high risk

GFR categories Description and range				Persistent albuminuria categories Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30–300 mg/g 3–30 mg/mmol	>300 mg/g >30 mg/mmol
	G1	Normal or high	≥90 ml/min per 1.73 m²			
	G2	Mildly decreased	60–89 ml/min per 1.73 m²			
	G3a	Mildly to moderately decreased	45–59 ml/min per 1.73 m²			
	G3b	Moderately to severely decreased	30–44 ml/min per 1.73 m²			
	G4	Severely decreased	15–29 ml/min per 1.73 m²			
	G5	Kidney failure	<15 ml/min per 1.73 m²			

Levin A, Stevens PE, Bilous RW, et al. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. Kidney Int Supp. 2013;3(1):1-150. Reproduced with permission.

Figure 2.2.1.1. Prognosis of Chronic Kidney Failure by GFR and Albumin Values (30)

While there is no clinical sign in case of a slight decrease in GFR, mild proteinuria, microalbuminuria and hematuria are observed with renal dysfunctions with a decrease below 60 ml/min per 1.73 m2. If there is no glomerulonephritis (detected by biopsy), it is not diagnosed as CRF. If GFR is <60 for three months or more, deterioration in biochemical parameters is observed with functional losses in kidney functions. With its further decrease (GFR <30), hyperphosphatemia, hypocalcemia, renal osteodystrophy, anemia, metabolic acidosis, and gastrointestinal and neurological symptoms can be seen with significant uremic symptoms. In case of exacerbation of uremic ulcers and decrease in urine, patients are referred to RRT (30).

2.3. Treatment of Chronic Renal Failure

Treatment takes place in two ways;

2.3.1. Preventive Treatment

It is applied to eliminate uremic symptoms to prevent and slow the progression of the disease to end-stage renal failure. Hypertension control includes renal osteodystrophy, anemia, and nutritional treatment (31).

2.3.2. Renal Replacement Therapy

It is a type of treatment applied to ensure the survival of patients with end-stage renal failure and includes hemodialysis, peritoneal dialysis, and transplantation (32).

2.3.2.1. Hemodialysis

Hemodialysis is an intermittent treatment type in which the patient's blood is filtered through a semi-permeable membrane and then returned to the parallel vein and then the blood is given to the patient again and the sessions last for 3 to 5 hours 2-3 times a week (33). In other words, machines do the task of the kidney. During dialysis, potassium, phosphorus, urea, uric acid, creatinine, and other metabolic wastes are removed from the patient's blood and calcium and bicarbonate are given to the patient from the dialysate fluid (1).

The first experimental HD application was performed in dogs that underwent nephrectomy in 1913. The first HD application in humans was made in 1944 by Kolff, a Dutch doctor, using cellulose acetate as a semi-permeable membrane and heparin as an

anticoagulant (36). According to TSN 2020 data, 60,558 people receive hemodialysis and this number constitutes 72.66% of RRT patients (4).

2.3.2.1.a. Complications of Hemodialysis

Some acute and chronic complications may occur during hemodialysis. Hypotension, fever, itching, shaking, cramping, inability to balance, bleeding, hemolysis, and fluid-electrolyte balance disorders are among the acute complications. Chronic complications occur due to long-term dialysis deficiency, uremia, acetate accumulation, and the nutritional deficiency (35).

2.3.2.2. Peritoneal Dialysis

In peritoneal dialysis, the patient's own peritoneum acts as a filtration membrane. The dialysate is placed in the peritoneal cavity, filtered periodically, and replaced with a new solution from the catheter. Since a hyperosmolar dextrose dialysate is used to remove waste products from the blood, some dextrose is absorbed by the patient in this process (33, 34).

2.3.2.3. Kidney Transplantation

It is a form of treatment that enables patients to live without the need for dialysis, but in some cases, post-transplant resection may occur, and in some cases, the patient may need dialysis again despite a positive response to treatment. According to TSN 2020 data, the number of patients transplanted in our country is 19,405, which constitutes 23% of the total number of patients receiving RRT (4).

2.4 Malnutrition

Malnutrition can be defined as nutrient deficiency, excess, or imbalance that has negative effects on body components, functions, and clinical outcomes (6). Disease-related malnutrition is a common and frequent problem (7). The presence of malnutrition aggravates comorbidities and causes a worsening of the prognosis. Therefore, the presence or the determination of the risk of malnutrition is important for the prevention of malnutrition and successful follow-up treatment (6, 9).

2.4.1. Malnutrition in Hemodialysis Patients

Malnutrition is a common condition in hemodialysis patients as a result of inadequate and unbalanced intake of one or more nutrients (40). The incidence of malnutrition in HD patients was found to be 18-75% (8). Differences in prevalence are mostly due to differences in age, comorbidities, and treatment quality. The etiology of malnutrition in CRF is complex and occurs due to many factors such as insufficient food intake due to anorexia, nausea-vomiting, hormonal changes, and an increase in energy requirement (41).

Table 2.4.1.1. Distribution of patients who started hemodialysis for the first time in Turkey in 2020, according to the etiology of end-stage renal disease (27)

	n	%
Diabetes Mellitus	574	36.63
Type 1 DM	68	4.34
Type 2 DM	506	32.29
Hypertension	431	27.51
Glomerulonephritis	92	5.87
Polycystic Kidney Disease	61	3.89
Obstructive Nephropathy	22	1.41
Amyloidosis	21	1.34
Tubulointerstitial Nephritis	21	1.34
Renal Vascular Disease	14	0.89
Other	100	6.38
Etiology Unknown	231	14.74
Total	1567	100.00

There are strong suspicions that hypertension is not primary and it is secondary hypertension due to chronic renal failure (4).

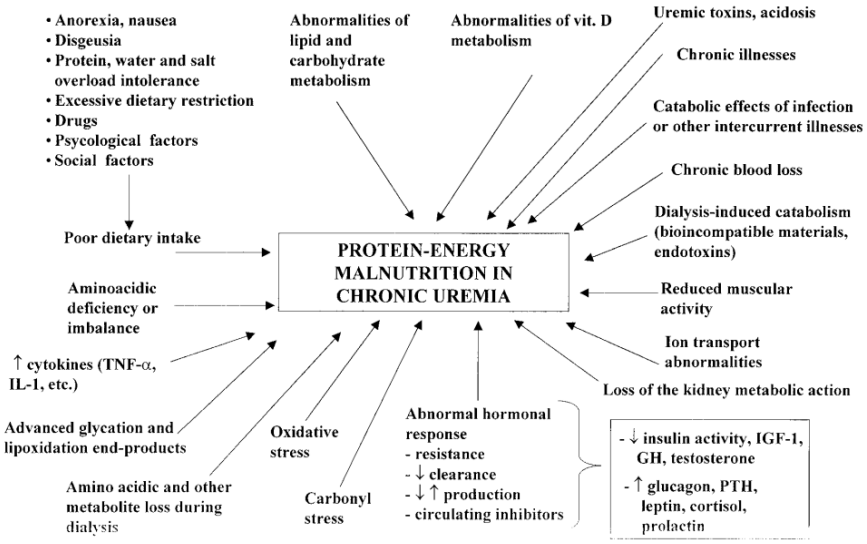

Figure 3.1.1. Causes of Protein Energy Malnutrition in Chronic Uremic Patients (41)

Dialysis methods cause nutrients to disappear in dialysis and catabolism increases during hemodialysis. It is stated that this increase may also be related to amino acid loss during dialysis (41).

Most CRF patients have metabolic acidosis, which is also considered as rising catabolism. Uremic symptoms including loss of appetite and vomiting in people receiving HD treatment cannot be fully controlled, resulting in less energy and protein intake (42). In patients with end-stage renal failure, two types of malnutrition, Type 1 and Type 2, have been identified where inflammation and insufficient nutrient intake are at the forefront. It is observed that serum albumin levels decrease with low energy protein intake due to decreased uremic toxicity in Type 1. In Type 2, protein catabolism, resting energy expenditure (REE), oxidative stress and CRP levels increase with the decrease in serum albumin levels. These two types of malnutrition are generally seen as two types of mixtures in dialysis patients, as they give similar overlapping symptoms (table 3.1.1) (43).

