T.C.

YEDİTEPE UNIVERSITY

INSTITUTE OF HEALTH SCIENCES

DEPARTMENT OF NUTRITION AND DIETETICS

DETERMINATION OF MALNUTRITION DEVELOPMENT STATUS IN HEMODIALYSIS PATIENTS

Dietitian Ece Ergun

MASTER'S THESIS

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Supervisor

Asist. Prof. Dr. Arzu Durukan

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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 18../05./2017.. tarih ve 2017/09-08.. sayılı kararı ile onaylanmıştır.

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INDEX OF ABBREVIATIONS

APD – Automated Peritoneal Dialysis

BAPEN - British Association for Parenteral and Enteral Nutrition

BMI - Body Mass Index

BUN - Blood Urea Nitrogen

CAPD - Continuous Ambulatory Peritoneal Dialysis

CRF - Chronic Renal Failure

dL - Deciliter

ENHA - European Nutrition for Health Alliance

ESPEN - The European Society for Clinical Nutrition and Metabolism

ESRD - End Stage Renal Disease

g - Gram

GFR - Glomerular Filtration Rate

HD - Hemodialysis

HDL - High Density Lipoprotein

KEPAN - Clinical Enteral Parenteral Nutrition Society

kg - Kilogram

kcal – kilocalorie

L – Liter

LDL - Low Density Lipoprotein

m - Meter

mg - Milligram

MNA - Mini Nutritional Assessment

MUST - Malnutrition Universal Screening Tool

MST - Malnutrition Screening Tool

NKF – DOQI - The National Kidney Foundation Kidney Disease Outcomes Quality Initiative

NRS 2002 - Nutritional Risk Screening 2002

PD - Peritoneal Dialysis

RRT - Renal Replacement Therapy

SGA - Subjective Global Assessment

SNAQ - Short Nutritional Assessment Questionnaire

VLDL – Very Low Density Lipoprotein

ABSTRACT

Ergun E. (2017). Determination of Malnutrition Development Status in Hemodialysis Patients. Yeditepe University Institute of Health Sciences, Nutrition and Dietetics Program, Master Thesis, İstanbul.

The aim of this study is to determine the status of malnutrition in hemodialysis patients due to chronic renal insufficiency. For this work; between April 2016 and August 2016, a total of 281 adult patients aged 23 to 94, 124 women and 157 men were studied. Malnutrition screening for patients participating in the study was performed using some of the methods given in the literature. First, a questionnaire, reliability analysis is given in Annex 6, was applied (Annex 4). Serum albumin, total cholesterol, blood urea nitrogen and serum creatinine levels in this questionnaire were collected at dialysis centers where patients were treated since they have blood donation every month and it was determined whether patients were malnutrition according to these values. Later, the NRS 2002 test (Annex 5), a test that ESPEN proposed to use as a malnutrition screening tool in patients, was performed.

Malnutrition rates according to the results of blood samples from patients are as follows; according to serum albumin standard 65.8%, according to serum creatinine standard 76.5%, according to cholesterol concentration standard 33.6% and according to blood urea nitrogen standard it was only 1.1 %. According to the results of NRS - 2002 test; mild malnutrition was found in 12.5% moderate malnutrition was found in 17.4%, severe malnutrition was found in 14.9% of the patients participating in the study. Result for all patients was 44.8% malnutrition.

Key Words: Malnutrition, hemodialysis, NRS 2002, albumin, cholesterol

ÖZET

Ergun E. (2017). Hemodiyaliz Hastalarında Malnütrisyon Gelişme Durumunun Tespit Edilmesi. Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü, Beslenme ve Diyetetik Programı, Yüksek Lisans Tezi, İstanbul.

Bu çalışmanın amacı, kronik böbrek yetmezliği nedeniyle hemodiyaliz tedavisi alan hastalarda malnütrisyon gelişme durumunun tespit edilmesidir. Çalışma; Nisan 2016 – Ağustos 2016 tarihleri arasında, yaşları 23 – 94 arasında olan, 124'ü kadın ve 157'si erkek toplam 281 yetişkin hasta ile gerçekleştirilmiştir. Araştırmaya katılan hastalara malnütrisyon taraması literatürde bulunan yöntemlerden bazıları kullanılarak yapılmıştır. İlk olarak güvenilirlik analizi Ek - 6 da verilmiş olan bir anket uygulanmıştır (Ek - 4). Bu anket içerisinde sorulan serum albümin, total kolesterol, kan üre azotu ve serum kreatinin seviyeleri hastaların tedavi gördükleri diyaliz merkezlerinde her ay düzenli olarak bakılan kan tahlili sonuçlarından alınmış ve bu değerlere göre hastada malnütrisyon olup olmadığı tespit edilmiştir. Daha sonrasında, ESPEN'in de hastalarda malnütrisyon tarama aracı olarak kullanılmasını önerdiği test olan NRS 2002 testi (Ek - 5) hastalara uygulanmıştır.

Hastalardan alınan kan örneklerinin sonuçlarına göre; serum albümin standardına göre hastaların %65.8'inde, serum kreatinin standardına göre hastaların %76.5'inde, plazma kolesterol konsantrasyonu standardına göre hastaların %33.6'sında malnütrisyonun yüksek oranda varlığı tespit edilmiştir. Kan üre azotu standardına göre ise hastaların sadece %1.1'inde malnütrisyon olduğu görülmüştür. NRS 2002 testinin sonuçlarına göre; araştırmaya katılan hastaların %12.5'inde hafif malnütrisyon, %17.4'ünde orta şiddette malnütrisyon, % 14.9'unda ağır malnütrisyon olmak üzere %44.8'inde malnütrisyon tespit edilmiştir.

Anahtar Kelimeler: Malnütrisyon, hemodiyaliz, NRS 2002, albümin, kolesterol

1. INTRODUCTION AND OBJECTIVE

Malnutrition is a nutritional condition created by measurable side effects on body functions, tissues and clinical outcomes by inadequate, excessive or unbalanced intake of energy, protein or other nutrients (1). Malnutrition is one of the most important factors determining morbidity and mortality in dialysis patients (2). The prevalence of malnutrition has been reported to be 23-76% in hemodialysis (HD) patients and 18-50% in peritoneal dialysis (PD) patients (3).

According to the last two reports published by the Turkish Nephrology Society (2013 - 2015), the number of patients undergoing dialysis in our country is increasing constantly. While the total number of patients receiving HD and PD treatment in 2013 was 57,212, this number reached 60,860 in 2015. Within the last two years, the number of PD patients declined from 4537 to 3909 whereas the number of HD patients increased from 52675 to 56951. HD is the most commonly used renal replacement therapy (RRT) method in our country (4, 5).

In this study, the reason of including HD patients as the study group is because it is the most commonly used dialysis type in Turkey and it is the dialysis type in which malnutrition occurs most commonly. The aim of this study is to determine the status of malnutrition development in HD patients.

2. GENERAL INFORMATION

2.1. Definition and Causes of Chronic Renal Failure

Chronic Renal Failure (CRF) is the anatomical - functional impairment of the kidney along with chronic, progressive and irreversible tissue destruction and the clinical picture ensued along with it (6). At the same time, CRF is the decline of glomerular filtration rate (GFR) to such an extent that it causes permanent and detectable changes in renal function (7). Since the glomerular filtration rate value is decreased in CRF, it cannot regulate renal fluid-solute balance and therefore chronic, progressive deterioration of metabolic and endocrine functions occur (8). CRF is a disease with high morbidity and mortality affecting the quality of life adversely, bringing major economic burden,

occurring commonly. The awareness level and early diagnosis rate of the disease is low and it can be prevented or delayed (Web - 1). CRF can be defined as GRF falling below 60 ml / min / 1.73 m² regardless of underlying etiology of underlying renal disease and / or objective renal injury lasting at least for three months (10). End-stage renal failure (ESRF) still remains important due to its high morbidity and mortality rates despite the advances in its diagnosis and treatment (8).

CRF is a nephrological syndrome which may develop secondary to many diseases and is characterized by chronic, progressive and irreversible loss of nephrons (9). Any condition causing permanent damage in nephron may result in chronic renal failure (7). In general, the most common causes include chronic glomerulonephritis, diabetes, hypertension, polycystic kidney disease, interstitial nephritis and obstructive uropathy. Since a major part of patients is admitted to doctor with severe uremic presentation, it may not be possible to detect the underlying disease (11). Since CRF may occur as a result of progressive loss of functional nephrons due to various causes, various changes may develop in functional nephrons in order to maintain homeostasis during this loss. However, after a certain point, these changes remain incapable and end-stage renal failure ensues (6). In a study, considering the etiologies of 172 CRF patients (109 male, 63 female), those with indefinite cause were in the first rank with 59 patients (34.3%). This etiology was followed by chronic glomerulonephritis with 22 (12.8%) patients, diabetic nephropathy with 21 (12.2%) patients, hypertension with 17 (9.8%) patients, interstitial nephropathy with 16 (9.3%), systemic vasculitis with 10 (5.8 %) patients, amyloidosis secondary to familial Mediterranean fever with 9 (5.2%) patients, obstructive nephropathy with 5 (3%) patients, polycystic kidney with 5 (3%) patients and other causes with 8 (4.6%) patients (12). One of the first disturbed functions of kidney is the diminished ability to concentrate urine, diurnal rhythm deteriorates and nocturia begins. Until ESRD, water, sodium, potassium balances are preserved under normal conditions, but lower and upper limits are reduced in patients with CRF (8).

2.2. Treatment of Chronic Renal Failure

The treatment of CRF is carried out with two ways.

2.2.1. Preventive Treatment

Preventive treatment is administered to a CRF patient who has just reached to terminal stage. Preventing, reducing or eliminating the emerging uremic symptoms by slowing the progression of disease to ESRD is the goal of preventive treatment in CRF. The methods of preventive treatment are as following: hypertension control, renal osteodystrophy treatment, diet treatment and anemia treatment. The treatment is initiated immediately after the diagnosis of CRF. Determinant complications and initiating drug and diet therapy are important parts of treatment (6).

2.2.2. Renal Replacement Treatment

Although medical and diet treatments are sufficient at the beginning of the disease, renal replacement therapy is administered in cases in whom uremic symptoms and signs cannot be controlled by preventive treatment, in other words, when the kidneys are completely unable to perform their function. Renal replacement treatments are dialysis or renal transplantation (6).

2.3. Dialysis Treatment and Types

Dialysis is administered as a life-saving treatment method when diet and medical treatments do not yield any results in the patients who have reached to the terminal stage of CRF (13). The goal of dialysis treatment is to increase the probability of living close to normal for patient, to regulate the general condition of patient, and to prepare patient for transplantation (6). Thirty-forty years ago, ESRD patients lost their lives within days and weeks. Developments in dialysis technology first prolonged the life span and then increased the quality of life of these patients (14).

Dialysis is a treatment modality based on fluid-solute exchange between the patient's blood and appropriate dialysis solution through a semi-permeable membrane. The direction of fluid and solute movements is usually from the patient's blood towards the dialysate, and the fluid-solute disequilibrium that is present in the patient approaches

the normal value with the elimination of this dialysate (14). There are two types of dialysis methods, namely, peritoneal dialysis and hemodialysis (web - 2).

2.3.1. Peritoneal Dialysis

Peritoneum is a membrane covering the intraabdominal cavity and abdominal organs (6). It is approximately equal to the body surface area (about 1-2 m^2 in adults, twice as much in infants compared to adults). Peritoneal dialysis is a dialysis method in which dialysate is administered to the peritoneal cavity with a catheter, it is periodically drained and replaced with fresh solution (15). PD is the transport of water and solutes through a membrane which separates two compartments containing fluid. These two compartments are dialysis solution in the peritoneal cavity and flow in the peritoneal capillaries (typically contain sodium, chloride, lactate and become hyperosmolar with the addition of glucose at high concentration). Peritoneal cavity, peritoneal membrane and dialysates are used in PD. The peritoneal membrane functions as a semi-permeable membrane which transfers the toxic substances accumulated in the body to the dialysate in the abdominal cavity. Water, sodium, potassium, chloride, calcium, magnesium, sulphate, urea, creatinine and uric acid are the substances that can easily pass through the peritoneum. However, the peritoneum is semipermeable to proteins. The substance exchange between the peritoneum and blood occurs through diffusion and convection (6).

It includes two types, continuous ambulatory peritoneal dialysis (CAPD) and automated peritoneal dialysis (APD). CAPD is a manually conducted dialysis method. CAPD is the most common type of peritoneal dialysis and with this method 2 - 2.5 L of fluid exchange is performed four times a day and each session lasts 4-8 hours. The dialysis technique is simple and consists of repeated exchange stages. These stages include drainage, filling and waiting. The APD includes all PD types requiring device use. In the APD, 3 to 10 changes are made using an automatic machine at night. It has advantages such as reducing the incidence of peritonitis, performing normal activities during the day since patients receive dialysis during the night, feeling happy psychosocially, decreasing the complications related to the catheter (6).

2.3.2. Hemodialysis

HD is the reorganization of fluid and solute content of the blood taken from the patient through a membrane and with the help of a machine (14). The blood of the patient is circulated in a machine outside the body and this machine is called artificial kidney (6). Through the use of a semi-permeable membrane, the transfer of some substances into the fluid is enabled with the help of a machine via diffusion (13). Adequate blood flow should be provided to accomplish HD procedure (approximately 200 to 600 ml per minute in adults) (14). The machine is divided into two compartments with a membrane made of a semi-permeable material called cellazone. On one side of the membrane, there is blood coming from the patients and on the other side, there is the dialysis fluid (dialysate) with special composite. In its simplest form, the dialysis machine pumps the blood and dialysate through a dialyzer (6). Substances such as urea, creatinine, potassium, uric acid, phosphates, sulphates pass from blood to this solution (13) and bicarbonate and calcium, which are often found less in amount in the blood of uremic patients pass from this solution to blood in the opposite direction (6).

HD treatment is administered 2 - 3 times per week by evaluating the renal functions of patient and for 4 - 5 hours each time (6). Experimental first HD application was performed on nephrectomized dogs in 1913. The first HD administration on human was performed by Kolff, a Dutch physician in 1944, using cellulose acetate membrane as semi-permeable membrane and heparin as anticoagulant (14). HD has three types of ultrafiltration (hemodiafiltration), bicarbonate - bikart dialysis and hemofiltration. Owing to these methods, complications such as hypotension, cramping and nausea are less commonly encountered during dialysis in patients. Also, much more fluid can be withdrawn from the patients (6).

2.4. Incidence and Prevalence of CRF, HD, PD and Transplantation

All of the information given for Turkey under this title are the results of the latest declaration published by the Turkish Nephrology Society in 2016. The foundations of the Turkish Nephrology Society registration system were laid in 1990. According to the CREDIT study, the prevalence of CRF in the population over 18 years of age in our country was found to be 15.7% (16). According to the center-based data, RRT was determined to be administered to a total of 73660 patients in our country by the end of

2015 (5). The increase in the number of patients undergoing RRT continues although the rate of increase has decreased somewhat in recent years (16). In 2015, the point prevalence of end-stage chronic kidney disease requiring RRT in Turkey was determined to be 935.4 per million population, including the pediatric patients. Also, in 2015, the incidence of renal replacement therapy in Turkey was calculated to be 147.3 per million population, including pediatric patients (of the new transplant patients, the patients with only preemptive transplants were not included) (5)(Figure 1).

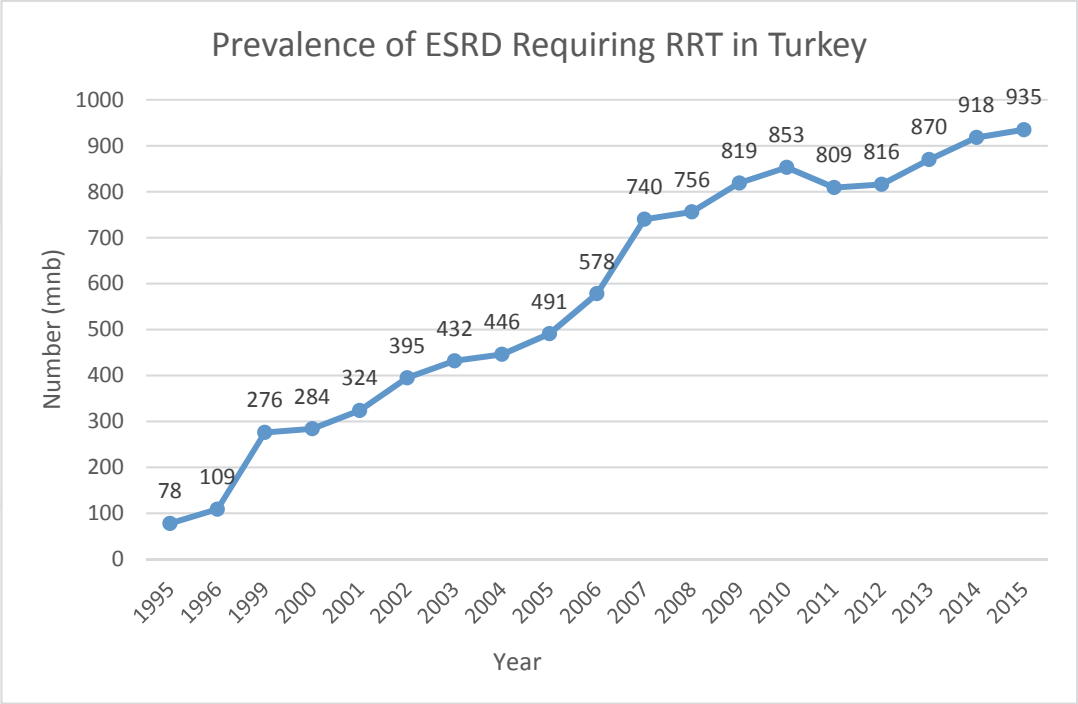

Figure - 1: Prevalence of ESRD requiring RRT in Turkey

(Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara)

Considering the worldwide status, there was a total of 2,217,350 patients with ESRD receiving RRT in 2014. The highest prevalence of ESRD requiring RRT is in Taiwan, Japan, the United States of America, Singapore, Portugal, Korea, Mexico. Turkey ranks as the thirty second country in terms of highest prevalence among the evaluated 53 countries (17) (Figure-2).