Table 3.1.1. Malnutrition Types (43)

	TYPE 1	TYPE 2
Serum Albumin	Low or Normal	Low
Comorbid Disease	Rare	Frequent
Inflammation	No	Yes
Food Consumption	Low	Low or Normal
BMH	Normal	High
Oxidative Stress	There is an increase	There is a high level of increase

CRF progression may cause irreversible loss of endocrine functions. Nutrition is an important factor in the evaluation and treatment of kidney disease as in many diseases. HD patients become prone to inflammation with malnutrition caused by uremia (37). Malnutrition, increased serum proinflammatory cytosine levels and depression are common in HD patients (38).

Protein-energy malnutrition begins in the period when GFR begins to decrease before dialysis and as the disease advances hypoalbuminemia develops (39).

2.5. Diagnosis and Evaluation of Malnutrition

To determine the nutritional status of the patients, the presence/degree of malnutrition is determined by using laboratory tests, anthropometric measurements, clinical symptoms, and psychosocial data together with food intake, health, and drug histories (1).

2.5.1. Anthropometric Measurements

Anthropometric measurements are an indicator of protein and fat stores, and growth and body compositions can be determined. Bodyweight, height, skinfold thickness, mid-upper arm circumference, and waist/hip ratio are among the anthropometric measurements, and since each of these measurements gives different information about the body composition, the nutritional status of the patient can be evaluated healthily when used continuously and regularly (44, 45).

2.5.1.1. Body Weight and Height and Body Mass Index (BMI)

Bodyweight and height provide a general description of body size and mass. BMI is used to show the relationship between weight and height (46). BMI indicates that the person is at risk when it is less than 12 in males and 10 in females. The height is shortened in elderly patients, therefore, a BMI value lower than 22 indicates malnutrition, but if the BMI value is in the normal range and there is unintentional weight loss in a short time, this indicates malnutrition (12). BMI classification of the World Health Organization (WHO) is given in Table 4.1.1.1 (47).

Since the water and electrolyte balance is impaired in CRF, patients are generally oliguric and have edema. The presence of edema affects the measurement results. The fluid formed in the body as a result of the metabolism of the fluids and nutrients they consume between the two dialyses is removed from the body by ultrafiltration. In calculating the body mass index (BMI), the dry weight is taken as a basis. BMI only provides information about the general structure of the body, and other measurements such as skinfold thickness, and waist and arm circumference are used for information about body shape and fat ratio (48).

Table 4.1.1.1. BMI Categorizations

< 18.5	Underweight
18.5 – 24.9	Normal
25.9 – 29.9	Overweight
≥ 30	Obesity

2.5.1.2. Mid-Upper Arm Circumference and Skin Fold Thickness

MUAC and SFT measurements are used to determine muscles without fat and fat masses (46). In cases where weight measurement is not possible, MUAC can be used as it reflects the sum of tissue, bone, muscle, water, and fat mass. SFT is a good indicator of body fat as it is the percentage of total fat mass in the body. It is recommended that this value be measured at least 3 times in four different areas (triceps, biceps, sub-scapular, and supra-iliac) and averaged. It is stated as a method that has a disadvantage as the results may change since the tool used during the measurement is different or the measurement

is made by other people. When these two measurement types are evaluated together, it is reported that muscle and fat mass can be determined more accurately (12).

Percentile values determined by National Health and Nutrition Examination Survey (NHANES-1) are used for skinfold thickness and mid-upper arm circumference measurements. According to NHANES, levels lower than the 25th percentile indicate the presence of malnutrition (49). Studies are showing that low percentile values are related to increased mortality and poor quality of life (50).

Anthropometric measurement methods used in the evaluation of malnutrition status in dialysis patients are given in Table 4.1.2.1 together (45).

Table 4.1.2.1. Anthropometric Measurements Used in Evaluation of Nutritional Status in HD Patients (45)

Indication	Evaluation	Stability	Utility
Height	total body size	very high	high
Body weight	total body size	very high	high
Triseps skinfold thickness	fat mass	very high	moderate
Supscaplar skinfold thickness	fat mass	moderate	moderate
Arm Circumference	Lean mass and fat mass	moderate	moderate
Calf Circumference	lean mass	moderate	moderate
Elbow Width	body size	moderate	moderate

2.5.2 Screening Tools

In addition to being valid and reliable, the tools used for malnutrition screening should be fast, easy to use, and practical for the clinician and practitioner. There are many screening methods and they generally focus on weight, height, recent weight loss, and nutrient intake. Malnutrition Screening Tool (MST) and Short Nutritional Assessment Questionnaire (SNAQ) are some of these (12). Since some screening tools include clinical status, disease severity, and physical examination, they can be seen as evaluation methods rather than screening methods. SGA is a good example of this. The use of NRS-2002 is also supported by ESPEN (51).

2.5.2.1. Nutritional Risk Screening (NRS-2002)

NRS was developed by Kondrup et al. in 2002 to determine the presence and risk of malnutrition in patients. It is one of the most commonly used screening tests today. It also determines the degree of malnutrition according to MUST (52).

NRS-2002 is a two-stage test. The first stage consists of 4 questions about BMI, insufficient food intake, weight loss status, and disease severity. If the answers to the questions are 'no', the test is repeated every week; if a question is answered 'yes', the second stage is started. At this stage, the patient is evaluated in two ways according to nutrition and disease severity. Nutritional status is related to BMI, food intake, and weight loss of the patient. In the case of disease, it changes the disease score of the patients. If the specific disease is not on the table, the clinical evaluation has the task of scoring the disease. In general, patients with chronic disease are in the mild category if they have one or more difficulties.

According to the test result;

Score 0: no malnutrition

Score 1: mild malnutrition

Score 2: moderate malnutrition

Score 3: severe malnutrition

If the score is ≥ 3, it is accepted that the patient has a “risk of malnutrition” (53).

2.5.2.2. Malnutrition Universal Screening Tool (MUST)

It aims to determine nutritional deficiency based on the relationship between impaired nutritional status and impaired functions. BMI is used as the main variable. In a study of hospitalized and home care patients, the incidence of malnutrition was reported to be high in both groups, and the use of the MUST test was found to be more appropriate compared to other tests (54). In another study in which only inpatients were included, it was stated that MUST detected severe malnutrition at a high rate and moderate malnutrition at a low rate (55).

While the British Association of Parenteral and Enteral Nutrition (BAPEN) stated that the MUST test should be preferred to determine the nutritional risk and plan the treatment of the patient, ESPEN stated that it is suitable for patients who are not hospitalized (56). After admission to the hospital, the most valid one in the evaluation of the risk of malnutrition in the elderly was accepted as MUST, and NRS-2002 was found to exaggerate the nutritional risk in the elderly (57).

2.5.2.3. Mini Nutritional Assessment (MNA)

It was mainly developed to screen and determine the risk of malnutrition and development in-home care patients, elderly care centers, and the elderly living in hospitals. Since MNA screening in the elderly often includes physical, mental, and nutritional status, it enables the detection of malnutrition at an early stage (12).

2.5.2.4. Subjective Global Assessment (SGA)

Patients who are found to be at nutritional risk according to any nutrition screening tool should be evaluated for nutrition by a nurse or dietitian experienced in clinical nutrition. Some of the screening tools are used as evaluation tools rather than screening tools, as they also question the patient's clinical status, disease severity, physical examination, and gastrointestinal symptoms. SGA is the most commonly used of these. According to these criteria, patients are divided into 3 groups;

A: well-fed

B: moderately malnourished

C: Severely malnourished (12).

SGA is a reliable test developed to evaluate and define malnutrition (58, 59).

While SGA is characterized as a stronger determinant in the predetermination of nutritional complications than other objective tests, ASPEN recommends the use of clinical and biochemical parameters in the detection of malnutrition. SGA has also been shown to correlate very well with anthropometric measurements and biochemical parameters (60).

2.5.3. Biochemical Evaluation Methods

It is one of the preferred methods in the evaluation of malnutrition due to its ease of application in the clinical environment and being objective. It has been reported that clearer results can be obtained when serum protein levels including parameters such as albumin, transferrin, creatinine, and BUN are used together with other anthropometric and physical evaluations (61, 62).

2.5.3.1. Albumin

It is one of the biochemical parameters frequently used in the evaluation of nutritional status in chronic diseases since it is easy to measure. Serum albumin level is checked periodically in dialysis patients, especially since it is strongly compatible with mortality level. In case of malnutrition, serum albumin levels decrease with a decrease in daily protein intake (63).