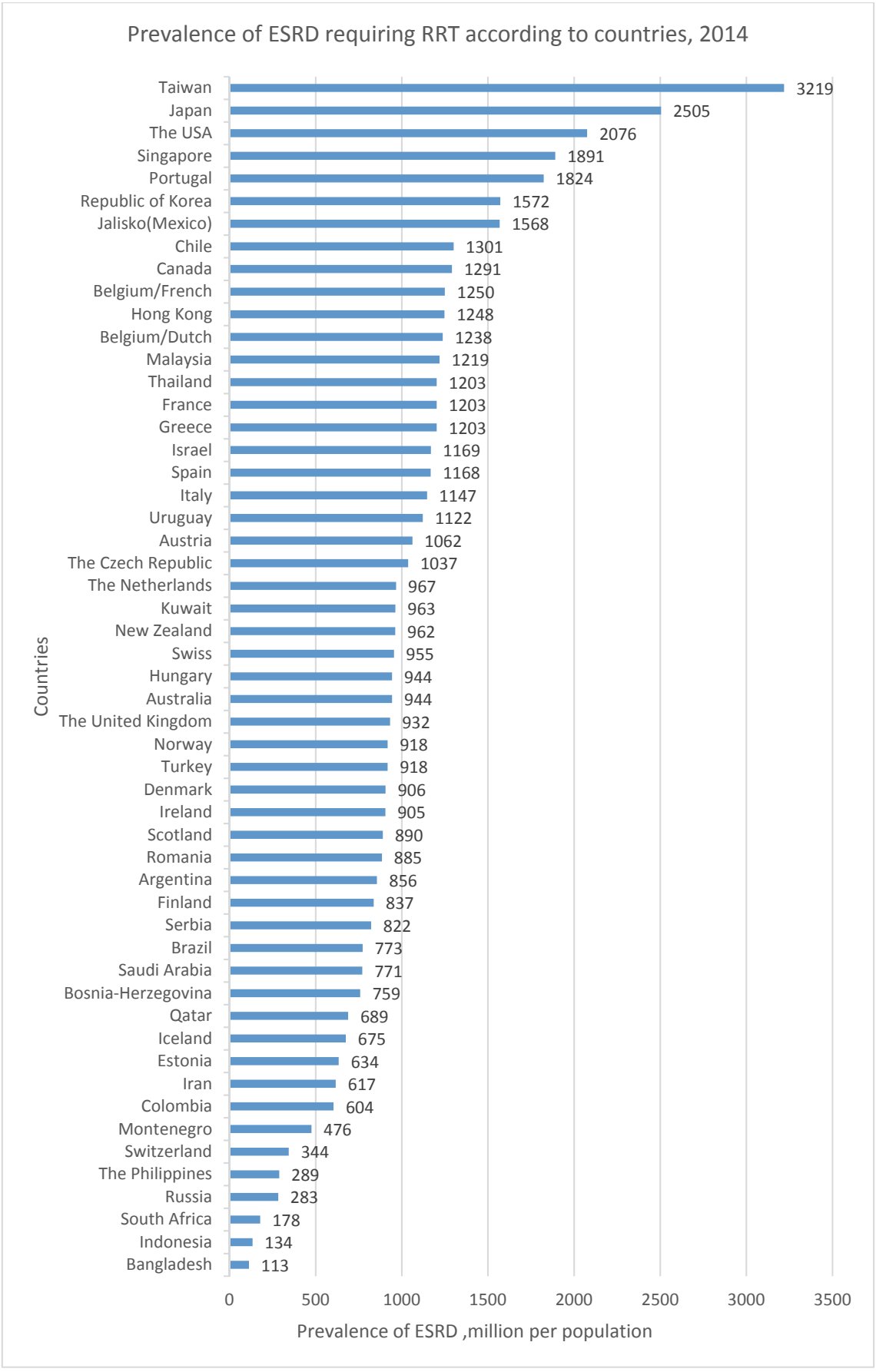

Figure - 2: Prevalence of ESRD requiring RRT according to countries, 2014

(Reference: USRDS Annual Data Report 2016, Epidemiology of Kidney Disease In The United States, Volume 2: ESRD In The United States)

Considering the dialysis prevalence worldwide, the highest prevalences are observed in Taiwan, Japan, Singapore, the United States of America, Korea, Portugal, Malaysia, Thailand and Chile. Turkey has the 13th highest prevalence of dialysis among the evaluated 55 countries (17) (Figure-3).

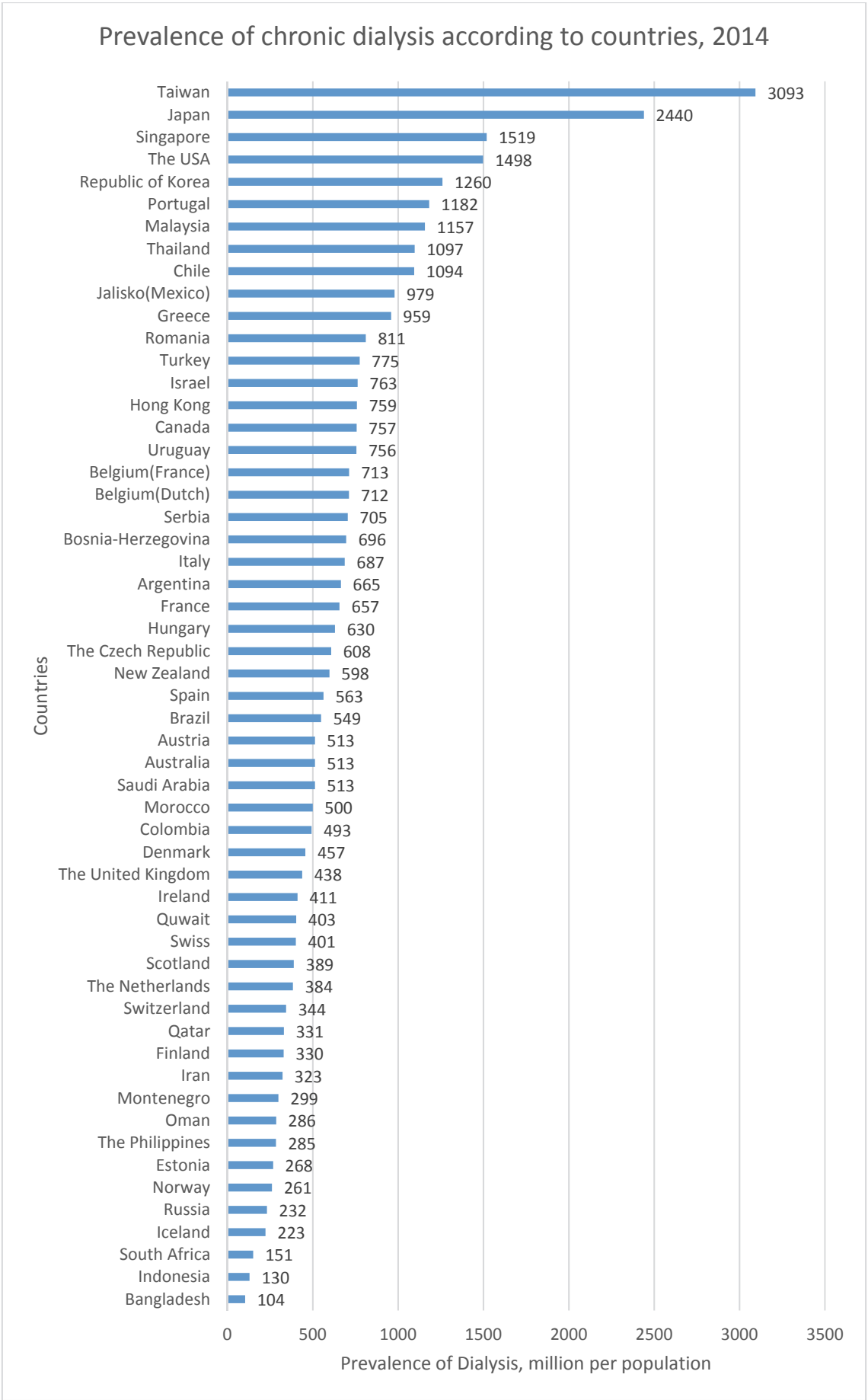
Prevalence of chronic dialysis according to countries, 2014
Countries
Taiwan 3093
Japan 2440
Singapore 1519
The USA 1498
Republic of Korea 1260
Portugal 1182
Malaysia 1157
Thailand 1097
Chile 1094
Jalisko(Mexico) 979
Greece 959
Romania 811
Turkey 775
Israel 763
Hong Kong 759
Canada 757
Uruguay 756
Belgium(France) 713
Belgium(Dutch) 712
Serbia 705
Bosnia-Herzegovina 696
Italy 687
Argentina 665
France 657
Hungary 630
The Czech Republic 608
New Zealand 598
Spain 563
Brazil 549
Austria 513
Australia 513
Saudi Arabia 513
Morocco 500
Colombia 493
Denmark 457
The United Kingdom 438
Ireland 411
Quwait 403
Swiss 401
Scotland 389
The Netherlands 384
Switzerland 344
Qatar 331
Finland 330
Iran 323
Montenegro 299
Oman 286
The Philippines 285
Estonia 268
Norway 261
Russia 232
Iceland 223
South Africa 151
Indonesia 130
Bangladesh 104
0
500
1000
1500
2000
2500
3000
3500
Prevalence of Dialysis, million per population

Figure - 3: Prevalence of chronic dialysis according to countries, 2014

(Reference: USRDS Annual Data Report 2016, Epidemiology of Kidney Disease In The United States, Volume 2: ESRD In The United States)

The most commonly administered type of RRT in our country is HD (77.31%), followed by transplantation (17.38%) and PD (5.31%) (Table 1) (5).

Table - 1: Distribution of all patients (including pediatric patients) who are in follow-up for chronic HD / PD program or functional graft according to RRT type by the end of 2015

	n	%
Hemodialysis	56951	77.31
Peritoneal Dialysis	3909	5.31
Transplantation	12800	17.38
Total	73660	100.00

Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara

The number of the patients in whom RRT was initiated for the first time in 2015 in our country is given in Table-2.

Table - 2: Distribution of the patients in whom RRT was initiated for the first time in 2015 (including the pediatric patients) according to administered RRT type

	n	%
Hemodialysis	9590	82.69
Peritoneal Dialysis	995	8.58
Transplantation*	1012	8.73
Total	10601	100.00

* Preemptive Transplantation

Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara

Prevalence continues to increase over the years. In 2015, 9590 new patients initiated HD (Table-3) (5).

Table - 3: Age and gender distribution of the patients who initiated HD as the first RRT and were included in chronic HD program in 2015

	Male		Female		Total	
Age	n	%	N	%	n	%
0 – 19	62	0.65	58	0.60	120	1.25
20 – 44	701	7.31	435	4.54	1136	11.85
45 – 64	2265	23.62	1478	15.41	3743	39.03
65 – 74	1444	15.06	1166	12.16	2610	27.22
≥ 75	1018	10.61	963	10.04	1981	20.65
Total	5490	57.25	4100	42.75	9590	100.00

Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara

The total number of the HD patients in our country is 56951 (Table - 4) and the annual upward trend continues. Of all patients receiving HD treatment, 56.38% are male and 43.62% are females. It is noteworthy that more than 80% of HD patients are elderly and middle-aged (16).

Table - 4: Age and gender distribution of the patients who were in follow-up for chronic HD program by the end of 2015

	Male		Female		Total	
Age	n	%	N	%	n	%
0 – 19	226	0.40	230	0.40	456	0.81
20 – 44	4958	8.70	3320	5.83	8278	14.53
45 – 64	14053	24.68	9482	16.65	23535	41.32
65 – 74	7932	13.93	6844	12.02	14776	25.95
≥ 75	4942	8.68	4964	8.72	9906	17.39
Total	32111	56.38	24840	43.62	56951	100.00

Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara

In our country, especially in recent years, HD frequency was determined to be three times per week in the majority of patients (16). HD treatment is administered to more than 90% of patients as three sessions per week (Table-5) (4).

Table - 5: Distribution of chronic HD patients according to HD frequency by the end of 2015

	n	%
Once per week	289	0.51
Twice per week	4550	7.99
Three times per week	51637	90.67
> Three times per week	475	0.83
Total	56951	100.00

Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara

The distribution of the patients who were in follow-up for chronic HD program by the end of 2015 according to the duration of dialysis is given in Table-6 (5).

Table - 6: The distribution of the patients who were in follow-up for chronic HD program by the end of 2015 according to the duration of dialysis

	n	%
0-5 years	37328	65.54
6-10 years	12380	21.74
11-15 years	4647	8.16
16-20 years	1804	3.17
> 20 years	792	1.39
Total	56951	100.00

Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara

The decrease in the frequency of hypoalbuminemia (albumin <3.5 gr / dL) in HD is a consequence of the improvement in the nutritional status of patients. In our country, hypoalbuminemia, which was 16.2% in HD in 1999, decreased to 13.42% in 2015 (16). The serum albumin level distributions of chronic HD patients by the end of 2015 are shown in Table-7.

Table - 7: Distribution of chronic HD patients according to serum albumin level (mean of the last three months) by the end of 2015

	n	%
< 3.5 gr / dL	7641	13.42
3.5 – 4.0 gr / dL	28024	49.21
> 4 gr / dL	21286	37.37
Total	56951	100.00

Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara

By the end of 2015, the total number of the PD patients in our country was 3909 (5), the downward tendency observed in recent years (4777 patients in 2012) (4) (4537 patients in 2013) (5) continued. The absence of an expected increase in new patient inclusion seems to be an important factor. The number of the patients who initiated PD in 2015 was 995. Serum albumin level, one of the important indicators of nutritional status, was below 3.5 gr / dL in 24.61% of PD patients. It was over 4 gr / dL in 23.62% of patients. The serum albumin levels of 51.77% of prevalent PD patients were between 3.5-4 g / dL (5). Over the past 10 years, the frequency of hypoalbuminemia usually ranged between 25-30% (16). The ratio of hypoalbuminemia in PD patients was higher than that of HD patients HD (24.6% in PD, 13.4% in HD) (5).

The number of kidney transplants in our country is increasing year by year. In 2015, according to the Ministry of Health data, 3204 patients underwent renal

transplantation. It is noted that the cases concentrated in the age range of 20-64 years (Table-8) (5).

Table - 8: Age and gender distribution of the patients who underwent renal transplantation in 2015

	Male		Female		Total	
Age	n	%	N	%	n	%
0 – 19	134	4.18	110	3.43	244	7.62
20 – 44	1027	32.05	544	16.98	1571	49.03
45 – 64	802	25.03	472	14.73	1274	39.76
65 – 74	71	2.22	41	1.28	112	3.50
≥ 75	2	0.06	1	0.03	3	0.09
Total	2036	63.55	1168	36.45	3204	100.00

Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara

In our country, 79.09% of kidney transplants performed in 2015 were taken from live donors. Among live donors, first-degree relatives (67%) was on the first rank. The ratio of cadaver donor was 20.91%. Infection was the most important reason among the causes of death after transplantation (31%). The number of kidney transplants performed in 2015 was below the need. The lack of an increase in cadaveric donors, which is the most important source, and persistence of low rates are thought-provoking (5).

The number of patients receiving HD since 1990, receiving PD since 1994 and underwent transplantation since 1996 are as in Figure 4, Figure 5 and Figure 6, respectively (5).

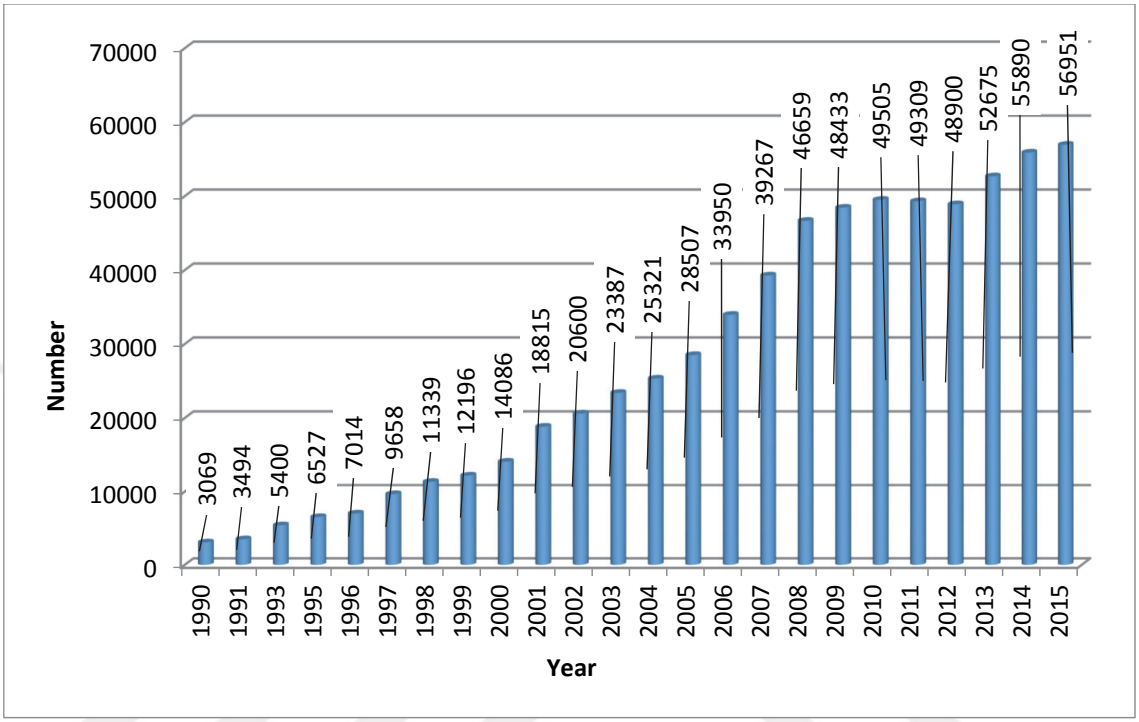

Figure - 4: Change in the number of HD patients in Turkey according to years

(Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara)

As seen in Figure 4, the number of HD patients has been increasing since 1990. Only a decrease was observed in the total number of HD patients between 2010 and 2012. Since 2012, the number of HD patients has begun to increase again.

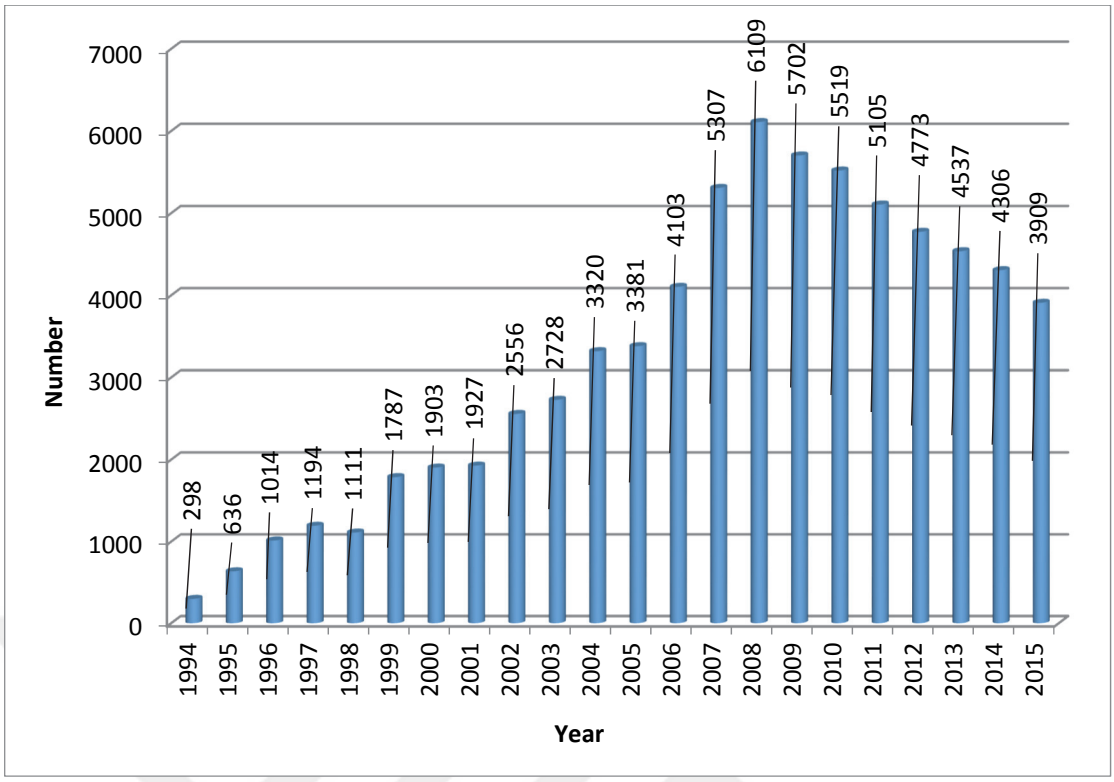

Figure - 5: Change in the number of PD patients in Turkey according to years

(Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara)

As seen in Figure 5, while 298 PD patients were present in Turkey in 1994, this number reached to its highest level in 2008 with 6109 patients. After 2008, the number of patients went into a decline.

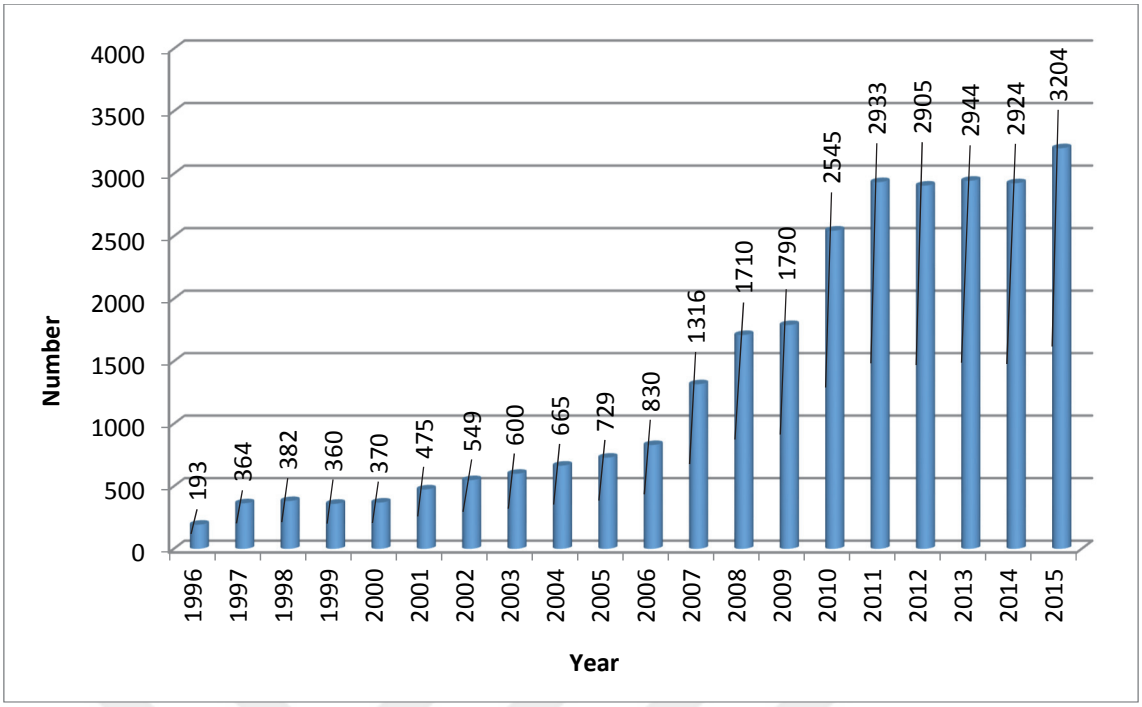

Figure - 6: Distribution of the number of the patients who underwent kidney transplantation in Turkey according to years

(Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara)

As seen in Figure 6, the number of transplants continued to increase with slight increases between 1996 and 2006 kept its increase by accelerating in 2007, only experienced a decline in 2014 and reached the highest number of transplantation in 2015.

Although hypoalbuminemia in HD patients had showed increases from time to time since 1990 up to date, it showed a quite serious decline (Figure-7).

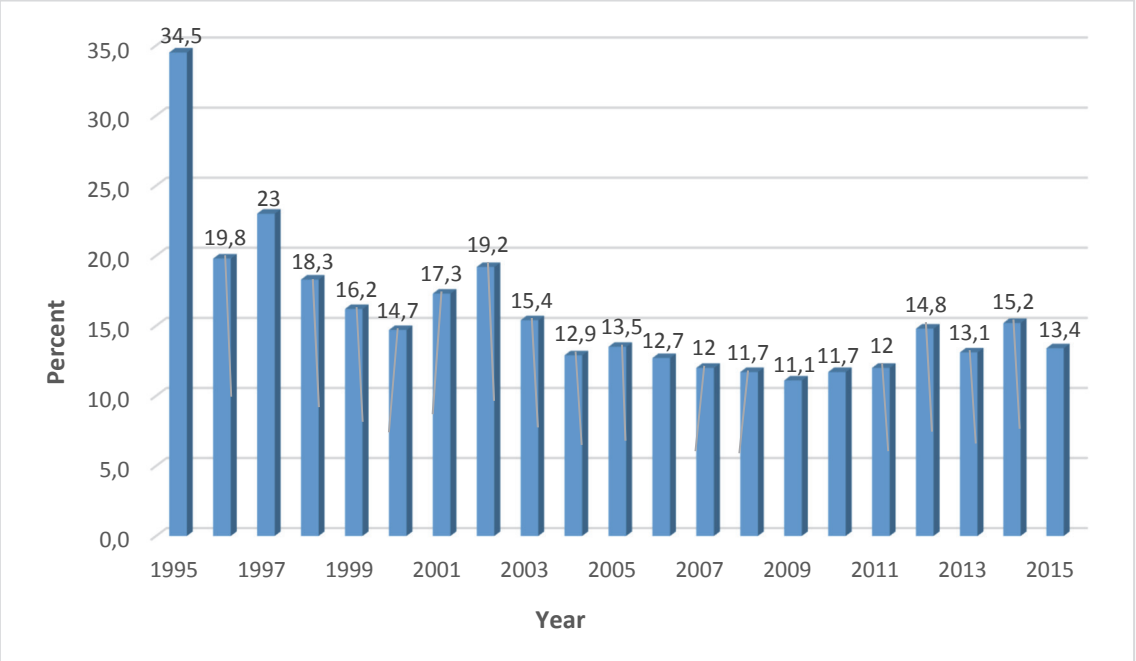

Figure - 7: Percent change in hypoalbuminemia (<3.5 gr / dL) of prevalent HD patients

(Reference: Suleymanlar G., Ates K., Seyahi N., Publications of Turkish Nephrology Society, 2016, Ankara)

2.5. Definition, Incidence, Causes and Outcomes of Malnutrition

Malnutrition is the imbalance between consumption of nutritional elements and meeting the varying needs of metabolism (18). According to another definition, malnutrition (protein - energy malnutrition), a nutritional condition created by measurable side effects on body functions, tissues and clinical outcomes by inadequate, excessive or unbalanced intake of energy, protein or other nutrients (1). Hospital malnutrition is currently one of the most important world problems (19). Having malnutrition in a patient, who admitted to hospital with any reason, due to inadequate nutrition or as a result of the condition caused by disease constitutes the reason influencing the treatment adversely. Malnutrition increases the patient's susceptibility to infections, decreases the

quality of life, delays recovery and prolongs the length of hospital stay. Moreover, it increases the risk of death for many patients (Web - 3).

In recent years, although health policies and researches have focused on obesity (or over-nutrition), inadequate nutrition or malnutrition imposes a serious burden on population in terms of economy and health. Despite significant developments in medicine, malnutrition is an important and frequent health problem worldwide, including developed countries (Web - 3). The incidence of malnutrition is 30-50% in the hospitals of the United States of America and the nutritional status is observed to deteriorate as the length of hospital stay prolongs (19). According to numerous serious research results, in Europe, 5-15% of healthy people, 40% of hospitalized patients and 60% of those living in nursing homes are at risk of malnutrition or have malnutrition (Web - 3). Malnutrition occurs in up to 45% of respiratory system patients, in 80% of inflammatory bowel disease patients and in 85% of patients with malignancy (18).

The European Union has begun to attach importance to the issue with the demonstration of the negative effects of malnutrition on human health and national economy. In 2007, the "Prague Declaration" was published by the European Nutrition for Health Alliance (ENHA). Afterwards, the decision of European Parliament : "Obesity and malnutrition are the most important public health problems." was issued and in 2008, the subject entered the official agenda of European Union. The European Parliament has invited the member countries for collaboration in order to work on the subject of malnutrition until 2013. The "Clinical Enteral Parenteral Nutrition Society (KEPAN)", our only national association on nutritional support, assessed approximately 35,000 patients as a result of the study conducted from 34 centers in 19 cities and lasted 6 months in the years of 2005-2006 with the aim of identifying the situation in our country. The NRS 2002 test was used as a screening method. Consequently, 15% of the patients were found to be at risk in terms of nutrition at admission (Web - 3).

The causes of malnutrition are shown in Table - 9.

Table - 9: Causes of malnutrition

Causes of malnutrition
- Inadequate food intake
- Increased food need
- Malabsorption
- Malignant diseases
- Infections
- Disorders in the metabolic processes of nutritional elements in the body

Reference: Selcuk H., "Malnutrition and its Significance", Current Gastroenterology,16 (2): 158-162,2012

Protein - energy malnutrition is a clinical and measurable nutritional state emerging with impairments in total body performance and functions accompanied by loss of body fat and somatic protein deposits and decreased serum protein levels secondary to inadequate and / or imbalanced protein uptake. Malnutrition increases the risk of cardiovascular death by 27% which increases to 33% in severe malnutrition (20). In general, malnutrition causes immunosuppression, decrease in striated muscle mass, impaired wound healing, atrophy of intestinal mucosa, development of widespread edema, growth retardation in children, and decline in cognitive functions. Physiological losses associated with malnutrition affect gastrointestinal system, immunological system, cardiovascular system, respiratory system, endocrine system wound healing and organs such as kidney, skin, bone marrow, hair. The tendency to anxiety and depression increases with malnutrition. B1, B12, calcium, phosphate and magnesium levels changes and therefore neurological functions are affected adversely. Protein loss results primarily in the disruption of diaphragm and respiratory muscles structure. Heart muscle loss increases and cardiac output decreases, renal plasma flow and glomerular filtration rate

decrease. With long-term starvation, villus sizes, crypt numbers and sizes are reduced and mucosal atrophy develops. Malabsorption and often diarrhea occur with the decrease in gastric, pancreatic, biliary secretions. In severe malnutrition states, vasoconstriction and thermogenic reaction to cold deteriorate. Starvation and weight loss has the tendency for hyponatremia without malnutrition as well (18).

The immune system is impaired secondary to malnutrition, and changes begin in T lymphocytes and complement system, even only with starvation. Thymus atrophy is also one of the conditions associated with malnutrition. If malnutrition causes hypoalbuminemia, cytokine metabolism will be affected due to protein synthesis. IL - 1 activity is suppressed. The decrease in this activity causes slowing in lymphocyte production. Affected complement system leads to negative effects on phagocytosis, chemotaxis and intracellular destruction of bacteria. The early phase of wound healing is delayed. Ultimately, wound healing is delayed and the risk of infection increases. Edema occurs, bowel motility decreases, hypoproteinemia is observed. Bone marrow depression develops. All these factors cause an increase in mortality and morbidity, prolongation in the length of hospital stay and an increase in cost (Figure 8) (18).

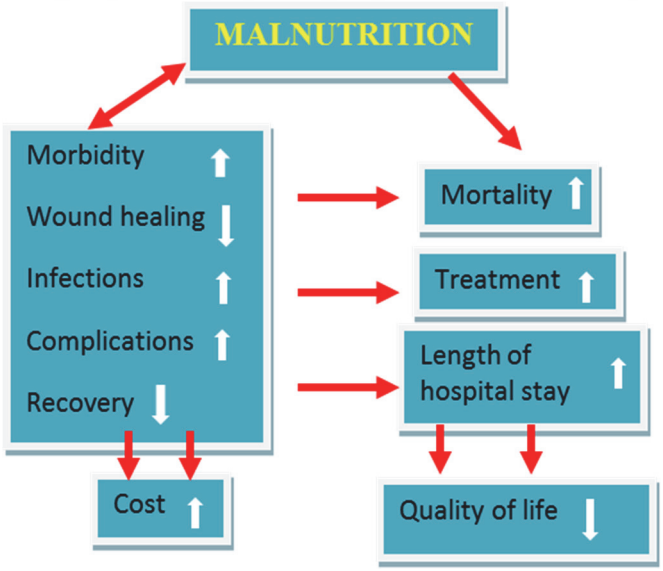

Figure - 8: Outcomes of malnutrition

(Reference: Selcuk H., 'Malnutrition and its Significance', Current Gastroenterology, 16 (2): 158-162,2012)

2.6. The Relationship among Malnutrition - ESRD and Dialysis

The causes of malnutrition in patients with CRF are parallel to the causes of general malnutrition (inflammation, increased resting energy, increased catabolism, decreased food intake, increased food need, economic insufficiency, metabolic acidosis, abnormalities in lipid and carbohydrate metabolism, oral and dental problems). However, in addition to those, malnutrition also occurs as a consequence of reasons such as chronic blood loss during HD, nutrient loss during dialysis, depression, interruption of daily life with HD, HD - associated nausea - vomiting - decrease in taste sensation, side effects of medications (phosphate, iron chelators), not being able to consume numerous loved foods due disease - specific diet and fluid restriction (13). The most common cause is inadequate food intake (20). Malnutrition is one of the most important factors determining morbidity and mortality in dialysis patients (2). Schribner et al. first reported in 1960 that malnutrition may be a problem in patients with CRF (21). The studies conducted in subsequent years showed that malnutrition is an important risk factor for morbidity and mortality in dialysis patients (22).

Malnutrition frequency was reported to be 23-76% in HD patients and 18-50% in PD patients (3). There are two types of malnutrition in HD patients: Type 1 malnutrition called classical type develops due to inadequate protein and calorie intake (13). In this type of malnutrition, the inadequacy of food intake is the main cause (3). Adequate nutrition provides improvement (13). The other type of malnutrition referred as type 2 malnutrition is "the MIA syndrome" (23). In this syndrome, malnutrition, inflammation and atherosclerosis are associated with each other. Protein and calorie intake are usually normal. Proinflammatory cytokines, increased oxidative stress, increased protein proteinuria, increased resting energy, and hypoalbuminemia are its most significant characteristics. It is difficult to treat and it cannot be treated with diet support (13).

Table - 10 includes the comparison of type 1 and type 2 malnutrition (3).

Table - 10: Comparison of malnutrition types in HD patients

	Type 1 (Classical type)	Type 2 (MIA syndrome)
Resting Energy Consumption	Normal	High
Oxidative stress	Increased	Increased
Presence of inflammation	Absent	Present
Serum CRP level*	Normal	High
Frequency of comorbid state	Less frequent	Frequent
Clinical status	Low protein intake	Atherosclerosis - Inflammation
Serum albumin level	Normal or low	Low
Dietary protein intake	Low	Normal or low
Protein catabolism	Reduced	Increased
Body mass	Low	Normal
Dialysis and improvement with nutrition	Yes	No

* CRP level is used as an indicator of inflammation.

Reference: Demir M., Tonbul H. Z. 'Malnutrition-Inflammation-Atherosclerosis (MIA Syndrome) in Patients with End-stage Renal Failure', Turkish Nephrology Dialysis and Transplantation Journal, 14 (4): 160-165,2005

2.7. Biochemical Parameters and The Tests Used in Detection of Malnutrition

The goal of nutritional status assessment at intervals is to determine the presence, the risk and degree of malnutrition in patient and to detect whether nutrition is proper or not (19). Since malnutrition poses a high risk for mortality in CRF patients, it should be assessed correctly. There is no gold standard test for assessing malnutrition in CRF patients (24). According to the NKF / DOQ1 (National Kidney Foundation / DOQ1) declaration, the interpretation of clinical evaluation and biochemical tests together will yield the most accurate result (25).

2.7.1. Biochemical Parameters Used in Detection of Malnutrition

2.7.1.1. Albumin

Albumin is a protein with complex structure and high molecular weight and it is produced in the liver. Because it is an easy and common biochemical parameter, it is also frequently used for nutritional assessment (19). The association of the decrease in serum albumin level with mortality and morbidity was clearly demonstrated in the studies conducted on this subject (2). In a study including more than 12,000 HD patients, a strong association was found between low serum albumin and mortality (20). Serum albumin level is usually a measure reflecting the general clinical condition of patient (6). Albumin level is considered as an indicator of protein deposits in the body (24).

Malnutrition in ESRD patients often results in hypoalbuminemia (3). The main causes of hypoalbuminemia in ESRD patients are the presence of metabolic acidosis, decreased albumin synthesis and exogenous losses (6). In HD patients, 8-12 grams of amino acid loss is observed per session (3). Hypoalbuminemia is the most common cause of death in patients with end-stage renal failure (6). The reports of American Renal Data systems also demonstrate that hypoalbuminemia may increase mortality risk (2).

However, the fact that the half-life of serum albumin is 20 days indicates that it can delay the assessment of nutrition and malnutrition. Also, changes in the rate of crossing into intravascular and extravascular systems and rate of synthesis and catabolism was accepted as a parameter for delayed detection of malnutrition (6). In addition, the facts that its serum concentration level may decrease secondary to inflammation, its

synthesis in liver may be reduced due to hepatic diseases, albumin concentration may decrease due losses through gastrointestinal system and kidneys, hypervolemia, burns limits its use as determinant of nutrition. For these reasons, an albumin level below 3 - 4 g / dL in the blood sample taken before dialysis should be interpreted on the behalf of malnutrition if it is supported with other findings used in detection of malnutrition (24). The annual risk of death was shown to be seven times higher in the patients with an albumin level below 3 mg / dL compared to the patients with an albumin level over 4 mg / dL (26). In the study of Butterworth in 1974, it was found that 56% of cases had no height loss and 23% had no weight loss. Of the patients who lost weight, 61% of the patients lost weight more than 6 kilograms and 37% of the patients had serum albumin levels below 3 g / dL (27). The study conducted on 486 HD patients in Canada by Churchill et al. demonstrated a relationship between low serum albumin levels and mortality and morbidity (28). If serum albumin level was higher than 4 g / dL in HD patients, mortality was minimum. If it was lower than 3 g / dL, mortality increased significantly (2). The conclusion drawn from all references is that a serum albumin level below 4 g / dL is an indicator of malnutrition (20)

2.7.1.2. Blood Urea Nitrogen (BUN)

Another biochemical parameter that can be used while assessing malnutrition is blood urea nitrogen (6). It is accepted as an indicator of protein intake and nutrition (24). The main factors affecting the BUN level are as following; the amount of dietary protein intake, residual GFR, efficacy of dialysis treatment (20). Low BUN value found in the predialysis period was found to increase mortality (24). A predialysis BUN less than 60 mg / dL is an indicator of malnutrition and increases mortality risk (20).