Serum albumin values of <3,5 g/dL according to ESPEN (64), <3,8 g/dL according to ISRNM (65) and <4 g/dL according to ERA-EDTA (66) were accepted as indicators of malnutrition. Since albumin has a half-life of 14-20 days, it is considered a serum protein that gives clear results in the later stages of malnutrition due to its transition to the intra and extravascular system and variable catabolic rate in various diseases that stimulate acute phase reactants. Prealbumin is also a negative acute phase reactant, but its half-life is quite short compared to albumin (2-3 days). Due to the rapid decrease in serum prealbumin levels in acute inflammation, its reliability is higher than albumin for short-term nutritional status assessment. If the serum prealbumin level is <30 mg/dL, it is accepted as an indicator of malnutrition. In summary, in addition to being widespread, it has been stated that the use of serum albumin alone is not reliable in the evaluation of malnutrition (67).

2.5.3.2. Transferrin

Its half-life is 8-10 days and is used for the evaluation of short-term nutritional status. Serum transferrin level below 200 mg/dL is an indicator of malnutrition. Although it is an earlier indicator than albumin, it can be affected by erythropoietin and iron therapy used in patients (68). When serum proteins are examined, acidemia seen in dialysis patients can also be affected by non-nutritional factors such as inflammation, fluid loss, and urinary albumin loss (30).

2.5.3.3. Creatinine

Muscle mass determines the amount and function of the kidney's creatinine production. Creatinine is a breakdown product formed as a result of a non-enzymatic breakdown of keratin phosphate in the muscle in skeletal muscles. As a result of 24-hour urine collection, 23 mg/kg is normal in males and 18 mg/kg is normal in females (1). Creatinine level has an important role in the calculation of lean body mass, but it has been stated that it is not easy to correctly detect muscle loss. Decreased muscle mass has been

associated with an increased risk of mortality in patients receiving CRF and dialysis treatment. Muscle mass in these patients is evaluated with serum creatinine level due to its low cost and reliability (69).

2.5.3.4. Blood Urea Nitrogen (BUN)

High BUN values before dialysis were found to be associated with mortality, and blood urea nitrogen values below 60 mg/dL in predialysis are considered an indicator of malnutrition (70).

2.5.3.5. Total Cholesterol

Cholesterol is the precursor of steroid hormones, bile acids, and vitamin D synthesis and serum cholesterol are one of the biochemical parameters used to evaluate PEM (71). Serum cholesterol levels may fall below 150 mg/dL in patients receiving dialysis treatment due to the development of malnutrition and chronic inflammation. Although this is an indicator of malnutrition, it has been associated with high mortality (72).

In a recent study, it has been argued that serum uric acid level is associated with body composition, muscle function, inflammation, and health-related quality of life in hemodialysis patients and is a good nutritional indicator (73). In addition, serum insulin-like growth factor (IGF-1) below 200 ng/mL is stated as an indicator of malnutrition and it is said that it can predict changes in serum albumin level. It has been reported that the high level of C-reactive protein (CRP) in CRF before dialysis can initiate chronic inflammation and is negatively associated with albumin (74).

When the literature is examined, it is seen that the use of a single method or parameter is not sufficient to determine the presence of malnutrition or development risk in CRF patients. In the patient group receiving hemodialysis treatment, it was reported that more than one nutritional parameter should be used to detect and monitor the presence of malnutrition. However, since some evaluation tools touch on the same points as the detection tools, it is thought that the use of more than one parameter may lead to a loss in terms of time and cost (75).

3. MATERIALS and METHODS

The study was conducted with 121 adult patients between the ages of 25-80 who were receiving HD treatment in the Özel Ada Dialysis Center between 31.12.2019 and 31.04.2020. Before starting the study, individuals who wanted to participate voluntarily were included by reading the "Patient Consent Form" and asking whether they wanted to participate in the study. After the approval of the patient, firstly NRS and SGA tests were applied and the presence and degree of malnutrition were determined according to the responses of the patients. Then, the anthropometric measurements of the patients (weight, height, body mass index, skinfold thickness, mid-upper arm circumference) were taken and statistical evaluation was made, and the weight measurements were taken as dry weight after dialysis by the nurses under the observation of the researcher. In the biochemical parameters, the blood results of the last month, which were examined in the monthly follow-up of the patients, were used.

In the research, the analysis of the data was made using "IBM SPSS 25.00" and Excel computer programs. In particular, the IBM SPSS program includes statistical tools (mean, standard deviation, factor analysis, relationship analysis, dependency tests, distribution charts, etc.) required by the research problem to statistically solve the data collection tool with the data collection tool.

Test tools used in the analysis; "Crosstabs-Contingency Tables", "Factor Analysis", "Correlation (Relationship) Analysis", "Chi-Square Tests", "Kruskal Wallis Variance Analysis", "t-Test-test" and "Mann-Whitney It can be given as" U Test".

IBM SPSS reliability analyzes were used for validity determinations. Screenshots and evaluations obtained from the program are given below.

Table 3.1. Difficulty Level Test of Questions

Hotelling's T-Squared Test

Hotelling's T-Squared	F test value	df_1	df_2	Sig(p)
205061.586	6243.862	26	95	,000

Df: Degree of freedom

As a result of the test, it was seen that the mean of the questions was different (T2 = 205061.586; p = 0.000 <0.05). According to this test value, it can be said that there is a statistically significant difference between the question averages. Question averages are not equal to each other; It shows that the questions are not perceived with the same approach by the subjects, and the difficulty levels of the questions are not equal to each other.

Data analysis was started with normality test and by using “Kolmogorov-Smirnov”, and “Shapiro-Wilk” tests in IBM SPSS 25.0 program, it was examined whether the data were normally distributed or not. Here, as a result of both tests of normality, p values are less than 0.05 significance level, so the null (absence) hypothesis (H0), which is established as “the data at 95% confidence level are normally distributed” for all groups are rejected. In other words, for all groups, “95% confidence, data are not normally distributed.” can be called. IBM SPSS Test results printout for Normality Analysis is attached.

Since the data are not normally distributed and most of them are categorical data, nonparametric tests were used in relational tests and testing group differences.

Nonparametric tests can be given as Mann Whitney U in paired comparisons and Spearman's rho in correlation analysis, chi-square analysis can be given as examples. The findings obtained in the tests were used as a critical value (significance level) of 0.05 at a 95% confidence interval.

As a result of the correlation analysis, whether there is a linear relationship and if any, the degree of this relationship is calculated with the correlation coefficient. The correlation coefficient is denoted by “r” and takes values between -1 and +1. The interpretations of the correlation coefficient according to its values are given in the table below.

4. RESULTS

The distribution of information regarding the demographic characteristics of the individuals participating in the study is shown in Table 4.1. A total of 121 patients were included in the study and 51.2% of these patients were male and 48.8% were female. 36.4% of the patients were between the ages of 55-64. There was no relationship between age and gender in the Alpha 0.05 significance category ($p>0.05$). 9.7% of men and 35.6% of women stated that they were illiterate, 57% of them had primary school education and 5.8% had a bachelor's degree or higher. The educational status of the patients varies statistically according to gender ($p<0.05$).

Table 4.1 . The distribution of demographic characteristics of the patients

Demographic Features	**Male (n=62; %51.2)**		**Female (n=59; %48.8)**		**Total (n=121)**	
	n	**%**	**n**	**%**	**n**	**%**
Age (years)						
25-34	1	1.6	1	1.7	2	1.7
35- 44	5	8.1	3	5.1	8	6.6
45- 54	11	17.7	6	10.2	17	14.0
55-64	22	35.5	22	37.3	44	36.4
64 -74	14	22.0	13	22.0	27	22.3
75years and above	9	14.5	14	23.7	23	19.0
- ***X*±SS**	**4.13±1.208**		**4.44±1.207**		**4.28±1.213**	

Education Status						
Illiterate	6	9.7	21	35.6	27	22.3
Primary School	37	59.7	32	54.2	69	57.0
Middle School	4	6.5	2	3.4	6	5.0
High School	9	14.5	3	5.1	12	9.9
Undergraduate and graduate	6	9.7	1	1.7	7	5.8
$\bar{X}$±SS	**3.45±1.31**		**2.47±1.25**		**2.98±1.369**	
Job						
Self-Employment	1	1.6	0	0	1	0.8
Officer	3	4.8	0	0.0	3	2.5
Employee	1	1.6	2	3.4	3	2.5
Retired	55	88.7	9	15.3	64	52.9
Housewife	0	0	48	81.4	48	39.7
Other	2	3.2	0	0	2	1.7
$\bar{X}$±SS	**3.90±0.694**		**4.78±0.494**		**4.33±0.746**	

n: Number of patients; S: Number; %: Percentage; X: Mean; SS: Standard Deviation; Chi-Square Test; Quata Cofficient; p<0.05.