2.7.1.3. Creatinine

Creatinine is produced by non-enzymatic creatine metabolism in skeletal muscle (24). It shows variability depending on gender, ethnic characteristics, body measurements and protein intake of animal origin. Changes in creatinine over time indicate changes in muscle mass (6), because creatine levels are important in understanding muscle (lean mass) mass status (20). Malnutrition should be mentioned if the lean body mass of HD

patients is below 47% of normal level (24). If predialysis serum creatinine level is less than 8 mg / dL, the presence of malnutrition is mentioned in that patient (20).

2.7.1.4. Plasma cholesterol concentration

Total cholesterol is indicator of nutritional status in HD patients (20). The studies show that low serum cholesterol levels increase the risk of mortality (24). While the predialysis total cholesterol level below 200-250 mg / dL expresses the lowest mortality interval, the risk of mortality increases with the decrease of this value below 150 - 180 mg / dL. In conclusion, a predialysis level of plasma cholesterol concentration below 150 mg / dL is an indicator of malnutrition (20).

2.7.1.5. Body Mass Index and Body Weight

One of the simplest methods that can be used to determine nutritional status is to monitor body weight and body mass index (BMI) (22). When the ideal body weight of the patient is calculated, comparison should be made with healthy individuals of the same age and gender. If the weight of patient is between 90-110% of the standard body weight, it refers to the ideal nutritional status. If this ratio is less than 90%, mild-moderate malnutrition should be considered and if it is less than 70%, severe malnutrition should be considered (20). In other words, a weight loss of more than 10% or an excess weight of more than 20% according to the ideal weight of the patient is an indicator of malnutrition (24).

BMI should be over 23 kg / m² in HD patients. A BMI below 20 kg / m² is an indicator of malnutrition (20). With the increase in BMI, it was found that survival increased in HD patients in one year follow-up in contrast to the normal population (29). While obesity increases mortality risk in general healthy population, there are results from the studies on dialysis patients indicating that obesity, on the contrary, increases survival (6). In a study of 418055 patients who were newly initiated dialysis, the life span of the patients with normal BMI or obese patients were determined to increase at the end of 2 years of follow-up. High or normal BMI values also reported to reduce the number of hospitalizations and did not increase mortality (30). In conclusion, a body weight of the patient less than 85% of the ideal weight, a BMI less than 20 kg / m², continuous decrease

in estimated dry weight, a protein intake less than 0.8 g / kg / day, a caloric intake less than 35 kcal / kg / day are the indicators of malnutrition (20). There are also references considering a daily caloric intake less than 25 kcal / kg as an indicator of malnutrition (24). In the hemodialysis (HEMO) trial, 1000 patients who received dialysis for long-term were evaluated and 29% of the patients were found to have serum albumin levels below 3.5 g / dL, 76% had caloric intake below 28 kcal / kg / 1 g / kg / day (31). Considering these findings together with the National Kidney Foundation guideline, numerous dialysis patients are shown to have malnutrition (24).

2.7.1.6. Prealbumin

Prealbumin (Transthyretin - TTR) acts as a protein carrier binding thyroxine and retinol. Its plasma half life is 2.1 days (19). Compared to albumin with the half life of 20 days, it manifests the early changes in nutritional status (20). When the daily protein intake decreases, serum prealbumin level decreases but returns to normal within 2 - 3 days with appropriate nutritional support (6). A prealbumin level below 30 mg / dL in HD patients is an indicator of malnutrition (20).

In a 10-year prospective study by Mitman et al., serum prealbumin was found to be associated with serum albumin, creatinine and total cholesterol, and as a result, prealbumin levels were reported as the best predictor of mortality risk in HD patients (32). Morrell et al. conducted a study on HD and PD patients and demonstrated that for both HD and PD patients, serum prealbumin levels were associated with serum albumin, creatinine and total cholesterol, which are indicators of nutritional status. According to this study, serum prealbumin level was shown to be the strongest indicator of mortality in HD and PD patients and it was reported to be the best tool for determining nutritional status (33).

Although prealbumin is said to be a reliable biochemical parameter frequently used in ESRD, the opposite of this statement is also argued. Some conditions limit its use in nutritional assessment. Serum prealbumin level tends to increase in renal failure and does not respond to malnutrition in the same way as other plasma proteins. The other factors limiting its use as an indicator of malnutrition in patients with ESRD include its excretion via renal route, being affected by acute inflammation and decrease in its serum level in many inflammatory diseases since it is negative acute phase reactant (19).

2.7.2. The Tests Used in Detection of Malnutrition

The screening tests of nutrition should be sensitive enough to identify all patients at risk in terms of nutrition. Screening tests take recent weight loss, recent food intake, BMI and severity of illness into consideration (19). Screening tests should have high sensitivity and specificity, should be easily and fast applicable and should be able to detect moderate and severe malnutrition for early intervention (34). In addition, the validity of screening tests should be high, they should be reliable, practical and should not contain unnecessary information. The purpose of screening tests is to detect protein and /or energy malnutrition or to predict whether the nutritional status of the patient will worsen or improve at the moment or in the future (35).

Although there are numerous assessment tools to determine the nutritional status of hospitalized patients, yet there is no definite and ideal test that is most recommended and on which a consensus is reached. The absence of an ideal test still can be attributed to the fact that the "nutritional risk" concept has not been established. Inappropriate test may lead to wrong or delayed interventions. In this case, resources would be wasted.

The nutritional screening test are as following; MUST (Malnutrition Universal Screening Tool), MNA (Mini Nutritional Assessment), Nutritional Risk Screening (NRS), Short Nutritional Assessment Questionnaire (SNAQ), Malnutrition Screening Tool (MST), Subjective Global Assessment (SMA) (34).

2.7.2.1. MUST (Malnutrition Universal Screening Tool)

In a study including the hospitalized patients and the patients outside hospital, malnutrition incidence was shown to be high in both groups and use of MUST test was shown to yield more favorable outcomes compared to other tests (36). In another study evaluating the reliability of nutritional risk of inpatients, MUST test was reported to detect severe malnutrition at a high rate, but moderate malnutrition at a low rate (37). The MUST test is appropriate for measuring malnutrition in adult individuals in the population (35). The European Society of Parenteral and Enteral Nutrition Society (ESPEN) states that the MUST test should be preferred for non-hospitalized patients while British Association of Parenteral and Enteral Nutrition (BAPEN) recommends the MUST test to be used to determine the patient's nutritional risk and regulate the patient's treatment plan (34). (Annex - 7)

2.7.2.2. MNA (Mini Nutritional Assessment)

The aim of the MNA test is to determine the risk of malnutrition and malnutrition development risk in the elderly. Screening with MNA aims early detection of malnutrition and MNA is a dietary questionnaire including mental and physical indicators that affect nutritional status of the elderly (35). In two different studies investigating the reliability of the MNA test in elderly patients, MNA was found to be a fast, inexpensive, successful and reliable test for detecting the malnutrition risk of patient and that it can determine the mortality risk of the patients reliably (38, 39). However, two other studies, in contrast to the mentioned studies, state that nutritional assessments tests using body mass index as a criterion, especially in elderly patients, cannot be reliable tests (40, 41). (Annex - 8)

2.7.2.3. MST (Malnutrition Screening Tool)

The MST test is a test that questions whether the patient has experienced weight loss or not and whether there is a reduction food intake due to decrease in appetite (34). Ferguson et al. reported that the MST test could detect the patients with a risk of malnutrition with 93-97% confidence in heterogeneous group of patients followed up due to medical and surgical treatment and that it is an easy and rapidly applicable test (42). (Annex - 9)

2.7.2.4. SNAQ (Short Nutritional Assessment Questionnaire)

Kruzenga et al. stated that the SNAQ test was a reliable, easy and rapid test to determine the nutritional risk of patients in their study including heterogeneous patients followed up in the hospital (43). (Annex - 10)

2.7.2.5. SGA (Subjective Global Assessment)

Wu et al. showed that the SGA test was a reliable test to determine the patient's hospital stay and medical cost by determining the risk of malnutrition in patients undergoing surgical treatment for gastrointestinal tumors (44). In another study conducted on patients followed-up in intensive care unit, the SGA test was reported to be an easy-to-use test and that it could predict the outcome of patient (45). However, contrary to these two studies, it was reported that the SGA test is not reliable in

determining the outcome of critical patients, and serum protein measurement tests were more reliable than SGA in determining postoperative complication risk (34). (Annex - 11)

2.7.2.6. NRS 2002 (Nutritional Risk Screening 2002)

The purpose of the NRS 2002 test is to determine the presence of malnutrition and the risk of malnutrition in patients. The NRS 2002 test includes the nutritional components of the MUST test and in addition to that, determines the severity degree of malnutrition (35). It is the most commonly used nutritional screening test today. ESPEN recommends the NRS 2002 test in assessing the nutritional status of patients and the MNA test in the elderly. In the NRS 2002 test, patients are evaluated for severity of nutritional deficiency and malnutrition, and are scored as following: if the score is 0, there is no malnutrition in the patient; if the score is 1, the patient has mild malnutrition. If the score is 2, it is concluded that the patient has moderate malnutrition. If the score is 3, the patient has severe malnutrition. If the test result score is ≥ 3, the patient is considered to have "the risk of under-nutrition" (19).

In a study in which the nutritional risk assessment of the patients with gastric tumors was made with the NRS 2002 test in the preoperative period, it was reported that it could reliably determine the postoperative complications and the length of hospital stay in the patients with the NRS 2002 score ≥3 (46). In a study including elderly patients in whom acute illness occurred, it was shown that NRS 2002 and MNA tests can more reliably determine the nutritional risk of patient compared to serum protein level measurements (47). Gur et al. reported that the NRS 2002 test was more reliable on the patients underwent general surgery in their study (48). Likewise, Karl et al. indicated that the NRS 2002 test was more reliable in the patients who were followed up for urological diseases (49). (Annex - 5)

2.8. Nutritional Recommendations for Hemodialysis Patients

Dietary therapy plays an important role in the treatment of HD patients (50). All of the patients initiated HD should consult with a dietitian and plan diet therapy (51). In a study examining the nutritional status in dialysis patients treated with HD and CAPD in

Europe, it was shown that regular nutritional training by dietitians working in dialysis centers had a significant effect on taking the recommended energy and protein levels, anthropometric measurements in appropriate standards, and normal laboratory findings and owing to these trainings, malnutrition, which affects morbidity and mortality, was found to be less frequent in these patients (52).

The goal of arranging the nutrients to be taken by the patients receiving HD therapy is not to create fluid impairment and electrolyte disturbances in patients and not to aggravate uremia signs. This treatment improves and maintains the condition of patients by obtaining a well nutritional status (50). Although nutritional therapy is important for all dialysis patients, it is much more important especially in the patients who recently initiated HD, patients with decreased albumin level, patients with low serum creatinine which indicates that muscle mass is reduced, patients with low serum cholesterol which indicates that energy intake is insufficient, the patients with poor appetite - repetitive vomiting, patients with diarrhea - constipation and in overweight patients (51).

Dietitians play an important role in arranging the nutrition of patients receiving HD therapy. As mentioned above, the frequency of dietary consultation of patients varies according to their needs. However, the patient should visit dietician at least once a month in order to observe his/her course of treatment. The dietician ensures the short and long-term goals of the diet. A short-term goal is to prevent the consumption of high sodium and potassium-containing foods by patient or to provide them to be consumed in correct portions. Because high sodium and potassium intake can cause serious complications in the patient. The long-term goal is prevention of weight loss secondary to insufficient protein intake and renal osteodystrophy secondary to hyperphosphatemia (50). It was determined that the HD patients who paid attention to their diets had lower serum potassium levels, took less fluid between two dialyses and established better communication with the dialysis team (53). Protein, energy, carbohydrate, fat, sodium, water, potassium, phosphorus, calcium and vitamin needs of HD patients are as follows:

2.8.1. Protein

Protein need in patients receiving hemodialysis should be increased to avoid negative nitrogen balance and replace amino acid deficiencies during dialysis. Adequate protein intake has a significant role in dietary treatment of HD patients (6). Inadequate

protein uptake, loss of amino acids and protein through peritoneal membrane, from dialyser to dialysate may create hazardous consequences for the patient. In HD patients, up to 13 g of amino acid is lost, 5-8 g as free amino acid and 4-5 g as bound to peptides (2). In a study conducted on pigs, 40% reduction in plasma amino acid concentration was observed in pigs receiving HD compared to normal pigs (54). Protein catabolism increases secondary to metabolic disorders due to these losses. The lost amino acid must be replaced in order to avoid negative nitrogen balance (6).

The dietary protein should be adjusted to 1.2 g / kg / day in HD patients according to the National Kidney Foundation Dialysis Outcome Quality Initiative (NKF - DOQI) (55). According to ESPEN and some other sources, it was reported that the protein need in HD patients should be adjusted to 1.1 - 1.2 - 1.4 g / kg / day and that half of this protein should be of high biological value (of animal origin) (6). However, enough calorie intake should be provided to prevent the use of protein as an energy source by gluconeogenesis. When this is not provided, positive nitrogen balance cannot occur despite high protein intake (13). However, most patients will find the protein intake in this amount higher than 0.5 - 0.6 g / kg / day protein intake given diet in the predialysis period (50). This change emerging with HD should be explained to the person that s/he will benefit from this. Veeneman et al. examined the effects of protein and energy-rich meal on total body protein metabolism during dialysis in 6 HD patients. The content of this test meal was set at 0.6 g / kg / day protein (50% of daily protein intake) and 15 kcal / kg / day energy. During the four-hour HD session, the patients were made to consume this test meal. Comparisons were made during the session with the same patients without consuming food and by making them consume test meal. Plasma amino acid concentration in the session in which food intake occurred was determined to be higher than that of starvation HD session. This diet, rich in protein and energy, improved the negative effects of HD on total body protein balance. During the feeding, body protein synthesis and oxidation increased while total body protein degradation decreased (56).

Also, the amount of protein in patient's diet is determined by the rate of glomerular filtration, the body weight adjusted according to the patient's hydration status, and whether the disease is progressing or not. While the diet of HD patients are arranged, the body weight calculated from mean or dry weight + ideal body weight / 2 should be used instead of actual body weight (6). A BUN below 120 mg is a good parameter to evaluate the adequacy of protein intake in dialysis patients (57).

It was reported that when protein intake of 1.2 g / kg / day in dialysis patients provided, adequate control of blood urea nitrogen concentration was obtained, nutritional parameters (albumin, total protein, cholesterol etc.) improved and positive nitrogen balance was provided (6).

2.8.2. Energy

The energy needs of HD patients may vary depending on their physical activity (2). In order to achieve energy balance, energy expenditure must be equal to energy intake. Energy expenditure requires a sufficient level of energy intake to enable efficient use of the restricted dietary protein intake, efficient use of body nutrient deposits and protection and support of body nutrient deposits. The energy needs are stated as 35 kcal / kg / day for patients under 60 years old, as 30 - 35 kcal / kg (ideal body weight) / day for the patients who are 60 years old and over according to The National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF – DOQI) (6).

In a study conducted by the HEMO study group, 78% of the patients received less than 28 kcal / kg / day of energy and 59% of them received less than 1 g / kg / day of protein (58). In another study conducted by another HEMO study group, the dietary records of 1000 HD patients were saved. Male and female patients were detected to take 24.1 and 21.8 kcal / kg / day of protein with the means of 0.98 and 0.89 g / kg / day protein, respectively. It was concluded that the recommended energy and protein intake were inadequate in 90% and 50% of HD patients, respectively (31).

It is not easy for HD patients to take up protein and energy needs as recommended. Adequate energy intake can be neglected in situations such as occasional restriction conditions of phosphorus and potassium intake (6).

2.8.3. Carbohydrate

The dietary carbohydrate content must be high to preserve the protein to be used for tissue protein synthesis and to close the energy deficit. Three hundred - 400 g per day or 55 - 60% of the energy should be provided from carbohydrates (13). HD patients are also recommended to take 20-25 g of fiber per day, as in healthy people (59).

2.8.4. Lipid

Hypertriglyceridemia and type 4 hyperlipidemia are common findings in HD patients. Low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL) concentrations are high and high-density lipoprotein (HDL) concentration is low. The main cause of hypertriglyceridemia is the inadequacy of excreting the circulating triglycerides. The activities of lipoprotein lipase and hepatic lipase enzymes are reported to decrease in these patients (13). In 40-50% of patients, the triglyceride level is higher than 200 ml / dL and in 20-30% the total cholesterol level is 240 mg / dL and the LDL cholesterol level is over 130 mg / dL. Decrease in glomerular filtration causes a significant increase in plasma lipid levels. Especially clinically significant hyperlipidemia occurs in patients with creatinine clearance below 50 ml / min (60). In many patients, increased dietary imbalance and elevated levels of triglycerides may be satisfactorily reduced (50). In dialysis patients, 30-35% of calorie need should be provided from lipids (13). It is known that the carnitine deposits generally decrease in HD patients with malnutrition. However, during HD treatment, carnitine is also excreted from extracellular fluid and this causes a sudden drop in serum carnitine level. Carnitine deficiency causes impairment in oxidation of long chain fatty acids and causes insufficient energy production (6). Adding 1.5 g of carnitine three times a week to HD patients' diets were found to decrease plasma triglyceride and LDL cholesterol levels and increase HDL cholesterol levels (61).

2.8.5. Sodium and Water

Water and sodium intake are adjusted according to fluid balance, blood pressure and urine volume of HD patient (13). It is recommended that the body weight obtained between two HD sessions should not exceed 1.5 - 2 kg (6). The amount of fluid that should be given to an anuric patient according to the urine volume (less than 50 ml of daily urine) should be calculated as '24 x 0.5 x body weight (kg)'. In oliguric patients (daily urine volume less than 400 - 500 ml), it is calculated as '24 x 0.5 x body weight (kg) + urine volume of the day before'. The fluid intake between the two dialyses should be kept at about 1 L per day or at most 3% of dry weight (13). For most dialysis patients, daily fluid intake should be between 1000 - 1500 mL on average. The liquid content of nutrients should also be included in these allowed limits (50).

The daily sodium intake of a normal person is usually 2.3 to 6.9 g. In HD patients, sodium balance is closely associated with urinary output of patient (2). Daily intake of

sodium should be 3 - 4 g / day in oliguric patients and 1 - 2 g / day in anuric patients. Daily intake of sodium for HD patients can be adjusted to 2 g + 1 g per every liter of urine (59). The best evidence of excessive sodium intake in the diet is peripheral or pulmonary edema. Most of the stable dialysis patients learn to avoid excess sodium intake by reducing food containing high sodium from their diet a few months after they initiate regular dialysis treatment. However, some patients are unable to reduce sodium intake to avoid being overweight. Instead, they believe that excessive sodium and water intake will improve with dialysis ultrafiltration. Also, hyperglycemia in diabetic patients creates an additional osmotic load stimulating thirst, this is another encountered challenge (50).

2.8.6. Potassium

The average daily potassium intake of a normal person is 2-6 g. The daily potassium requirement should be considered personally for each patient (2). However, since HD patients are usually anuric, potassium restriction is required. Daily intake of potassium should be restricted to 1600 - 2000 mg in anuric HD patients. Acute hyperpotassemia usually occurs when a patient who is not in good condition do not receive HD for a few days. Chronic hypopotassemia may occur when oliguric patients do not pay attention to the potassium restriction recommended with diet. HD therapy is utilized for acute hyperpotassemia. In a HD patient who does not follow diet, hyperkalemia that is dangerous enough to threaten life may occur. Therefore, the dietician should emphasize the importance of potassium restriction when interviewing with HD patients. Most patients ultimately achieve control of potassium intake (50). Potassium rich foods include legumes, dried nuts, red meats, artichoke, potato, spinach, lettuce, parsley, banana, coffee, kiwi, dried fruits, fruit juices (Web - 4).

2.8.7. Phosphorus

Deficiency of phosphorus renal excretion is closely associate with glomerular filtration rate. Even a single nonfunctional nephron may cause phosphorus accumulation in the plasma by leading to inefficiency in phosphorus excretion (6).

Maintaining the predialysis level of serum phosphorus at 2.5-4.5 mg / dL is one of the goals of diet therapy (50). In order to achieve this goal, the patient is provided with 800 to 1200 mg of daily dietary intake of phosphorus. Since, especially protein sources

with high biological value containing essential amino acids are rich in phosphorus, it is difficult to restrict phosphorus (6). Dietary phosphorus restriction is generally insufficient to control serum phosphorus level alone (50). It is not possible to reduce the phosphorus to less than 1200 mg per day with this recommended protein diet, and therefore phosphate binder drugs are often needed (2). Another reason for needing the use of phosphate binders is that about 80% of the dietary phosphorus intake is absorbed from the gastrointestinal tract (6). Examples of nutrients rich in phosphorus are milk, cheese, yoghurt, red meat, poultry, fish, legumes, bulgur, coffee, dried nuts (Web - 4).

2.8.8. Calcium and Vitamin D

In dialysis patients, calcium need increases due to protein and phosphorus restriction, loss of appetite and vitamin D deficiency (6). Dialysis patients need more calcium in their diets than healthy people because of active vitamin D deficiency and resistance to vitamin D in uremic environment (13). Calcium absorption from the intestines is impaired in dialysis patients. Addition of calcium and vitamin D preparations is effective to ensure adequate calcium absorption (62). However, since calcium and vitamin D use in HD patients may result in severe hypercalcemia and cause renal osteodystrophy, this treatment should be carried out very carefully (6). Since the intake of dairy products is restricted in order to reduce phosphorus uptake, the renal diet tends to be poor in calcium (13). As a result, there is a need for 1000-1500 mg of calcium per day to keep the calcium balance at positive level in dialysis patients (58).

2.8.9. Other Vitamins

In HD patients, deficiencies of water-soluble vitamins may occur due to inadequate nutrient intake, metabolic changes caused by uremia, impaired absorption due to drug intake and uremia and losses through dialysis. For this reason, water soluble vitamins are given to most dialysis patients routinely (B group vitamins, folic acid, vitamin C) in water. Lipid soluble vitamin A and E are not given regularly. Serum vitamin A level is high in dialysis patients due to the increase in serum retinol binding protein, decrease in the renal catabolism of vitamin A and the inability to remove vitamin A through dialysis. Administration of vitamin A may cause toxicity in these patients. Controversial results were found in studies on vitamin E level in dialysis patients.

However, in short-term studies, the duration of erythrocyte life was found to prolong with the administration of vitamin E. However, its long-term effects are unknown. Thus, whether vitamin E supplementation is necessary or not is controversial (13).

In a study conducted in Japan, records were collected from patients receiving HD using nutritional measurement method. According to these records, patients were reported to receive an average of 66 g / day protein, 71 g / day fat, 261 g / day carbohydrate, 770 ml water and 1983 kcal / day energy. The dietary intake of vitamin B1, B2, B5, B6, B12, C, folic acid, calcium, iron, zinc, copper and manganese were determined to be less than their needs. It was said that inadequate intake of these vitamins was caused by restriction of dietary potassium and protein, and therefore, it was necessary to make replacements (63).

Coleman and Watson concluded that there was more loss in patients with long-term HD therapy while there was no vitamin or mineral deficiency in patients receiving short-term HD therapy and vitamins and minerals should be replaced (64).

3. MATERIALS AND METHODS

3.1. Research Time and Sample Selection

This research was conducted between the dates of April 2016 and August 2016 in the Private Aka Dialysis Center and the Private Yasam Dialysis Center. A total of 281 registered adult patients on chronic dialysis program with the age range of 23 to 94 years participated in the study. Of those, 124 were female and 157 were male. First of all, the patients were made to read "Patient information form" (Annex - 2) prepared to give information about the research and then they signed "Patient approval form" (Annex - 3). There were no patients who did not want to participate in the study. Two patients could not be included in the study because they had Alzheimer's disease. Another two patients were not included in the study because they were mentally disabled. For this study, "Ethics Committee Approval" (Annex - 1) dated 30.03.2015 was obtained from 'Istanbul Medipol University Non - Interventional Clinical Research Ethics Committee'.

3.2. Collection of Data

First, a questionnaire, (Annex-4) the reliability of which was measured by Cronbach's Alpha, was administered to the study participants. In this questionnaire, the personal information of the patients participated in the study was obtained by asking them questions and anthropometric information was taken (the weights of patients were measured after HD session (dry weight). The statistical results of medical information (serum albumin level, total cholesterol level, blood urea nitrogen level, creatinine level, presence of diabetes mellitus) were obtained from the results of blood tests which were routinely taken from patients every month and were obligatory to be studied in the dialysis centers that they were treated. Secondly, the NRS 2002 test (Annex 5) was administered to measure their malnutrition status. According to the answers given by the patients to the questions in the test, their malnutrition scores were calculated and malnutrition degrees were determined with these scores.

3.3. Statistical Assessment of Data

3.3.1. Techniques of Research

Statistical analysis of the study was carried out with the aid of SPSS 21 program. Of the numerical data in the study, the statistical analyzes of the normally distributed parameters were investigated with Independent t-test and one way Anova test. The parameters without normal distribution were analyzed by Mann Whitney U test and Kruskal Wallis H test (non-parametric tests). Categorical and ordinal data were analyzed by Pearson chi-square and Fisher's exact Chi-square tests. The graphical representations in the study were drawn with the help of the Microsoft Office Excel 2010 program. Also, the descriptive statistics for the categorical variables in the study were written as "n" and percentage values while those for numerical variables were written as minimum - maximum value and mean - standard deviation. In all analysis techniques, the error is kept at 0.05, so the decisions were given at 95% confidence level.

3.3.2. Reliability Analysis

A reliability analysis was conducted to measure the consistency of the answers given to the questionnaire, which were prepared according to the scale type. When reliability analysis was performed, of the ordinal and intermittent expressions included in the questionnaire, those which were significant for study were selected. Besides, increasing the number of expression in reliability analysis may increase the reliability coefficient incorrectly. In this context, when reliability analysis was performed, Cronbach's Alpha value was found to be 0.714 (Annex - 6). A Cronbach's Alpha value higher than 0.70 indicates that the questionnaire is reliable and applicable (65, 66).

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistics

4.1.1. Statistical Results of Personal Characteristics

Table - 11: Statistical results of the personal characteristics of the patients participated in the study

	Personal Characteristics
Age mean±std deviation (interval)	61,44 ± 13,91 (23-94)
Gender % (n)	
Female	44.1 (124)
Male	55.9 (157)
Body Weight mean±std deviation (interval)	70.37 ± 15.02 (35.5-131.5)
Body Weight (before three months) mean±std deviation (interval)	70.96 ± 15.16 (35.5-133.0)
Body Mass Index mean±std deviation (interval)	25.86 ± 6.26 (13.80-89.10)
Education Status % (n)	
Illiterate	19.2 (54)
Literate	5.7 (16)
Primary School Graduate	49.5 (139)
Secondary School Graduate	11.0 (31)
High School and its Equivalent Graduate	8.9 (35)
University Graduate	5.7 (16)
Occupational Information % (n)	
Self-employed	10.7 (30)
Public Servant	7.1 (20)
Worker	6.8 (19)
Retired	75.4 (212)

BMI *% (n)*	
Underweight	5.3 (15)
Normal	44.8 (126)
Overweight	29.9 (84)
Grade I obesity	15.7 (44)
Grade II and III Obesity	4.3 (12)

Information of the descriptive statistical characteristics of the participants in the study were reported as **"mean ± standard deviation (interval) and percentage value (sample size)"**.

Some descriptive information of HD patients participated in the questionnaire are summarized in Table - 11. The mean age of the study participants was found to be 61.44 ± 13.91 years. Of the study participants, 44.1% were female and 55.9% were male (Figure - 9). The mean age of the females in the study was 63.29 ± 13.74 years while the mean age of males was 59.98 ± 13.91 years.

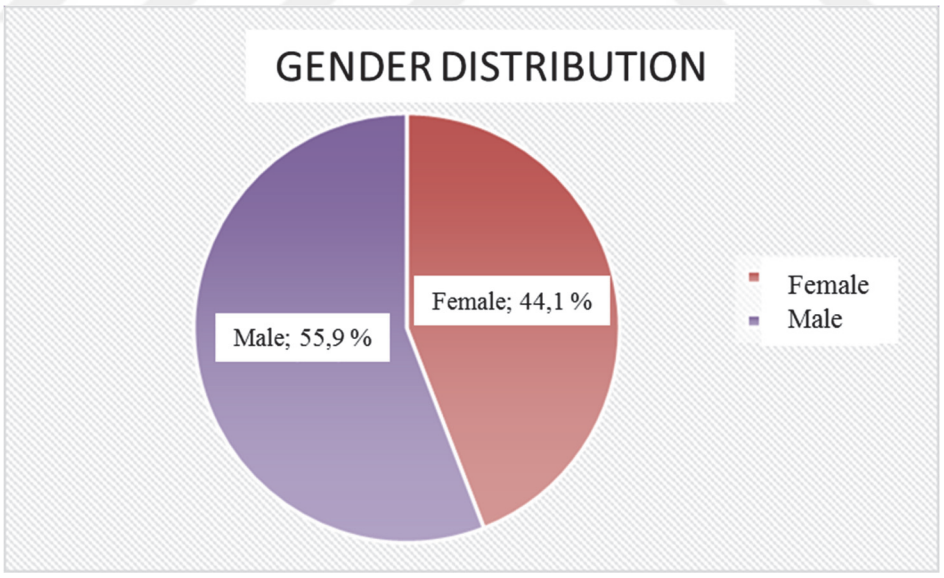

Figure - 9: Gender distribution of the patients participated in the study

The mean body weight of the study participants was 70.37 ± 15.02 kg on the day of participating the study whereas it had been found to be 70,96 ± 15,16 kg three months ago. The mean BMI of HD patients participated in the survey was 25.86 ± 6.26 (13.80-89.10). It was observed that 19.2% of the males and females were illiterate while 5.7% were literate and 49.5% were primary school graduates (Figure - 10). Also, 11.0% of them were secondary school graduates, 8.9% were high school and equivalent school graduates and 5.7% were university graduates. Most of the patients in the study were observed to be primary school graduates and some of them were illiterate. The number of university graduates was determined to be very low. In a research, the quality of life was determined to increase in parallel with the increase in the educational status of the patients (67). It was stated that as the level of education increases, the perception of health would change and improve in a positive way, individuals would take more responsibility of their own health and in this respect, they would better learn the strategies to manage their diseases / disease symptoms (68).

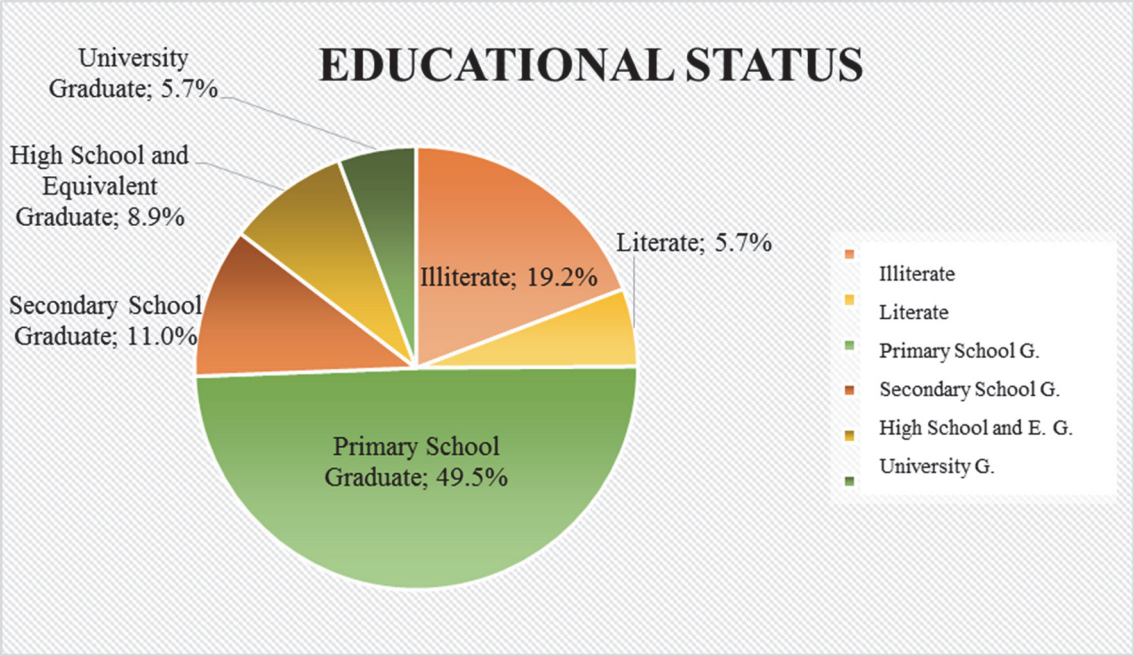

Figure - 10: Educational status of the patients participated in the study

Of the patients participated in the study, 6.8% were workers, 7.1% were civil servants, 10.7% were self-employed and 75.4% were retired (Figure-11).

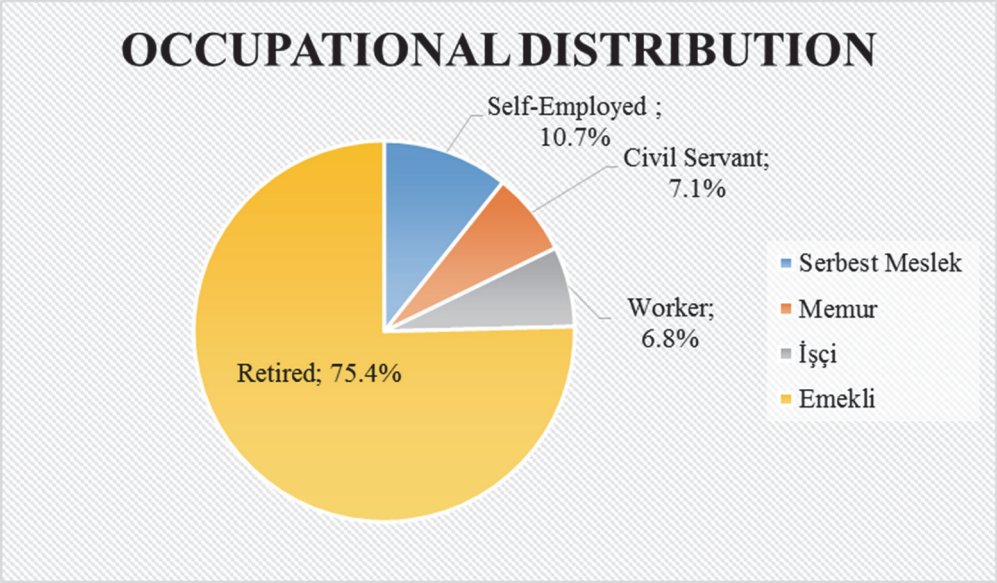

Figure - 11: Occupational distributions of the patients participated in the study

While calculating BMI in HD patients, dry weight is taken as actual weight. Also in this study, the dry weight of the patients after dialysis were taken as basis. Examining the body mass index groups, the results were as follows: 5.4% of the study participants were in the underweight group, 44.8% were in the normal weight group and 29.9% were in the overweight group. In addition to this, 15.7% of the patients were in the Grade I obesity group and 4.3% were in the Grade II and III obesity group (Figure - 12). Since the number of people with grade II and III obesity was very low compared to other groups, those two groups were combined under the name of "the grade II and II obesity group".