Table 4.1 shows that 52.9% of the patients are retired, 39.7% are housewives, 2.5% are officers, 2.5% are workers, 1.7% are from other occupational groups and 0.8% are from the self-employed group. 88.7% of the retired are female and 15.3% are male. It was found that occupational groups showed a statistically significant difference according to gender ($p<0.05$). It is observed that 52.9% of the participants are retired, 39.7% are housewives, 2.5% are civil servants, 2.5% are workers, and 0.8% are from other occupational groups. 88.7% of retired are women and 15.3% are men.

Table 4.2. The Distribution of Information on the Disease

	Male (n=62; %51.2)		Female (n=59; %48.8)		Total (n=121)	
	n	**%**	**n**	**%**	**n**	**%**
Diagnosis Period (Year)						
0-1 Year ago	7	11.3	10	16.9	17	14.0
2 – 5 Years ago	24	38.7	27	45.8	51	42.1
6 – 10 Years ago	10	16.1	9	15.3	19	15.7
11 – 15 Years ago	8	12.9	6	10.2	14	11.6
16 – 20 Years ago	5	8.1	4	6.8	9	7.4
21 Years ago	8	12.9	3	5.1	11	9.1
$\bar{X}$±SS	**3.06 ±1.577**		**2.59±1.353**		**2.83±1.485**	
Dialysis Time						
0-1 Year ago	18	29.0	21	35.6	39	32.2
2 – 5 Years ago	19	30.6	21	35.6	40	33.1
6 – 10 Years ago	13	21.0	12	20.3	25	20.7
11 – 15 Years ago	5	8.1	3	5.1	8	6.6
16 – 20 Years ago	3	4.8	0	0	3	2.5
21 Years and above	4	6.5	2	3.4	6	5.0
$\bar{X}$±SS	**2.48±1.446**		**2.08±1.149**		**2.29±1.319**	

Frequency of Dialysis						
1 time per week	0	0	1	1.7	1	0.8
2 times a week	13	21.0	12	20.3	25	20.7
3 times a week	49	79.0	46	78.0	95	78.5
$\bar{X}$±SS	**2.79±0.410**		**2.76±0.468**		**2.29±1.319**	
Diabetes Status						
Diabetic	45	72.6	33	55.9	78	64.5
Without Diabetes	17	27.4	26	44.1	43	35.5
$\bar{X}$±SS	**0.27±0.450**		**0.44±0.501**		**0.36±0.481**	

n: Number of patients; S: Number; %: Percentage; X: Mean; SS: Standard Deviation; Chi-Square Test; Quata Cofficient; p<0.05.

While 42.1% of the patients were diagnosed 2-5 years ago, 9% were diagnosed at least 21 years ago. 38.7% of those diagnosed 2-5 years ago were male and 45.8% were female. Of the patients diagnosed, 5% have been receiving dialysis treatment for more than 21 years and 32% have been receiving dialysis treatment for about 1 year, and 78.5% of these patients receive dialysis 3 times a week. Considering the presence of diabetes, which we frequently encounter in hemodialysis patients, it was determined that 64.5% of the patients had diabetes, while 35.5% did not have diabetes (Table 4.2).

When table 4.2 is examined, it is not seen that the information about the duration of diagnosis, the duration, and frequency of dialysis.

Table 4.3. Distribution of Patients' Anthropometric Measurements

Anthropometric Measurements	Male (n=62; %51.2)		Female (n=59; %48.8)		Total (n=121)	
	n	**%**	**n**	**%**	**n**	**%**
Body Mask Index						
Underweight	1	1.6	2	3.4	3	2.5
Normal	30	48.4	24	40.7	54	44.6
Overweight	22	35.5	18	30.5	40	33.1
Obesity	9	14.5	15	25.4	24	19.8
Upper middle arm circumference (cm)						
≥5<10 %5	19	30.6	8	13.6	27	22
≥10<25 (% 10)	20	32.3	11	18.6	31	26
≥25<50 (%25)	13	21.0	6	10.2	19	16
≥50<75 (%50)	2	3.2	7	11.9	9	7
≥75<90 (%75)	1	1.6	18	30.5	19	16
≥90<95 (% 90)	1	1.6	3	5.1	4	3
≥95 (% 95)	1	1.6	6	10.2	7	6
>5 (under %5)	5	8.1	0	0.0	5	4

Triceps skinfold thickness						
≥5<10 (%5)	8	13.56	45	72.6	53	43.80%
≥10<25 (% 10)	12	20.3	8	12.9	20	16.53%
≥25<50 (%25)	15	25.4	9	14.5	24	19.83%
≥50<75 (%50)	18	30.5	0	0	18	14.88%
≥75<90 (%75)	4	6.8	0	0	4	3.31%
≥90<95 (% 90)	2	3.4	0	0	2	1.65%

n: Number of patients; S: Number; %: Percentage; X: Mean; SS: Standard Deviation; Chi-Square Test; Quata Cofficient; p<0.05.

When the anthropometric measurements, which are one of the methods used in the evaluation of nutritional status, are examined in table 4.3, it is seen that 48.4% of men and 40.7% of women have normal BMI, while 1.6% of men and 3.4% of women have low BMI.

One of the other measurements is the mid-upper arm circumference, and according to this measurement, 3.2% of men are in the ideal range and in the 50th percentile, while 30.6% are inadequate and in the 5th percentile. 11.9% of the women are in the 50th percentile and 13.6% are in the 5th percentile.

Triceps skinfold thickness measurement is also one of the anthropometric methods, and while 30.5% of men are ideal in the 50th percentile, 13.56% are inadequate in the 5th percentile. 72.6% of the women were at an insufficient level in the 5th percentile and any woman in the 50th percentile was not detected.

Table 4.4. Distribution of the findings of the Subjective Global Assessment (SGA)

SGA	Male (n=62; %51.2)		Female (n=59; %48.8)		Total (n=121)	
	n	%	n	%	n	%
A : well- fed	41	66.1	33	55.9	74	61.2
B : moderately-malnourished	15	24.2	17	28.8	32	26.4
C : Severely-malnourished	6	9.7	9	15.3	15	12.4
$\bar{X}$±SS	2.435±0.668		2.593±0.745		2.512±0.708	

n: Number of patients; S: Number; %: Percentage; X: Mean; SS: Standard Deviation; Chi-Square Test; Quata Cofficient; p<0.05.

The findings of the Subjective Global Assessment Scale revealed that 61.2% of the participants were well fed and 12.4% had high-level malnutrition. 66.1% of men and 55.9% of women were well fed, while 9.7% of men and 15.3% of women had high levels of malnutrition.

Table 4.5. Distribution of SGA Scale Findings by Age

Crosstab

			Age						
			25 - 34 years old	35 - 44 years old	45 - 54 years old	55 -64 years old	65 -74 years old	75years and over	Total
SGA	A : well-fed	n	2	4	13	28	16	11	74
		%	%100,0	%50,0	%76,5	%63,6	%59,3	%47,8	%61,2
	B : moderately malnourished	n	0	2	3	12	7	8	32
		%	%0,0	%25,0	%17,6	%27,3	%25,9	%34,8	%26,4
	C : severely malnourished	n	0	2	1	4	4	4	15
		%	%0,0	%25,0	%5,9	%9,1	%14,8	%17,4	%12,4
Total		n	2	8	17	44	27	23	121
		%	%100,0	%100,0	%100,0	%100,0	%100,0	%100,0	%100,0

$\chi 2$: Pearson Kikare correlation value , p: sign. Value

According to SGA findings, 76.5% of the patients are between the ages of 45-54 according to SGA-A. According to SGA-C, patients between the ages of 35-44 constitute 25% of all patients (Table 4.5).

Table 4.6. Distribution of Nutritional Risk Screening-2002 Scale Findings

Nutritionel Risk Screening-2002	**Male (n=62; %51.2)**		**Female (n=59; %48.8)**		**Total (n=121)**	
	n	**%**	**n**	**%**	**n**	**%**
Score < 3	53	85.5	51	86.4	104	86.0
Score > 3	9	14.5	8	13.6	17	14.0
$\bar{X}$±SS	**1.145±0.345**		**1.135±0.745**		**1.140±0.349**	

n: Number of patients; S: Number; %: Percentage; $\bar{x}$: Mean; SS: Standard Deviation; Chi-Square Test; Quata Cofficient; p<0.05.

According to NRS findings, 86% of the patients had a score of < 3 (malnutrition) and 14% had a score of < 3 (under the risk of malnutrition). Of the patients with a score of < 3, 85.5% were male and 86.4% were female, of the patients with a score of >3, 86.4% were female and 13.6% were female.

In table 4.6, it can be said that while 14% of the participants are at risk in terms of nutrition, 86% of them should be screened once a week. Most of the patients who are at risk in terms of nationality are in the 55-64 age range (18.2%). The patients to be screened are mainly in the 45-54 age range and constitute 94.1% of all patients.

Table 4.7. Distribution of NRS Score Findings by Age

Crosstab

			Age						
			25 - 34 years old	35 - 44 years old	45 - 54 years old	55 -64 years old	65 -74 years old	75years and over	Total
Nutrition risk screening-2002	Score <3: The patient should be scanned once a week	n	2	7	16	36	24	19	104
		%	%100,0	%87,5	%94,1	%81,8	%88,9	%82,6	%86,0
	Score >3: Patient at risk of nutrition	n	0	1	1	8	3	4	17
		%	%0,0	%12,5	%5,9	%18,2	%11,1	%17,4	%14,0
Total		n	2	8	17	44	27	23	121
		%	%100,0	%100,0	%100,0	%100,0	%100,0	%100,0	%100,0

χ2 : Pearson Kikare correlation value , p: sign. Value

According to NRS findings, 94.1% of the patients with a score less than 3 are in the 45-54 age range. Those with a score bigger than 3 constitute 5.9% of patients between the ages of 45-54 (table 4.7).

Table 4.8. Relationship Analysis of Malnutrition Tests Applied to Patients with BMI

Diagnosis Test of Malnutration			BMI of Patients						
			Underweight	Normal	Overweight	Obese	Total	χ	p value
Subjectif Global Assesment (SGA)	***A : well-fed***	***Count***	0	30	29	15	74		
		%	0.0 %	40.5 %	39.2%	20.3%	100.0 %		
	B : moderately malnourished	***Count***	2	14	8	8	32	0.284	0.101
		%	6.3 %	43.8 %	25.0%	25.0%	100.0 %		
	C : Severely malnourished	***Count***	1	10	3	1	15		
		%	6.7 %	66.7 %	20.0%	6.7%	100.0 %		
Total		***Count***	3	54	40	24	121		
		%	2.5 %	44.6 %	33.1%	19.8%	100.0 %		
Nutrisyonel Risk Screening-2002	***Score <3 : The patient should be scanned once a week***	Count	3	45	34	22	104		
		%	2.9 %	43.3 %	32.7%	21.2%	100.0 %	0.110	0.688
	Score > 3 : *Patient at Risk of Nutrition*	Count	0	9	6	2	17		
		%	0.0 %	52.9 %	35.3%	11.8%	100.0 %		
Total		Count	3	54	40	24	121		
		%	2.5 %	44.6 %	33.1%	19.8%	100.0 %		

n: Number of patients; S: Number; %: Percentage; X: Mean; SS: Standard Deviation; Chi-Square Test; Quata Cofficient; p<0.05.

In table 4.8, 40.5% of patients with SGA-A level, 43.8% of patients with SGA-B level, and 66.7% of patients with high malnutrition at SGA-C level have normal BMI values, and no statistically significant relationship was found between SGA and BMI (p>0.05). When evaluated according to NRS, it was seen that 43.3% of the patients with a score of < 3 and 52.9% of those with a score of < 3 had normal BMI. As in SGA, no statistically significant relationship was found between NRS and BMI (p>0.05).

Table 4.9. Distribution of relationship between Subjective Global Assessment (SGA) and Nutritional Risk Screening-2002 (Nutrition risk screening)

		Nütrisyonel Risk Tarama-2002 (Nutrition risk screening)				
Subjectif Global Assessment (SGA)		Score <3	Score > 3 under of nutrition risk	Total		p
A : well-fed	Count	74	0	74		
	% (SGA)	100.0%	0.0%	100.0%		
B : moderately malnourished	Count	27	5	32		
	% (SGA)	84.4%	15.6%	100.0%	59.5%	0
C : Severely malnourished	Count	3	12	15		
	% (SGA)	20.0%	80.0%	100.0%		
Total	Count	104	17	121		
	% (SGA)	0.859504132	0.140495868	1		

SGA between NRS Correlations

		N=121	Subjective Global Assessment (SGA)	Nutritional Risk Screening
	(SGA)	Correlation Coefficient	1	.616**
		p		0.00
	(NRS)	Correlation Coefficient	.616**	1
		p	0.00	

**. Correlation is significant at the 0.01 level (2-tailed).

When the consistency between SGA and NRS is examined in table 4.9, it is seen that there is a high-level relationship between the two scales ($p<0.05$).

Table 4.10. Correlation Table

		Nütritional Risk Screening-2002	Subjective Global Assessment (SGA)	Skinfold Thickness Measurement Values	Upper Middle Arm Circumference Measurement Values
Nütritional Risk Screening-2002	Correlation	1.000	**0.781**	-0.139	-0.227
	p		**<0.01**	0.128	0.012
Subjective Global Assessment (SGA)	Correlation	**0.781**	1.000	-0.181	-0.365
	p	**<0.01**		0.047	<0.01
Skin Fold Thickness Measurement Values	Correlation	-0.139	**-0.181**	1.000	**0.643**
	p	0.128	**0.047**		**<0.01**
Upper Middle Arm Circumference Measurement Values	Correlation	**-0.227**	**-0.365**	**0.643**	1.000
	p	**0.012**	**<0.01**	**<0.01**	

A high-level relationship was found between NRS and SGA ($p<0.05$). While there was no significant relationship between the skinfold thickness of the participants and NRS, it can be said that there was a very low and inverse relationship with SGA. In other words, as the skinfold thickness increases, the SGA value decreases slightly. (If Alpha is taken as 1 percent, there is no relationship). A high level of correlation was found between SFT and MUAC measurements ($p<0.05$).

A low-grade inverse relationship was found between MUAC and SGA and NRS ($p<0.05$) (Table 4.10). In other words, it is expected that the NRS and SGA values of the participants will decrease as the MUAC value of the participants' decreases.

Tablo 4.11. Correlations

		Lab Results_creatinine	Skin Fold Thickness Measurement Values	Upper Middle Arm Circumference Measurement Values
Lab Results_creatinine	r	1	-0.082	-0.014
	p		0.373	0.883
Skin Fold Thickness Measurement Values	r	-0.082	1	.643**
	p	0.373		<0.01
Upper Middle Arm Circumference Measurement Values	r	-0.014	.643**	1
	p	0.883	<0.01	

**. Correlation is significant at the 0.01 level (2-tailed).

No relationship was found between the SFT and MUAC measurements and the creatinine value of the participants (p>0.05).