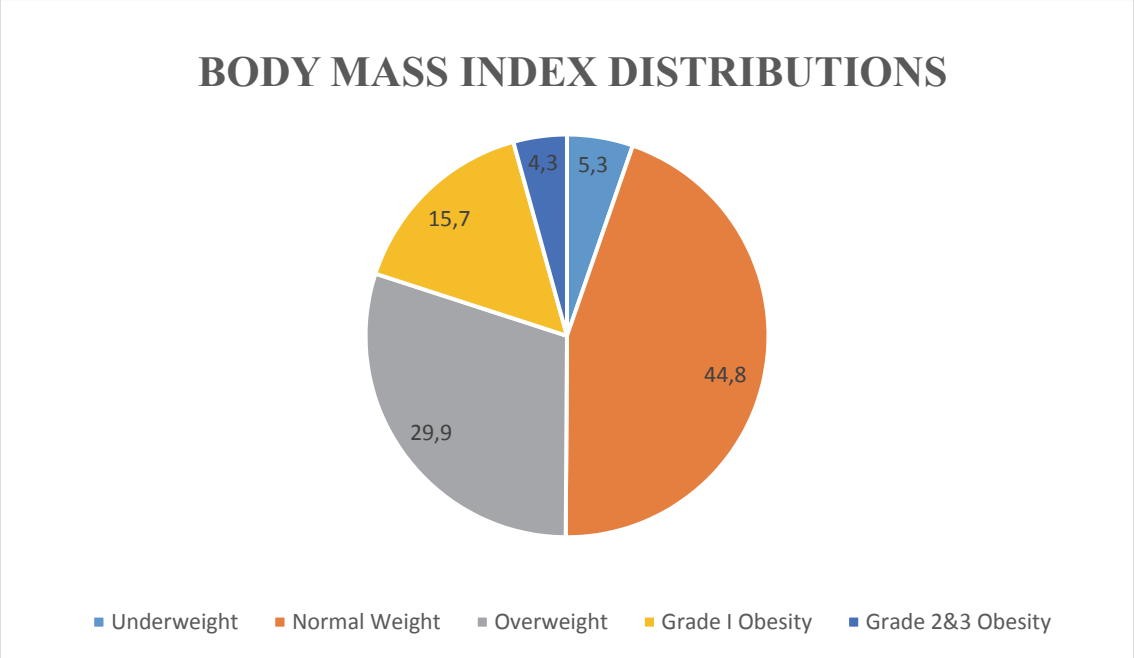

Figure - 12: Body Mass Index distributions of the patients participated in the study

4.1.2. Statistical Results of Medical Information

Table - 12: Medical information results of the patients participated in the study

	Medical Information
NRS Malnutrition Groups % (n)	
No malnutrition	55.2 (155)
Mild Malnutrition	12.5 (35)
Moderate Malnutrition	17.4 (49)
Severe malnutrition	14.9 (42)
Disease of Diabetes % (n)	
Present	38.8 (109)
Absent	61.2 (172)
Renal Diagnosis % (n)	
Before 0 – 1 Year	18.1 (51)
Before 2 – 5 Years	45.2 (127)
Before 6 - 10 Years	19.9 (56)
Before 11 - 15 Years	7.8 (22)
16 Years or Before a Longer Period of Time	7.8 (22)
Duration of Hemodialysis % (n)	
Before 0 – 1 Year	29.5 (83)
Before 2 – 5 Years	46.3 (130)
Before 6 - 10 Years	16.4 (46)
Before 11 - 15 Years	4.6 (13)
16 Years and Longer Period of Time	2.1 (6)

Frequency of Hemodialysis % (n)	
Twice per Week	20.6 (58)
Three Times per Week	77.9 (219)
Four Times per Week	0.7 (2)
Serum albumin % (n)	
Malnutrition is present	65.8 (185)
No malnutrition	34.2 (96)
Blood Urea Nitrogen % (n)	
Malnutrition is present	1.1 (3)
No malnutrition	98.9 (278)
Serum creatinine% (n)	
Malnutrition is present	76.5 (215)
No malnutrition	23.5 (66)
Plasma cholesterol concentration % (n)	
Malnutrition is present	33.6 (92)
No malnutrition	66.4 (182)

Information of the descriptive statistical characteristics of the participants in the study were reported as **"mean ± standard deviation (interval) and percentage value (sample size)"**.

The NRS 2002 test is the most commonly used nutritional status screening method currently. In addition to other malnutrition tests, it determines the severity of malnutrition (35). ESPEN recommends the NRS 2022 test in assessing the nutritional status of patients (19). For this reason, the NRS 2002 test was used to determine the malnutrition status and degrees of the patients in the study.

According to the NRS 2002 test results of HD patients in the study (Table-12), malnutrition was not detected in 55.2% of the patients while it was observed in 44.8% (mild malnutrition in 12.5%, moderate malnutrition in 17.4% and severe malnutrition in 14.9%) of the patients (Figure - 13). In parallel with this study, Saran et al. found the incidence of malnutrition in HD patients as 40% and stated that this increased mortality and morbidity (69).

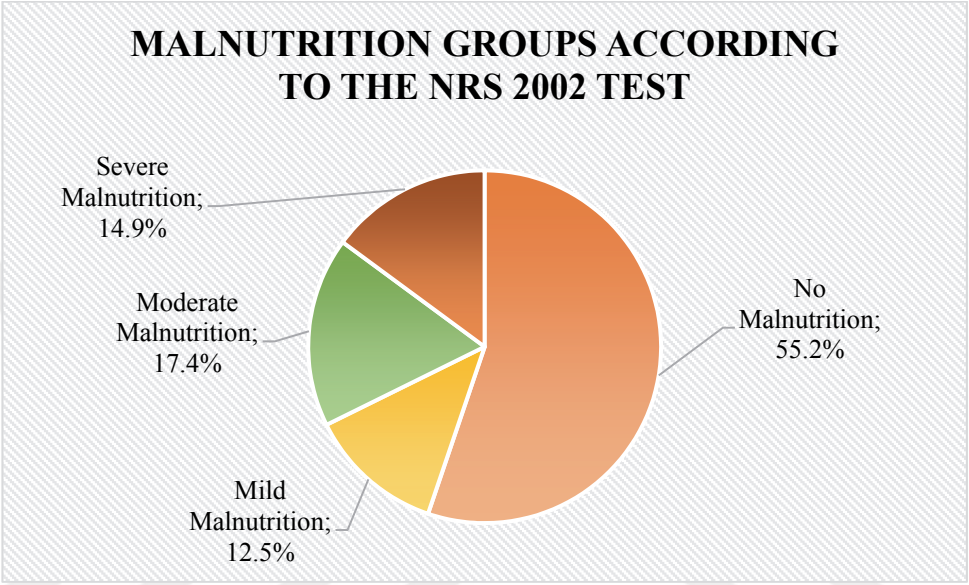

Figure - 13: Malnutrition status of patients participated in the study according to the NRS 2002 Test results

Of the study participants, 38.8% were diabetic while 61.2% were not (Figure - 14).

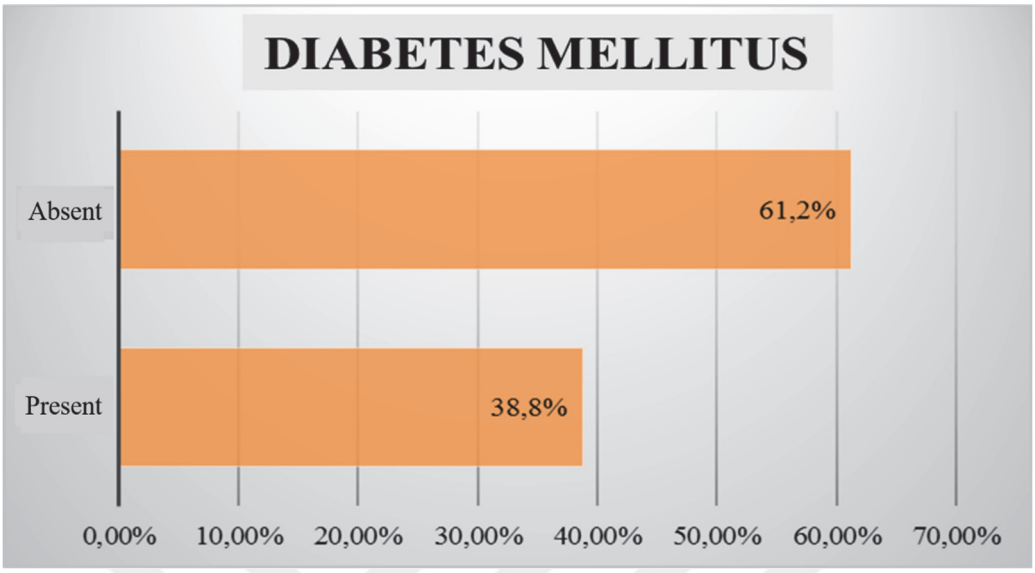

Figure - 14: Distribution of patients participated in the study according to the presence of diabetes mellitus

Of the patients participated in the study, renal disease diagnosis was made 0-1 year ago in 18.1%, 2-5 years ago in 45.2% and 6-10 years ago in 19.9%. The diagnosis was made 11-15 years ago in 7.8% of the patients and before 16 years or more in 7.8% of the patients (Figure-15).

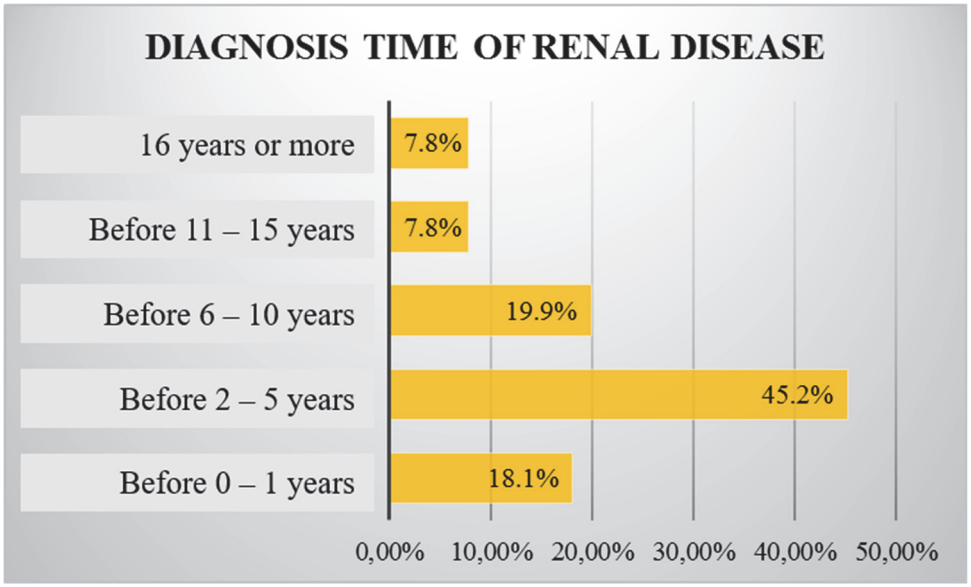

Figure - 15: Disease diagnosis time of the patients participated in the study

Of the patients in the study, 29.5% reported that they had received HD for 0-1 year, this duration was 2-5 years for 46.3% of them and 6-10 years for 16.4% of them. Of the patients, 4.6% had been on HD therapy for 11-15 years and 2.1% had been on HD therapy for 16 years or more (Figure - 16).

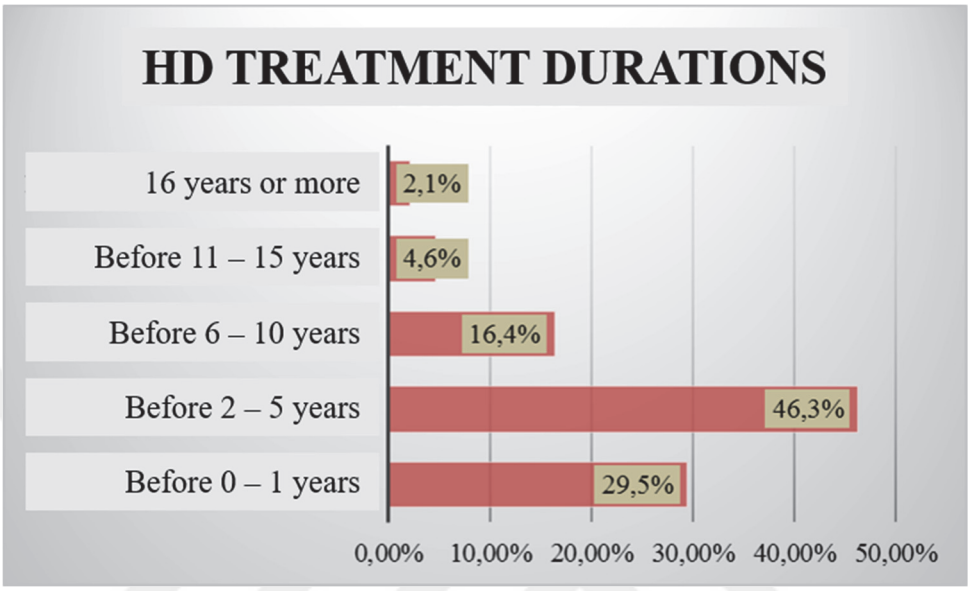

Figure - 16: HD treatment durations of the patients participated in the study

Of the renal patients, 20.6% received HD treatment twice per week, 77.9% three times per week and 0.7% four times per week (Figure - 17).

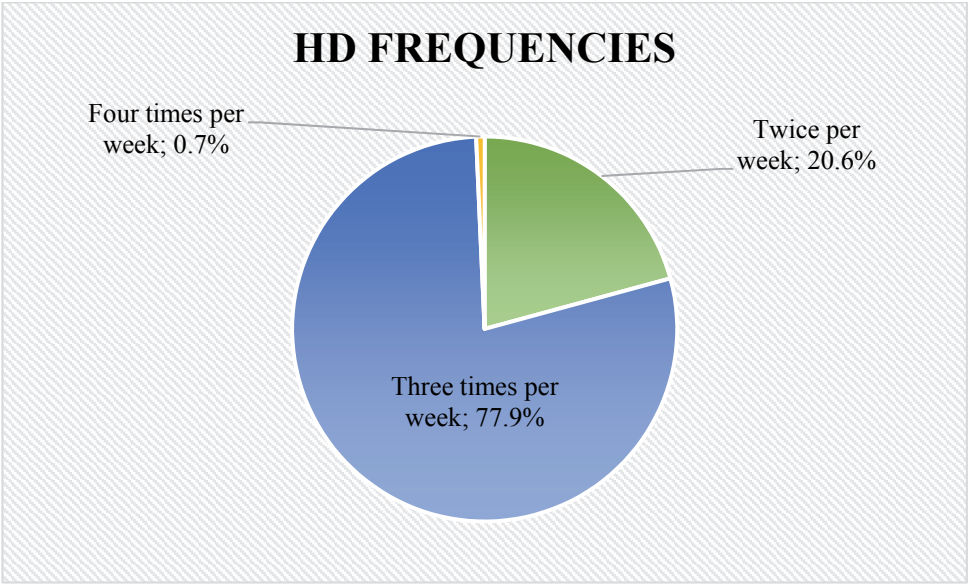

Figure - 17: Frequency of HD treatment received per week by the patients participated in the study

According to the results of the predialysis blood samples of the HD patients, when the serum albumin level was below 4 g / dL, they were accepted to have malnutrition (20). Malnutrition was detected in 65.8% of the patients participated in the study in terms of albumin and 34.2% of them did not have any malnutrition finding (Figure - 18). In the study examining the relationship between nutritional status and mortality in HD patients by Fuhr et al., malnutrition was reported to occur most frequently in the group with the lowest serum albumin level (70). Lowrie et al. emphasized that HD patients with low BUN and albumin levels had a higher likelihood of mortality and morbidity compared to other dialysis patients. Evaluating the results of 12,000 patients on hemodialysis were evaluated, 25% of patients were found to have serum albumin levels lower than 3.7 g / dL (26).

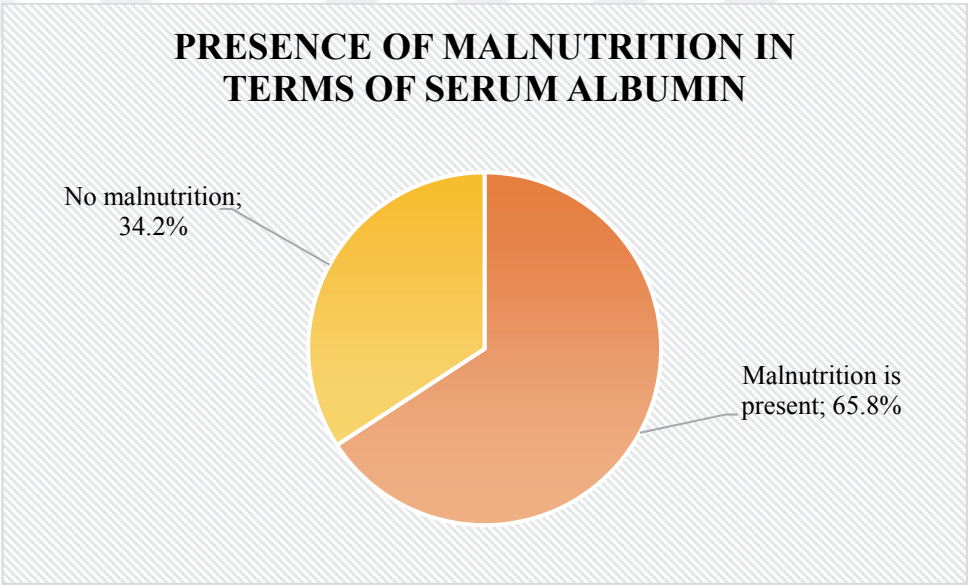

Figure - 18: Malnutrition status of the patients participated in the study in terms of serum albumin

According to the results of the predialysis blood samples of the HD patients, when the blood urea nitrogen level of the person was below 60 mg / dL, the person was considered to have malnutrition (20). Malnutrition in terms blood urea nitrogen was present only in 1.1% of the patients participated in the study while 98.9% of the patients did not have malnutrition (Figure - 19). The BUN level was not lower than the reference value in the majority of the patients. The study by Ozturk on HD patients also supports this research. It was indicated that the BUN levels of all the patients participated in the research were over the reference intervals (13).

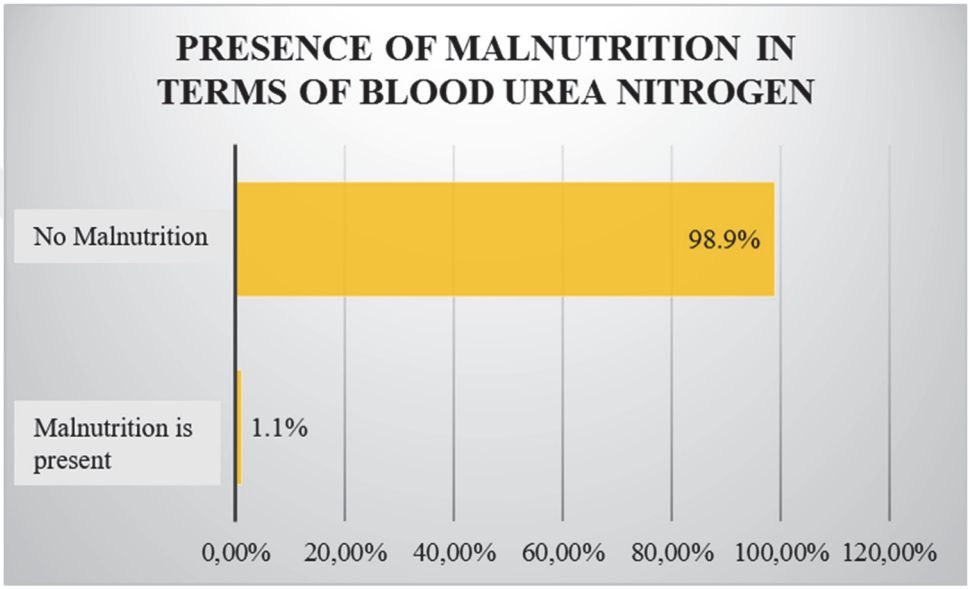

Figure - 19: Malnutrition status of the patients participated in the study in terms of blood urea nitrogen

According to the results of the predialysis blood samples of the HD patients, when the serum creatinine level was less than 8 mg / dL, the patient was accepted to have malnutrition (20). Malnutrition was found in terms of serum creatinine in 76.5% of the HD patients whereas no malnutrition was present in 23.5% of the patients (Figure - 20). In the study by Ozturk, the creatinine values of all patients participated in the study were found to be over reference value (13). Olcay found the mean initial blood creatinine levels of the patients as 9.21 ± 1.75 mg / dL in his research on HD patients (71).