Table 4.12. Distribution of Upper Middle Arm Circumference and Skin Fold Thickness Measurement Values of Patients

Upper Middle Arm Circumference Measurement Values of Female Competitors				Upper Middle Arm Circumference Measurement Values of Male Mixers				P	
		Frequency (n=59)	**Percent (%)**			**Frequency (n=59)**	**Percent (%)**		
≥5 <10	**%5**	8	13.6	**≥5 <10**	**%5**	19	30.6	27	0.22314
≥10 <25	**%10**	11	18.6	**≥10 <25**	**%10**	20	32.3	31	0.256198
≥25 <50	**%25**	6	10.2	**≥25 <50**	**%25**	13	21.0	19	0.157025
≥50 <75	**%50**	7	11.9	**≥50 <75**	**%50**	2	3.2	9	0.07438

≥75<90	**%75**	18	30.5	**≥75<90**	**%75**	1	1.6	19	0.157025
≥90<95	**%90**	3	5.1	**≥90<95**	**%90**	1	1.6	4	0.033058
≥95	**%95**	6	10.2	**≥95**	**%95**	1	1.6	7	0.057851
>5	**%5 altı**	0	0.0	**>5**	**%5 altı**	5	8.1	5	0.041322

Skin Fold Thickness Measurement Values of Female Participants				Skin Fold Thickness Measurement Values of Male Participants				121	
		Frequency (n=59)	**Percent (%)**			**Frequency (n=59)**	**Percent (%)**		
≥5<10	**%5**	8	13.56	**≥5<10**	**%5**	45	72.6	53	0.438017
≥10<25	**% 10**	12	20.3	**≥10<25**	**%10**	8	12.9	20	0.165289
≥25<50	**%25**	15	25.4	**≥25<50**	**%25**	9	14.5	24	0.198347
≥50<75	**%50**	18	30.5	**≥50<75**	**%50**	0	0	18	0.14876
≥75<90	**%75**	4	6.8	**≥75<90**	**%75**	0	0	4	0.033058
≥90<95	**% 90**	2	3.4	**≥90<95**	**%90**	0	0	2	0.016529

Table 4.12 shows the distribution of the mid-upper arm circumference and skinfold thickness measurement. When we look at the MUAC values, it is seen that 26% of all patients are in the 10% percentile. When the SFT measurements are examined, it is seen that 43.8% of all patients are in the 5th percentile; women consist of %13,56 and men consist of %72,6 of this percentile.

Table 4.13. Comparison of Hemodialysis Frequency and serum albumin levels (Crosstab)

			Lab Results_Albumin					
			low albumin <3.2	normal level albumin : 3.2-4.6	high albumin >4.6	Total	X	p
Frequency of Dialysis	1 time per week	n	0	1	0	1		
		%	0.0%	100.0%	0.0%	100.0%	0.142	0.51
	2 times a week	n	1	24	0	25		
		%	4.0%	96.0%	0.0%	100.0%		
	3 times a week	n	2	92	1	95		
		%	2.1%	96.8%	1.1%	100.0%		

Table 4.13 shows the relationship between the frequency of receiving dialysis and the albumin levels of the patients. While none of the patients who receives dialysis once or twice a week had high albumin levels, only 1 person who receives dialysis three times a week had high albumin levels. It was found that 4% of patients with low albumin levels receive dialysis 2 times a week and 2.1% of patients receive it 3 times a week. 96% of patients with normal albumin levels receive dialysis twice a week and 96.8% of these patients receive it 3 times a week. No significant relationship was found between the frequency of dialysis and the albumin values of the participants ($p>0.05$).

Table 4.14. Comparison of the Presence of Diabetes and serum albumin levels (Crosstab)

			Lab Results_Albumin					
			Low Albumin <3.2	Normal Albumin : 3.2-4.6	High Albumin >4.6	Total	X	p
Diabetes Status of Patients	Diabetic	n	2	75	1	78		
		%	2.6%	96.2%	1.3%	100.0%		
	Without diabetes	n	1	42	0	43	564	0.754
		%	2.3%	97.7%	0.0%	100.0%		
Total		n	3	117	1	121		
		%	2.5%	96.7%	0.8%	100.0%		

Table 4.14 shows the relationship between patients' diabetes status and albumin levels. While there were no patients with diabetes with high albumin levels, 1.3% of patients without diabetes were found to have high albumin levels. It was observed that 97.7% of the patients with diabetes and 96.2% of the patient without diabetes had normal albumin levels, and no significant relationship was found between the diabetes status and albumin values of the patients ($p>0.05$).

Table 4.15. The Relationship Between Frequency of Dialysis and Diabetes Status of Participants

			Diabetes Status of Patients		
			Without Diabetes	Diabetic	Total
Frequency of Dialysis	1 time per week	n	1	0	1
		%	100.0%	0.0%	100.0%
	2 times a week	n	15	10	25
		%	60.0%	40.0%	100.0%
	3 times a week	n	62	33	95
		%	65.3%	34.7%	100.0%
Total		n	78	43	121
		%	64.5%	35.5%	100.0%

Table 4.15 examines the relationship between the frequency of dialysis and the presence of diabetes status, and 40% of the patients receiving dialysis twice a week and 34.7% of the patients receiving dialysis three times a week have diabetes.

Table 4.16. Comparison of albumin-based malnutrition structure and SGA (Crosstab)

			Lab Results_Albumin					
			Low Albumin <3.2	Normal Albumin 3.2-4.6	High Albümin >4.6	Total	X2	p
(SGA)	A : well-fed	n	0	74	0	74		
		%	0.0%	100.0%	0.0%	100.0%		
	B : moderately malnourished	n	1	30	1	32	0.301	0.017
		%	3.1%	93.8%	3.1%	100.0%		
	C : severely malnourished	n	2	13	0	15		
		%	13.3%	86.7%	0.0%	100.0%		
Total		n	3	117	1	121		
		%	2.5%	96.7%	0.8%	100.0%		

Table 4.16 compares the presence of malnutrition and albumin values according to SGA. Of the patients diagnosed with moderate malnutrition, 93.8% had normal albumin levels and 3.1% had low albumin levels. SGA was found to show a statistically significant difference according to albumin levels ($p<0.05$).

Table 4.17. Crosstab albumin levels according to NRS

			Level of albumin					
			Low Albumin <3.2	Normal Albumin 3.2-4.6	High Albumin >4.6	Total	X2	p
Nütritional Risk Screening-2002	Skore< 3: The patient should be scanned once a week	n	2	102	0	104		
		%	1.9%	98.1%	0.0%	100.0%		
	Score > 3 : : Patient at Risk of Nutrition	n	1	15	1	17	0.237	0.027
		%	5.9%	88.2%	5.9%	100.0%		
Total		n	3	117	1	121		
		%	2.5%	96.7%	0.8%	100.0%		

According to NRS, when the presence of malnutrition and albumin values were compared, 98.1% of the patients with a score of < 3 had normal and 1.9% had low albumin levels. 88.2% of the patients with a score < 3 had normal and 5.9% had low albumin levels. As in SGA, NRS was also found to show a statistically significant difference according to albumin levels in table 4.17 ($p<0.05$).

Tablo 4.18. All Correlations

		TST Values of Participants	MUAC Values of the Participants	Age	Participants' Diagnosis Time	How long has he been on dialysis?	Dialysis frequency?	Diabetes Status of Participants?	Education Status of the Participants	Gender
BMI	r	**0.534**	**0.753**	0.069	-0.110	**-0.245**	**-0.212**	**0.230**	-0.141	0.093
	p	**<0.01**	**<0.01**	0.227	0.115	**<0.01**	**<0.01**	**<0.01**	0.061	0.155
Subjective Global Assessment (SGA)	r	**-181**	**-0.365**	0.122	-0.101	-0.026	0.076	-0.123	-0.004	0.112
	p	**0,023**	**<0.01**	0.091	0.135	0.388	0.203	0.089	0.483	0.111
Nutritional Risk Screening -2002 (Nutrition risk screening)	r	**-154**	**-0.255**	0.063	-0.035	-0.071	0.043	-0.101	-0.010	-0.014
	p	**0,046**	**<0.01**	0.245	0.351	0.220	0.319	0.134	0.456	0.440

a. Cells contain zero-order (Pearson) correlations.

In table 4.18, various correlations are given. A high-level and significant relationship was found between BMI and skinfold thickness and mid-upper arm circumference. A low-level relationship was found between BMI and diabetes status, and an inverse relationship was found with the duration and frequency of dialysis ($p<0.05$).

A low-grade and inverse relationship was found between SGA and NRS and skinfold thickness and mid-upper arm circumference ($p<0.05$). In other words, as the skinfold thickness and mid-upper arm circumference measurements of the patients increase, SGA and NRS values are expected to decrease.

DISCUSSION and CONCLUSION

According to the report published by the Turkish Society of Nephrology in 2020, 75% of patients with end-stage renal failure receive HD treatment (4). Dialysis patients have various metabolic and nutritional disorders. The most common of these is protein-energy malnutrition (5). Although the incidence of malnutrition varies according to the methods used, it was found to be 18-75% in hemodialysis patients (8).

The presence of malnutrition aggravates comorbidities and causes a worsening of the prognosis. The presence or the determination of the risk of malnutrition is important for the prevention of malnutrition and successful follow-up treatment (6,9). Many screening tools are used in the detection of malnutrition. Nutritional Risk Screening (NRS-2002) and Subjective Global Assessment (SGA) are the 2 most commonly used methods.

In the study conducted by Chmielewski et al. with 292 patients hospitalized in the Nephrology department to test the effectiveness of NRS in the evaluation of the risk of malnutrition in patients, 40% of the patients were found to have malnutrition compared to NRS. The efficacy of NRS was compared with the SGA results previously used for nutritional status evaluation in the nephrology service. As a result of this comparison, a strong correlation was found between NRS and SGA (77). In a study conducted with hemodialysis patients in 2017, they used NRS instead of SGA, which is more commonly used in the detection of malnutrition in hemodialysis patients. As a result of the study, it was concluded that NRS was an effective method in determining the malnutrition status, but it was not sufficient on its own, and along with NRS, it has been suggested that the biochemical parameters (serum albumin, BUN, cholesterol, creatinine, prealbumin) of the patients should be used together with anthropometric measurements (body weight, height, mid-upper arm circumference, triceps skinfold thickness), body composition analysis (lean body mass, body fat ratio, total body water, etc.), handgrip strength and different screening tests (NRS and SGA) (18). In our study, we aimed to examine the compatibility/incompatibility of NRS and SGA with each other in determining the prevalence of malnutrition in patients receiving hemodialysis. 121 patients receiving hemodialysis were included in the study and 51.2% of them were male and 48.8% were female. While 14% of our patients were at nutritional risk according to NRS, 38.8% of the patients were found to have moderate and high malnutrition, 61% were well fed

(SGA-A), 26.4% were found to have moderate malnutrition (SGA-B), and 12.4% were found to have high level (SGA-C) malnutrition according to SGA.

Studies evaluating NRS and SGA together in the detection of malnutrition were mostly conducted with cancer patients (81). In a study conducted with 107 gastrointestinal cancer patients, 72% of the patients were found to be at risk of malnutrition according to the NRS and 78% according to the SGA ($p<0.05$) (82). In our study, a high degree of consistency was found between the two scales when it came to the consistency between NRS and SGA ($p<0.05$). In another study conducted with different types of cancer patients, the rate of malnutrition was found to be 41% according to both methods (NRS and SGA) (83). There was no statistically significant difference between the mean age of patients with malnutrition and the mean age of patients without malnutrition ($p>0.05$). In the study in which malnutrition evaluation was made using SGA in patients with end-stage renal failure receiving hemodialysis treatment in Australia, no significant relationship was found between the age of the patients and their malnutrition status (84). In our study, it was found that NRS and SGA values did not change according to age ($p>0.05$).

Since edema is common in renal patients receiving dialysis treatment, dry weights of patients were measured after dialysis for BMI calculation, but some patients do not pay attention to fluid and nutrient intake during dialysis and this may cause slight deviations in dry weight values and therefore in BMI. When BMI is used as a single assessment, it may not detect weight loss and malnutrition. BMI and weight loss are not the only indicators of malnutrition. Although the person has malnutrition, he/she may be overweight or obese. Malnutrition can also be seen in people who consume foods with insufficient and unbalanced nutrient content from macro and micronutrients and who have an unhealthy fat and sugar diet. However, Piccini et al. found an independent inverse relationship between BMI and the risk of malnutrition in HD patients (86). In our study, no statistically significant relationship was found between NRS and SGA tests and BMI ($p>0.05$). According to NRS, 52.9% of the patients with a high risk of malnutrition are in the range of 18.5-24.9 and the normal class; 35.3% of the patients are in the range of 25-29.9 and the overweight class, and 11.8% of the patients are in the range of over 30 and the obese class.

While there was a very low-level inversely proportional relationship between BMI and the duration of hemodialysis and the frequency of dialysis, a positive correlation was found with the presence of diabetes status in the patients ($p<0.05$). Espahbodi et al. conducted a study with SGA in patients receiving hemodialysis treatment and found no significant relationship between hemodialysis duration and malnutrition (84).

In a study evaluating the nutritional status of HD patients with anthropometric measurements, 73.6% of the patients had triceps skinfold thickness and 75% had mid-upper arm circumference measurement above the 25th percentile, and a strong correlation was found between TSFT and MUAC (87). In our study, 19.83% of the patients had TSFT in the 25th percentile. TSFT value of 43.8% is in the 5th percentile and 13.56% is male and 72.6% is female in this group. According to the measurement of the MUAC, the majority of the patients (26%) were above the 10th percentile and 32.3% were male and 18.6% were female of this group. It can be said that TSFT and MUAC measurements showed a statistically significant difference according to gender ($p<0.05$). In our study, there was also a strong and positive correlation between the TSFT and MUAC measurements of the patients ($p<0.05$ r:0.643). While there was no relationship between TSFT and NRS, a low level of inverse correlation was found with SGA ($p<0.05$). There is a low level of inverse correlation between MUAC and both NRS and SGA values ($p<0.05$). In other words, it can be said that as the triceps skinfold thickness of the patients' increases, SGA values decrease very little, and as the mid-upper arm circumference increases, NRS and SGA values decrease. While skinfold thickness is affected by edema, the upper middle arm circumference is not affected by edema. For this reason, we think that upper middle arm circumference is a better indicator. In a study by Alharbi and Enrione in 2012 investigating the prevalence of malnutrition in HD receiving patients, it was reported that TSFT and MUAC were positively correlated with SGA and the risk of developing malnutrition was higher in women with lower levels of TSFT (88).

When the albumin value, which is one of the biochemical parameters used in the evaluation of nutritional status, was examined, it was observed that 100% of the patients who were well fed according to SGA-A had normal albumin levels, while 86.7% of the patients with the high level of malnutrition according to SGA-C had normal albumin levels and 13.3% of the patients had low albumin levels. According to NRS, 94.1% of the patients at nutritional risk had normal and high albumin levels, while 5.9% of the patients

had low albumin levels. As a result, it was observed that NRS and SGA showed a statistically significant difference according to albumin level ($p<0.05$). However, it has been accepted that albumin is a guiding parameter in the late period of malnutrition since its half-life is approximately 20 days, its transition to the intra- and extravascular system, and its synthesis-catabolism rate are variable (67). In chronic hemodialysis patients, hypoalbuminemia is mostly caused by an increase in external albumin losses. Depending on both blood loss and the type of dialyser used, different amounts of protein loss can be seen. At the same time, albumin levels may be lower in HD receiving patients due to excess volume. In summary, malnutrition has an important place among the causes of hypoalbuminemia, but it is not the only cause. Underlying infectious or inflammatory events may cause a decrease in albumin as a negative acute-phase reactant. For this reason, it is not a reliable parameter alone in the evaluation of malnutrition. The half-life of prealbumin is 2-3 days. Therefore, it is a more reliable parameter for the evaluation of short-term nutritional changes compared to the albumin that is commonly used in end-stage renal failure. However, prealbumin is an acute phase reactant and is affected by inflammation. Since its destruction in the kidneys decreases, serum prealbumin level increases with progressive renal failure (76). Therefore, its use in dialysis patients may not be reliable. Although the normal population can be used for short-term nutritional deficiency, we did not prefer to use it in the study because it is an acute phase reactant.

In conclusion, consistent with other studies, the incidence of malnutrition was found to be high in hemodialysis patients in our study. Malnutrition is one of the most important factors affecting the mortality and morbidity of the patient. Nutrition therapy is a very important part of malnutrition therapy, and the risk of malnutrition must be determined before the patient starts nutrition therapy as soon as possible. In some studies, while it has been concluded that NRS is an effective method in determining the malnutrition status, however, it is not sufficient alone; in some other studies, it was concluded that multiple methods, including SGA, malnutrition inflammation score (MIS), NRS, anthropometric measurements, and biochemical parameters, should be used together in determining the risk and degree of malnutrition in dialysis patients. (18, 19, 78- 80).