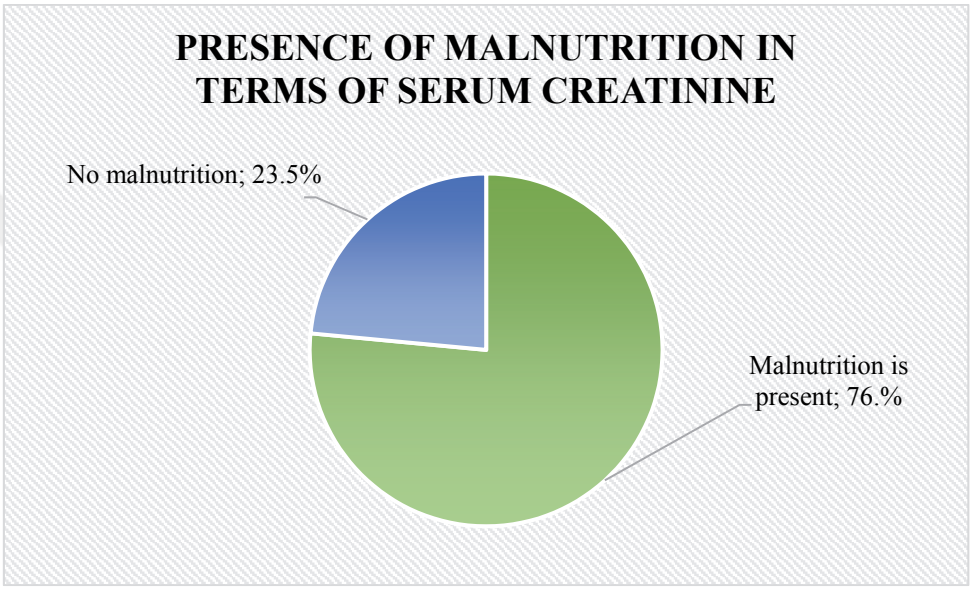

Figure - 20: Malnutrition status of the patients participated in the study in terms of serum creatinine

According to the results of the predialysis blood samples of the HD patients, when the plasma cholesterol concentration of the person was below 150 mg / dL, the person was considered to have malnutrition (20). In 33.6% of the patients included in the study, there was malnutrition in terms of plasma cholesterol concentration while 66.4% did not have malnutrition (Figure - 21).

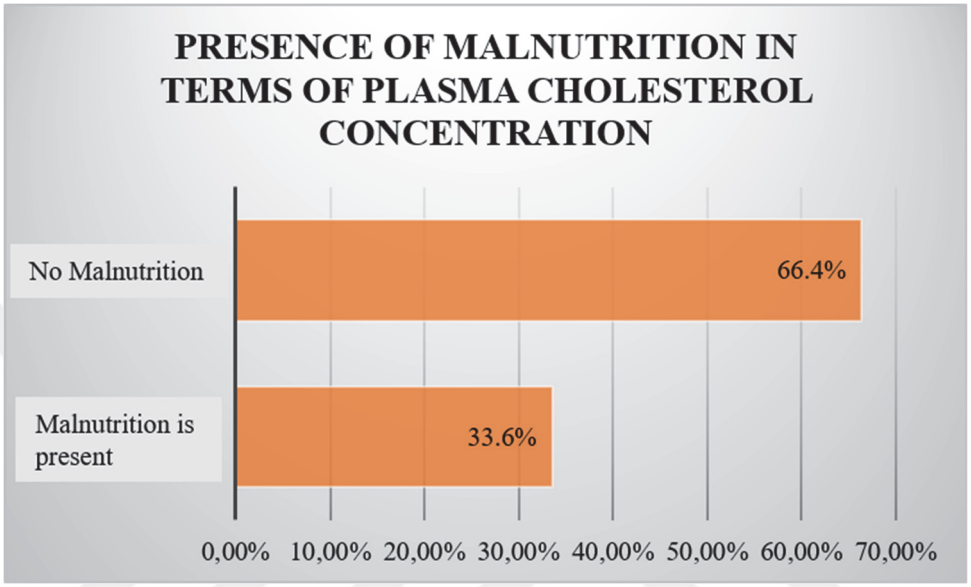

Figure - 21: Malnutrition status of the patients participated in the study in terms of plasma cholesterol concentration

4.2. Statistical Results of the Assessment of Research Parameters According to Each Other

4.2.1. Assessment of Body Mass Index with Other Parameters

Table - 13: Assessment of Body Mass Index with other parameters of the patients participated in the study

Assessment of Body Mass Index with Other Parameters

	Underweight	**Normal**	**Overweight**	**Grade I Obesity**	**Grade II and III Obesity**	**p¥**
Disease of Diabetes % (n)						
Present	0.0 (0)	27.8 (35)	56.0 (47)	50.0 (22)	41.7 (5)	**0.0001¥**
Absent	100.0 (15)	72.2 (91)	44.0 (37)	50.0 (22)	5,3 (7)	
Renal Diagnosis % (n)						
Before 0 – 1 Year	7.1 (1)	17.7 (22)	23.8 (20)	15.9 (7)	8.3 (1)	
Before 2 – 5 Years	50.0 (7)	37.9 (47)	488 (41)	568 (25)	5,3 (7)	
Before 6 - 10 Years	7.1 (1)	258 (32)	155 (13)	15.9 (7)	25.0 (3)	
Before 11 - 15 Years	7.1 (1)	9.7 (12)	48 (4)	114 (5)	0.0 (0)	**0,059**
16 Years or Before a Longer Period of Time	28.6 (4)	8.9 (11)	7.1 (6)	0.0 (0)	8.3 (1)	

Duration of Hemodialysis % (n)						
Before 0 – 1 Year	7.1 (1)	29.0 (36)	40.5 (34)	22.7 (10)	16.7 (2)	**0.040¥**
Before 2 – 5 Years	64.3 (9)	38.7 (48)	46.4 (39)	9.1 (26)	66.7 (8)	
Before 6 - 10 Years	14.3 (2)	21.0 (26)	10.7 (9)	15.9 (7)	16.7 (2)	
Before 11 - 15 Years	14.3 (2)	7.3 (9)	1.2 (1)	2.3 (1)	0.0 (0)	
16 Years and Longer Period of Time	0.0 (0)	4.0 (5)	1.2 (1)	0.0 (0)	0.0 (0)	
Frequency of Hemodialysis % (n)						
Twice per Week	15.4 (2)	22.2 (28)	20.2 (17)	18.2 (8)	25.0 (3)	**0.717**
Three Times per Week	84.6 (11)	77.8 (98)	77.4 (65)	81.8 (36)	75.0 (9)	
Four Times per Week	0.0 (0)	2.4 (2)	2.4 (2)	0.0 (0)	0.0 (0)	
Serum albumin % (n)						
Malnutrition is present	80.0 (12)	59.5 (75)	75.0 (63)	568 (25)	833 (10)	**0.042¥**
No malnutrition	20.0 (3)	40.5 (51)	25.0 (21)	43.2 (19)	16.7 (2)	

Blood Urea Nitrogen % (n)						
Malnutrition is present	0.0 (0)	1.6 (2)	1.2 (1)	0.0 (0)	0.0 (0)	
No malnutrition	100.0 (15)	98.4 (124)	98.8 (83)	100.0 (44)	100.0 (12)	**0.894**
Serum creatinine% (n)						
Malnutrition is present	93.3 (14)	74.6 (94)	75.0 (63)	77.3 (34)	833 (10)	**0.550**
No malnutrition	6.7 (1)	25.4 (32)	25.0 (21)	22.7 (10)	16.7 (2)	
Plasma cholesterol concentration % (n)						
Malnutrition is present	42.9 (6)	37.4 (46)	25.6 (21)	36.4 (16)	27.3 (3)	**0.402**
No malnutrition	57.1 (8)	62.6 (77)	74.4 (61)	63.6 (28)	72.7 (8)	

The associations of the study participants with some categorical parameters were observed by taking their body mass index groups as reference and the details of these associations are given in Table - 13. Of the BMI groups, none of the patients in the underweight group had diabetes mellitus while 27.8% of those with normal weight had diabetes mellitus. Of the overweight people, 56.0% of had diabetes while 44.0% did not have diabetes. Half of the patient with grade I obesity had diabetes. Of the patients with grade II and III obesity, 41.3% had diabetes while 58.3% did not have. There is a statistically significant relationship between the presence of diabetes and the BMI groups. The presence of Diabetes mellitus varies depending on BMI groups ($p = 0.0001$).

Of the underweighted patients according to the BMI groups, 7.1% were diagnosed with renal disease 0-1 year ago, 50% 2-5 years ago and 7.1% 6-10 years ago. Also, 7.1% of them were diagnosed with renal disease 11-15 years ago and 28.6% were diagnosed 16 years ago or more. Of the normal weight patients according to the BMI groups, 17.7% were diagnosed with renal disease 0-1 year ago, 37.9% 2-5 years ago and 25.8% 6-10 years ago and 9.7% 11-15 years ago. Also, 8.9% of them were determined to have renal disease 16 years ago or more. According to the BMI groups, of the overweight patients, 23.8% were diagnosed with renal disease 0-1 year ago, 48.8% 2-5 years ago and 15.5% 6-10 years ago and 4.8% 11-15 years ago. In addition to these, 7.1% of them were determined to have renal disease 16 years ago or more. According to the BMI groups, of the patients with grade I obesity, 15.9% learnt that they had renal disease 0-1 year ago, 56.8% 2-5 years ago and 15.9% 6-10 years ago and 11.4% 11-15 years ago. According to the BMI groups, of the patients with grade II and III obesity, 8.3% were determined to have renal disease 0-1 year ago, 58.3% 2-5 years ago and 25.0% 6-10 years ago and 11.4% 11-15 years ago. Also, 8.3% of the subjects were found to have renal disease 16 years ago or more. There was no statistically significant relationship between the diagnosis time of renal disease of the subjects and the BMI groups. The diagnosis time of renal disease showed independent distribution among the BMI groups ($p = 0.059$).

According to the BMI groups, of the underweighted patients, 7.1% stated to receive HD treatment for 0-1 year, 64.3% for 2-5 years and 14.3% for 6-10 years. Also, 14.2% of the people reported to receive HD treatment for 11-15 years. According to the BMI groups, of the normal weight patients, 29.0% reported to receive HD treatment for 0-1 year, 38.7% for 2-5 years, 21.0% for 6-10 years old, 7.3% for 11-15 years. Also, 4.0% of the patients had received HD treatment for 16 years or more. According to the BMI groups, of the overweight patients, 40.5% stated to receive HD treatment for 0-1 year,

46.4% for 2-5 years, 10.7% for 6-10 years and 1.2% for 11-15 years. In addition to this, 1.2% of the subjects were found to receive HD for 16-years or longer. According to the BMI groups, of the patients with grade I obesity 22.7% were found out to receive HD treatment for 0-1 year, 9.1% for 2-5 years, 15.9% for 6-10 years and 2.3% for 11-15 years. According to the BMI groups, of the patients with grade II and III obesity 16.7% were determined to receive HD treatment for 0-1 year, 66.7% for 2-5 years and 16.7% for 6-10 years. There was a statistically significant relationship between the duration of HD treatment of the subjects and the BMI groups. The duration of HD treatment of the subjects varied depending on the BMI groups ($p = 0.040$).

According to the BMI groups, of the underweighted patients, 15.4% reported to receive HD treatment twice per week, 85.6% three times per week. According to the BMI groups, of the normal weight patients, 22.2% declared to receive HD treatment twice per week, 77.8% three times per week and 2.4% four times per week. According to the BMI groups, of the overweight patients, 20.2% reported to receive HD treatment twice per week, 77.4% three times per week and 2.4% four times per week. According to the BMI groups, of the patients with grade I obesity who were in the survey, 18.2% reported to receive HD treatment twice per week and 81.8% three times per week. According to the BMI groups, of the patients with grade II and II obesity, 25.0% reported to receive HD treatment twice per week, 75.0% three times per week. There was no statistically significant relationship between the HD frequencies of the subjects and BMI groups. HD frequency showed distribution independent of BMI groups ($p = 0,717$).

According to the BMI groups, malnutrition was present in 80.0% of the underweighted patients in terms of serum albumin while 20% did not have malnutrition. Malnutrition was present in 59.5% of the normal weight patients in terms of serum albumin while 40.5% did not have malnutrition. Malnutrition was present in 75.0% of the overweight patients in terms of serum albumin while it was present in 56.8% of the patients with grade I obesity. In terms of serum albumin, 43.2% of persons with grade I obesity did not have malnutrition. Of the patients with grade II and III obesity, 83.3% had malnutrition and 16.7% did not in terms of serum albumin. There was a statistically significant relationship between the presence of malnutrition and BMI groups according to the serum albumin standard. The presence of malnutrition showed variability according to the BMI groups ($p = 0.0001$).

No finding of malnutrition was observed in the underweight patients in terms of blood urea nitrogen according to the BMI groups. Malnutrition was present in 1.6% of

the normal weight people in terms of blood urea nitrogen whereas malnutrition was not present in 98.4% of them. There was no malnutrition in 98.8% of the overweight people in terms of blood urea nitrogen. There was no malnutrition in the patients with grade I obesity in terms of blood urea nitrogen. Also, there was no malnutrition in the patients with grade II and III obesity. No significant relationship was observed between the presence of malnutrition in terms of blood urea nitrogen and BMI groups. The presence of malnutrition in terms of blood urea nitrogen was distributed independently of the BMI groups ($p = 0.894$).

According to the BMI groups, malnutrition was present in 93.3% of the patients in the underweight group in terms of serum creatinine and 6.7% of them did not have any malnutrition finding. Malnutrition was present in terms of serum creatinine in 74.6% of normal weight subjects, but there was no malnutrition in 25.4% of them. Malnutrition was present in terms of serum creatinine in 75.0% of the overweight subjects and in 77.3% of the subjects with grade I obesity. No malnutrition was detected in 22.7% of the subjects with grade I obesity. Whereas malnutrition finding was detected in 83.3 % of the subjects with grade II and III obesity and 16.7% of them did not have malnutrition. There was no statistically significant relationship between the presence of malnutrition in terms of serum creatinine of the subjects and BMI groups. The presence of malnutrition in terms of serum creatinine was randomly distributed among the BMI groups ($p = 0.550$).

According to the BMI groups, malnutrition was present in terms of plasma cholesterol concentration in 42.9% of the underweighted subjects whereas it was not found in 57.1% of them. Malnutrition was present in terms of plasma cholesterol concentration in 37.4% of the normal weight subjects but not in 62.6% of them. There is no malnutrition in terms of plasma cholesterol in 74.4% of the overweight people while it was not present in terms of plasma cholesterol in 63.6% of the subjects with grade I obesity. Malnutrition was present in terms of plasma cholesterol in 27.3% of the subjects with grade II and III obesity while it was not detected in 72.7% of them. There was no statistically significant relationship between the presence of malnutrition in terms of plasma cholesterol concentration of the subjects and BMI groups. The presence of malnutrition in terms of plasma cholesterol concentration was distributed independently of the BMI groups ($p = 0.402$).

4.2.1.1. Comparison of Body Mass Index Groups in Terms of Serum Albumin Levels

Table - 14: Comparison of body mass index groups in terms of serum albumin levels

Comparison of BMI Groups in Terms of Serum Albumin Levels

	Body Mass Index Groups				
	Underweight	**Normal**	**Overweight**	**Grade I Obesity**	**Grade II and III Obesity**
Serum albumin *mean±std deviation* ***(g / dL)***	3.670 ± 0.515	3.879 ± 0.316	3.744 ± 0.361	3.943 ± 0.335	3.713 ± 0.273
p Significance Value ¥			**0.002**¥		

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

Of the study participants, the mean serum albumin level of the patients who were underweight according to the BMI groups was found to be 3.670 ± 0.515 g/dL while it was found to be 3.879 ± 0.316 g/ dL for the normal weight group. The mean serum albumin level of overweight subjects was found to be 3.744 ± 0.361 g/dL. Also , the mean serum albumin level of the subjects with grade I obesity according to the BMI groups was found to be 3.943 ± 0.335 g/dL while that of the subjects with grade II and III obesity was found to be 3.713 ± 0.273 g/dL (Table - 14).

The serum albumin levels of the subjects were highest in the patients with grade I obesity and lowest in the underweight patients. There were statistically significant differences among the BMI groups in terms of the means of serum albumin levels (p = 0.002). These mean differences are as shown in Table - 15. According to the table, the serum albumin levels of the underweight subjects were statistically significantly lower than that of the normal weight patients and patients with grade I obesity (p = 0.027, p = 0.008). The serum albumin levels of normal weight patients

were statistically significantly higher than that of the overweight patients (p = 0.006). The serum albumin levels of the overweight patients were statistically significantly lower than that of the patients with grade 1 obesity (p = 0.002). Also, the aforementioned values of the patients with grade I obesity were statistically significantly higher than that of the patients with grade II and III obesity (p = 0.041).

Table - 15: Subgroup comparison of body mass index groups in terms of serum albumin levels

Subgroup Comparison of BMI Groups in Terms of Serum Albumin Levels

	Mean Differences	***Standard Error***	***p Significance Value ¥***
Underweight			
Normal Weight	-0.209	0.094	**0.027¥**
Overweight	-0.074	0.096	**0.441**
Grade I Obesity	-0.273	0.102	**0.008¥**
Grade II and III Obesity	-0.043	0.133	**0.745**
Normal Weight			
Underweight	0.209	0.094	**0.027¥**
Overweight	0.134	0.048	**0.006¥**
Grade I Obesity	-0.063	0.061	**0.291**
Grade II and III Obesity	0.165	0.103	**0.112**
Overweight			
Underweight	0.074	0.096	**0.441**
Normal Weight	-0.134	0.048	**0.006¥**
Grade I Obesity	-0.198	0.064	**0.002¥**
Grade II and III Obesity	0.031	0.106	**0.770**

Grade I obesity			
Underweight	0.273	0.102	**0.008¥**
Normal Weight	0.063	0.061	**0.291**
Overweight	0.198	0.064	**0.002¥**
Grade II and III Obesity	0.229	0.112	**0.041¥**
Grade II and III Obesity			
Underweight	0.043	0.133	**0.745**
Normal Weight	-0.165	0.103	**0.112**
Overweight	-0.031	0.106	**0.770**
Grade I obesity	-0.229	0.112	**0.041¥**

Information on the subject characteristics of the participants in the study were reported as **"mean differences and standard error"** in the table.

¥; Statistical studies were carried out at 95% confidence level.