In our study, NRS and SGA, which are some of the screening tests, were found to be compatible with each other and it is thought that the use of a single test will be

sufficient in addition to the use of these tests together as using both tests may lead to both cost and time loss.

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ANNEX-1

T.C. YEDİTEPE ÜNİVERSİTESİ

Sayı : 37068608-6100-15- 1813 **30/01/2020**
Konu: Klinik Araştırmalar
Etik kurul Başvurusu hk.

İlgili Makama (Aslıhan Özkan)

Yeditepe Üniversitesi Sağlık Bilimleri Fakültesi Beslenme ve Diyetetik Bölümü Prof. Dr. Serdar Özcan'ın sorumlu araştırmacı olduğu **"Hemodiyaliz Hastalarında Malnutrisyon Prevelansının Saptanmasında Kullanılan Tarama Araçlarının Birbiriyle Olan Tutarlılığının İncelenmesi"** isimli araştırma projesine ait Klinik Araştırmalar Etik Kurulu (KAEK) Başvuru Dosyası **(1795)** kayıt Numaralı KAEK Başvuru Dosyası, Yeditepe Üniversitesi Klinik Araştırmalar Etik Kurulu tarafından **29.01.2020** tarihli toplantıda incelenmiştir.

Kurul tarafından yapılan inceleme sonucu, yukarıdaki isimi belirtilen çalışmanın yapılmasının etik ve bilimsel açıdan uygun olduğuna karar verilmiştir (**KAEK Karar No: 1154**).

Prof. Dr. Turgay ÇELİK
Yeditepe Üniversitesi
Klinik Araştırmalar Etik Kurulu Başkanı

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ANNEX-2

Sample of Questionnaire Form

Doğum Tarihiniz :

Cinsiyetiniz : ( ) Kadın ( ) Erkek

1) Eğitim Durumunuz : ( ) 1. Okur – yazar değil ( ) 2. Okur – yazar
( ) 3. İlkokul ( ) 4. Ortaokul
( ) 5. Lise ( ) 6. Lisans veya Lisans Üstü

2) Mesleğiniz : ( ) 1. Serbest Meslek ( ) 2. Memur
( ) 3. İşçi ( ) 4. Emekli
( ) 5. Ev hanımı ( ) 6. Diğer :

3) Boyunuz : …….. cm Deri Kıvrım Kalınlığı: ……

4) Kuru Ağırlığınız : ……. Kg Üst Orta Kol Çevresi: ……..

5) Beden Kütle İndeksiniz :
( ) 1. 0-18.4 (Zayıf) ( ) 2. 18.5-24.9 (Normal)
( ) 3. 25.0-29.9 (Fazla Kilolu) ( ) 4. 30.0-34.9 (1. Derece Obez)
( ) 5. 35.0-44.9 (2. Derece Obez) ( ) 6. 45.0 ve üzeri (3. Derece Obez)

6) Kronik böbrek yetmezliği tanısı ne zaman kondu ?
( ) 1. 0-1 yıl önce ( ) 2. 2-5 yıl önce
( ) 3. 6-10 yıl önce ( ) 4. 11-15 yıl önce
( ) 5. 16-20 yıl önce ( ) 6. 21 yıl ve üzeri

7) Ne kadar zamandır hemodiyalize giriyorsunuz ?
( ) 1. 0-1 yıldır ( ) 2. 2-5 yıldır
( ) 3. 6-10 yıldır ( ) 4. 11-15 yıldır
( ) 5. 16-20 yıldır ( ) 6. 21 yıl ve üzeri

8) Haftalık hemodiyalize giriş sıklığınız nedir ?
( ) 1. Haftada 1 kez ( ) 2. Haftada 2 kez
( ) 3. Haftada 3 kez ( ) 4. Haftada 4 kez

9) Serum albümin seviyeniz :

10) Total kolesterol seviyeniz :

11) Kan üre azotu (BUN) seviyeniz :

12) Kreatinin seviyeniz :

13) Diyabet hastalığınız var mı ? ( ) Evet ( ) Hayır

ANNEX-3

Subjektif Global Değerlendirme

A. Öykü

1.Ağırlık Değişimi
Geçen 6 ayda genel kayıp: ____kg,
%kayıp____
(<%5;hafif, %5-10;orta, >10%;ciddi kayıp)
Geçen 2 haftada değişim : Artış ____
Değişim Yok ____Azalma

2. Normale göre besin alımında değişim
Değişim yok ____
Değişim : ____ Gün ____ Hafta
Tipi : Suboptimal katı diyet____
Tam sıvı diyet____
Hipokalorik sıvı____ Açlık ____

3.Gastrointestinal semptomlar (2 haftadır süren)
Yok____ Bulantı____ Kusma____ Diyare____
İştahsızlık____

4. Fonksiyon Kapasitesi
Disfonksiyon yok ____
Disfonksiyon : ____Gün Hafta____
Tipi: 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

Ciltaltı 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____
Orta-ağır malnütrisyon riski C____
Ağır malnütrisyon D____

ANNEX-4

Hastanede Yetersiz Beslenme Taraması

Nutritional Risk Screening (NRS 2002)

KondrupJ et al.,Clinical Nutrition2003; 22: 415-421 çerçevesinde

Avrupa Klinik Beslenme ve Metabolizma Birliği
(Europäische Gesellschaft für Klinische Ernährung und Stoffwechsel, ESPEN) tavsiyesiyle

Ön tarama:

•Vücut ağırlığı endeksi (BMI, BodyMassIndex) < 20,5 kg/m² mi?	❑ evet ❑ hayır
•Hasta son 3 ayda kilo kaybetti mi?	❑ evet ❑ hayır
•Geçen hafta gıda alımında azalma oldu mu?	❑ evet ❑ hayır
•Hasta ağır hasta konumunda mı? (örneğin yoğun terapi)	❑ evet ❑ hayır

⇨ Bu sorularda biri „**evet**" ile cevaplanırsa, esas taramayla devam edilir.

⇨ Bütün sorular „**hayır**" ile cevaplanırsa, hastaya her hafta yeniden ön tarama uygulanır.

⇨ Hastaya örneğin büyük bir ameliyat yapılması planlanıyorsa, olası bir riske karşı, önlem mahiyetinde bir beslenme planı uygulanması gerekir.

Esas tarama:

Beslenme durumunda düzensizlik	Puan
Yok	**0**
Hafif Kilo kaybı > %5/ 3 ay ise veya gıda alımı geçen hafta ihtiyacının < %50-75 kadarı ise	**1**
Orta Kilo kaybı > %5/ 2 ay veya BMI 18,5-20,5 kg/m² ve genel sağlık durumu (GSD) veya gıda alımı geçen hafta ihtiyacının %25-50 kadarı ise	**2**
Ağır Kilo kaybı > %5 /1 ay (>%15 / 3 ay) veya BMI < 18,5 kg/m² ve genel sağlık durumu veya gıda alımı geçen hafta ihtiyacının %0-25 kadarı ise	**3**

+

Hastalık şiddeti	Puan
Yok	**0**
Hafif Örneğin uyluk kemiği kırılması, belirgin komplikasyonlu seyreden bazı kronik hastalıklar: karaciğer sirozu, kronik obstrüktif akciğer hastalığı, kronik hemodiyaliz, diyabet, kanser hastalığı	**1**
Orta Örneğin büyük karın ameliyatı, inme, şiddetli pnömoni, hematolojik kanser hastalığı	**2**
Ağır Örneğin kafa yaralanması, kemik iliği nakli, yoğun bakım gerektiren hastalar (APACHE-II > 10)	**3**

+ 1 Puan, hasta yaşı ≥ 70 yıl ise

≥ 3 Puan	Beslenme riski mevcut, beslenme planı yapılması uygun.
< 3 Puan	Her hafta tarama tekrarlanması durumu uygun. Hastaya örneğin büyük bir cerrahi müdahale uygulanması planlanıyorsa, olası risklere karşı, önlem mahiyetinde bir beslenme planı uygulanmalıdır.

Almanca çeviri ve uyarlama: Dr. Tatjana Schütz, Dr. Luzia Valentini ve Prof. Dr. Mathias Plauth. Kontakt: elke-tatjana.schuetz@charite.de, Tel. 030-450 514 059

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