4.2.1.2. Comparison of Body Mass Index Groups in terms of Plasma Cholesterol Concentration Levels

Table - 16: Comparison of body mass index groups in terms of plasma cholesterol concentration levels

Comparison of BMI Groups in terms of Plasma Cholesterol Concentration Levels

	Body Mass Index Groups				
	Underweight	**Normal**	**Overweight**	**Grade I Obesity**	**Grade II and III Obesity**
Plasma cholesterol concentration *mean ± std deviation* ***(mg / dL)***	172.23 ± 55.609	168.98 ± 45.24	193.55 ± 55.273	172.704 ± 48.215	195.216 ± 74.225
p Significance Value ¥			**0.010**¥		

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

Of the study participants, the mean plasma cholesterol concentration level of the underweight patients according to the BMI groups was found to be 172.23 ± 55.609 mg/dL while it was found to be 168.98 ± 45.24 mg/dL in the normal weight group. The mean plasma cholesterol concentration level of the overweight patients was found to be 193.55 ± 55.273 mg/dL. Also, the mean plasma cholesterol concentration level of the subjects with grade I obesity according to the BMI groups was 172.704 ± 48.215 mg/dL whereas it was determined to be 195.216 ± 74.225 for those with grade II and III obesity. The plasma cholesterol concentration levels were highest in the subjects with grade II and III obesity and lowest in the underweight subjects. There were statistically significant differences among the BMI groups in terms of plasma cholesterol concentration levels (p = 0.010) (Table-16).

These mean differences are as shown in Table - 17. According to the table, the plasma cholesterol concentrations of the normal weight HD patients were statistically significantly lower than those of the overweight patients (p = 0.001). The plasma cholesterol concentration levels of the overweight HD patients were statistically significantly higher than those of the HD patients with grade I obesity (p = 0.029).

Table - 17: Subgroup comparison of body mass index groups in terms of plasma cholesterol concentration levels

Subgroup Comparison of BMI Groups in terms of Plasma Cholesterol Concentration Levels

	Mean Differences	***Standard Error***	***p Significance Value*** ¥
Underweight			
Normal Weight	3.253	14.595	**0.824**
Overweight	-21.322	14.67	**0.147**
Grade I Obesity	-0.468	15.56	**0.976**
Grade II and III Obesity	-22.981	20.441	**0.262**
Normal Weight			
Underweight	-3.253	14.595	**0.824**
Overweight	-24.576	7.233	**0.001**¥
Grade I Obesity	-3.722	8.912	**0.677**
Grade II and III Obesity	-26.234	15.966	**0.102**
Overweight			
Underweight	21.322	14.67	**0.147**
Normal Weight	24.576	7.233	**0.001**¥
Grade I Obesity	20.853	9.481	**0.029**¥
Grade II and III Obesity	-1.657	16.291	**0.919**

Grade I obesity			
Underweight	0.468	15.56	**0.976**
Normal Weight	3.722	8.912	**0.677**
Overweight	-20.853	9.481	**0.029¥**
Grade II and III Obesity	-22.511	17.102	**0.189**
Grade II and III Obesity			
Underweight	22.981	20.441	**0.262**
Normal Weight	26.234	15.966	**0.102**
Overweight	1.657	16.291	**0.919**
Grade I obesity	22.511	17.102	**0.189**

Information on the subject characteristics of the participants in the study were reported as **"mean differences and standard error"** in the table.

¥; Statistical studies were carried out at 95% confidence level.

4.2.1.3. Comparison of Body Mass Index Groups in Terms of Blood Urea Nitrogen Levels

Table - 18: Comparison of Body Mass Index Groups in Terms of Blood Urea Nitrogen Levels

Comparison of BMI Groups in Terms of Blood Urea Nitrogen Levels

	Body Mass Index Groups				
	Underweight	**Normal**	**Overweight**	**Grade I Obesity**	**Grade II and III Obesity**
Blood urea nitrogen ***mean±std deviation*** ***(mg / dL)***	126.013 ± 38.481	131.95 ± 31.324	132.60 ± 30.311	133.059 ± 23.785	135.558 ± 26.999
p Significance Value ¥			**0.933**		

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

Of the patients participated in the study, the mean blood urea nitrogen level of the underweight patients according to the BMI groups was found to be 126.013 ± 38.481mg/dL whereas those of the normal weight group were observed to be 131.95 ± 31.324 mg/dL. The mean blood urea nitrogen level of the overweight patients was determined to be 132.60 ± 30.311 mg/dL. Also, the mean blood urea nitrogen level of the patients with grade I obesity according to the BMI groups was 133.059 ± 23.785 subjects with grade II and III obesity and lowest in the group of

underweight subjects. However, there was no statistically significant difference among the BMI groups in terms of the means of blood urea nitrogen levels. Blood urea nitrogen levels of the subjects were observed to be similar in BMI groups ($p = 0.933$) (Table - 18).

4.2.1.4. Comparison of Body Mass Index Groups in Terms of Serum Creatinine Levels

Table - 19: Comparison of Body Mass Index Groups in Terms of Serum Creatinine Levels

Comparison of BMI Groups in Terms of Serum Creatinine Levels

	Body Mass Index Groups				
	Underweight	**Normal**	**Overweight**	**Grade I Obesity**	**Grade II and III Obesity**
Serum creatinine *mean±std deviation* ***(mg / dL)***	5.361 ± 1.795	6.672 ± 2.262	6.679 ± 2.177	6.587 ± 2.079	6.480 ± 2.476
p Significance Value ¥			**0.286**		

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

Of the patients participated in the study, the mean serum creatinine level in the underweight subjects according to the BMI groups was found to be 5.361 ± 1.795 mg/dL and it was found to be 6.672 ± 2.262 mg/dL in the normal weight subjects. The mean serum creatinine level of the overweight patients was found to be 6.679 ± 2.177 mg/dL. Also, the mean serum creatinine level in the group with grade I obesity according to the BMI groups was 6.587 ± 2.079 while it was determined to be 6.480 ± 2.476 mg/dL in the group with grade II and III obesity. The serum

creatinine levels of the HD patients participated in the study were observed to be highest in the overweight group and lowest in the underweight group. However, no statistically significant difference was found among the BMI groups in terms of the means of serum creatinine levels. Creatinine levels of the subjects were similar in the BMI groups ($p = 0.286$) (Table - 19).

4.2.2. Statistical Results of the NRS 2002 Test Results

Table - 20: Associations of Malnutrition Groups According to the NRS 2002 Test Results with Other Parameters

Associations of Malnutrition Groups with Other Parameters According to the NRS 2002 Test Results

	No malnutrition	**Mild Malnutrition**	**Moderate Malnutrition**	**Severe malnutrition**	**p¥**
Disease of Diabetes % (n)					
Present	39.4 (61)	31.4 (11)	53.1 (26)	26.2 (11)	**0.049¥**
Absent	60.6 (94)	68.6 (24)	46.9 (23)	73.8 (31)	
Renal Diagnosis % (n)					
Before 0 – 1 Year	17.4 (27)	27.3 (9)	16.3 (8)	17.1 (7)	**0.357**
Before 2 – 5 Years	49.7 (77)	30.3 (10)	42.9 (21)	46.3 (19)	
Before 6 - 10 Years	16.8 (26)	24.2 (8)	28.6 (14)	19.5 (8)	
Before 11 - 15 Years	10.3 (16)	3.0 (1)	4.1 (2)	7.3 (3)	
16 Years or Before a Longer Period of Time	5.8 (9)	15.2 (5)	8.2 (4)	9.8 (4)	

Duration of Hemodialysis % (n)					
Before 0 – 1 Year	29.0 (45)	27.3 (9)	34.7 (17)	29.3 (12)	
Before 2 – 5 Years	51.6 (80)	36.4 (12)	36.7 (18)	48.8 (20)	
Before 6 - 10 Years	12.3 (19)	24.2 (8)	24.5 (12)	17.1 (7)	**0.130**
Before 11 - 15 Years	5.2 (8)	3.0 (1)	4.1 (2)	4.9 (2)	
16 Years and Longer Period of Time	1.9 (3)	9.1 (3)	0.0 (0)	0.0 (0)	
Frequency of Hemodialysis % (n)					
Twice per Week	21.9 (34)	2.9 (1)	28.6 (14)	22.5 (9)	
Three Times per Week	77.4 (120)	97.1 (34)	69.4 (34)	77.5 (31)	**0.093**
Four Times per Week	0.6 (1)	0.0 (0)	2.0 (1)	0.0 (0)	
Serum albumin % (n)					
Malnutrition is present	61.9 (96)	57.1 (20)	77.6 (38)	73.8 (31)	**0.094**
No malnutrition	38.1 (59)	42.9 (15)	22.4 (11)	26.2 (11)	

Blood Urea Nitrogen % (n)					
Malnutrition is present	0.6 (1)	0.0 (0)	0.0 (0)	4.8 (2)	
No malnutrition	99.4 (154)	100.0 (35)	100.0 (49)	95.2 (40)	**0.086**
Serum creatinine % (n)					
Malnutrition is present	74.8 (116)	60.0 (21)	83.7 (41)	88.1 (37)	**0.018¥**
No malnutrition	25.2 (39)	40.0 (14)	16.3 (8)	11.9 (5)	
Plasma cholesterol concentration % (n)					
Malnutrition is present	26.6 (41)	40.0 (14)	36.2 (17)	52.6 (20)	**0.016¥**
No malnutrition	73.4 (113)	60.0 (21)	63.8 (30)	47.4 (18)	

According to the NRS 2002 Test results of the subjects participated in the study, some associations were observed between some categorical parameters and the degrees of malnutrition groups and the details of these associations relations were given in Table - 20.

According to the NRS 2002 Test results, 39.4% of the patients without malnutrition had diabetes while 60.6% did not. Diabetes mellitus was present in 31.4% of the patients with mild malnutrition. Of the subjects with moderate malnutrition, 53.1% had diabetes while 46.9% did not. Of the patients with severe malnutrition, 26.2% were diagnosed with diabetes and 73.8% were not. There was a statistically significant relationship between the presence of diabetes and the NRS 2002 Test results (malnutrition degrees) ($p = 0.049$).

According to the NRS 2002 Test results, 17.4% of the patients without malnutrition were diagnosed with renal disease 0-1 year ago, 49.7% of the patients were diagnosed 2-5 years ago and 16,8% were diagnosed 6-10 years ago. Of the subjects, 10.3% was diagnosed with renal disease 11-15 years ago and 5.8% were diagnosed 16 years ago or more. Renal disease diagnosis was made in 27.3% of the patients with mild malnutrition 0-1 year ago, in 30.3% 2-5 years ago, in 24.2% 6-10 years ago and in 3.0% 11 - 15 years ago. Also, 15.2% of the subjects were diagnosed with renal disease 16 years ago or more. Of the patients in the moderate malnutrition group, 16.3% were diagnosed with renal disease 0-1 year ago, 42.9% were diagnosed 2-5 years ago, 28.6% were diagnosed 6-10 years ago and 4.1% were diagnosed 11-15 years ago. Renal diagnosis was determined in 8.2% of the patients 16 years ago or more. Of the patients with severe malnutrition, 17.1% learnt that they had renal disease 0-1 year ago, 46.3% learnt 2-5 years ago, 19.5% learnt 6-10 years ago. Also, 7.3% of the patients learnt that they had renal disease 11-15 years ago and 9.8% learnt 16 years ago or more. There was no statistically significant relationship between the diagnosis time of renal disease and malnutrition groups determined according to the NRS 2002 test results. The diagnosis time of renal disease was distributed independently among the malnutrition groups ($p = 0.357$).

According to the NRS 2002 Test results, 29.0% of patients without malnutrition reported to receive HD for 0-1 year, 51.6% of them for 2-5 years and 12.3% of them for 6-10 years. Also, 5.2% of the subjects stated that they had received HD for 11-15 years and 1.9% for 16 years or more. Of the patients with mild nutrition, 27.3% were determined to receive HD for 0-1 year, 36.4% for 2-5 years, 24.2% for 6-10 years and 3.0% for 11-15 years. Also, 9.1% of the subjects were determined to receive HD for 16

years or more. Of the patients with moderate malnutrition, 34.7% reported that they had received HD for 0-1 year, 36.7% for 2-5 years, 24.5% for 6-10 years and 4.1% for 11-15 years. Of the patients with severe malnutrition, 29.3% were determined to receive HD for 0-1 year, 48.8% for 2-5 years, 17.1% for 6-10 years and 4.9% for 11-15 years. There was no statistically significant relationship between the duration of HD treatment and malnutrition grades. The durations of HD treatment were homogenously distributed in the malnutrition groups according to the NRS 2002 Test results (p = 0,130).

According to the NRS 2002 Test results of the malnutrition groups, 21.9% of the patients without malnutrition reported that they had received HD two times per week, 77.4% received three times per week, and only 0.6% received four times per week. Of the patients with mild malnutrition, 2.9% stated to receive HD therapy twice per week and 97.1% had received three times per week. Of the patients with moderate malnutrition, 28.6 % expressed that they had received HD therapy twice per week, 69.4% received three times per week and 2.0% received four times per week. Of the subjects who participated in the survey and were in the severe malnutrition group, 22.5% stated to received HD therapy twice per week while 77.5% reported that they had received the aforementioned treatment three times per week. There was no statistically significant relationship between frequency of HD treatment and the malnutrition groups occurred according to the NRS 2002 Test results. The frequency of HD therapy showed independent distribution in the malnutrition groups (p = 0.093).

Of patients without malnutrition according to the NRS 2002 test, 61.9% had malnutrition in terms of serum albumin and 38.1% did not. Of patients with mild malnutrition according to the NRS 2002 test, 57.1% had malnutrition in terms of serum albumin while there was no malnutrition in 42.9% of them. Of patients with moderate malnutrition according to the NRS 2002 test, 77.6% had malnutrition in terms of serum albumin and no malnutrition was encountered in 22.4% of them. There was malnutrition in terms of serum albumin in 73.8% of patients with severe malnutrition according to the NRS 2002 test. There was no statistical relationship between the presence of malnutrition in terms of serum albumin and the malnutrition groups determined according to the NRS 2002 Test results. The presence of malnutrition in terms of serum albumin standard did not vary in the malnutrition groups determined by the NRS 2002 Test results (p = 0.094).

No malnutrition finding in terms of blood urea nitrogen was observed in 99.4% of the patients without malnutrition according to the NRS 2002 Test results. None of the patients in the mild malnutrition group according to the NRS 2002 Test results had

malnutrition in terms of blood urea nitrogen. Also, no malnutrition finding was encountered in terms of blood urea nitrogen in the patients with moderate malnutrition. Of the patients in the severe malnutrition group according to the NRS 2002 Test results, 4.8% had malnutrition in terms of blood urea nitrogen and malnutrition was not observed in 95.2% of them. There was no statistically significant relationship between the malnutrition status of the subjects in terms of blood urea nitrogen and the malnutrition groups occurred as a result of the NRS 2002 test. The presence of malnutrition in terms of blood urea nitrogen was independently distributed in the malnutrition groups occurred according to the NRS 2002 Test results ($p = 0.086$).

Of the patients without malnutrition according to the NRS 2002 Test results, 74.8% had malnutrition in terms of serum creatinine and no malnutrition finding was encountered in 25.2% of them. Of the patients in the mild malnutrition group according to the NRS 2002 Test results, 60.0% had malnutrition in terms of serum creatinine while 40.0% did not have malnutrition. Of the patients with moderate malnutrition according to the NRS 2002 test, 83% had malnutrition in terms of serum creatinine and 16.3% did not have malnutrition. Malnutrition was present in terms of serum creatinine in 88.1% of the patients in the severe malnutrition group according to the NRS 2002 Test results. There was a statistically significant relationship between the malnutrition presence of individuals in terms of serum creatinine and the malnutrition groups occurred according to the NRS 2002 Test results. The distribution of individuals according to the NRS 2002 test result to the malnutrition groups was associated with the presence of malnutrition in terms of serum creatinine ($p = 0.018$).

Malnutrition in terms of plasma cholesterol concentration was not observed in 26.4% of the patients who did not have malnutrition according to the NRS 2002 Test results and malnutrition was present in 73.4% of them in terms of plasma cholesterol concentration. While there was malnutrition in terms plasma cholesterol concentration in 40.0% of the patients in the mild malnutrition group according to the NRS 2002 test, 60.0% did not have malnutrition. Of people with moderate malnutrition according to the NRS 2002 Test results, 36.2% had malnutrition in terms of plasma cholesterol concentration and 63.8% had no malnutrition. Malnutrition in terms of plasma cholesterol concentration was encountered in 52.6% of the patients with severe malnutrition according to the NRS 2002 Test results while it was not encountered in 47.4% of them. There was a statistically significant relationship between the presence of malnutrition in terms of plasma cholesterol concentration and the malnutrition groups occurred according

to the NRS 2002 Test results. The presence of malnutrition in terms of plasma cholesterol concentration showed variability in the malnutrition degrees grouped according to the NRS 2002 Test results ($p = 0.016$).

4.2.2.1. Comparison of Serum Albumin Levels with Malnutrition Groups according to the NRS 2002 Test Results

Table - 21: Comparison of serum albumin levels with malnutrition groups according to the NRS 2002 test results

Comparison of Serum Albumin Levels with Malnutrition Groups according to the NRS 2002 Test Results

	Malnutrition groups according to the NRS 2002 test results			
	No malnutrition	**Mild Malnutrition**	**Moderate Malnutrition**	**Severe malnutrition**
Serum albumin *mean±std deviation* ***(g / dL)***	3.893 ± 0.338	3.849 ± 0.316	3.741 ± 0.347	3.695 ± 0.385
p Significance Value ¥			**0.003**¥	

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

According to the NRS 2002 Test results, the mean serum albumin level of the patients without malnutrition was determined to be 3.893 ± 0.338 g/dL and it was determined to be 3.849 ± 0.316 g/dL in the mild malnutrition group. According to the NRS 2002 Test results, the mean serum albumin level of those with moderate malnutrition was detected to be 3.741 ± 0.347 g/dL. Also, according to the results of NRS 2002 test, the mean serum albumin level of the patients in the severe malnutrition group was found to be 3.695 ± 0.385 g/dL (Table-21).

Serum albumin levels of the subjects were highest in the patient group without malnutrition according to the NRS 2002 Test results and lowest in the patient group with severe malnutrition. There were statistically significant differences among the NRS 2002 test malnutrition groups in terms

of the means of serum albumin levels (p = 0.003). These mean differences are as shown in Table - 22. According to the table, the serum albumin levels of the subjects in the group without malnutrition were statistically significantly higher than those of the HD patients with moderate malnutrition (p = 0.009). Also, the serum albumin levels of the patients with severe malnutrition were statistically significantly lower than those of the patients without malnutrition (p = 0.001).

Table - 22: Subgroup comparisons of malnutrition groups according to the NRS 2002 Test results in terms of serum albumin levels

Subgroup Comparisons of Malnutrition Groups According to the NRS 2002 Test results in Terms of Serum Albumin Levels

	Mean Differences	***Standard Error***	***p Significance Value*** [¥]
No malnutrition			
Mild Malnutrition	0.041	0.064	**0.517**
Moderate Malnutrition	0.149	0.057	**0.009**[¥]
Severe malnutrition	0.196	0.060	**0.001**[¥]
Mild Malnutrition			
No malnutrition	-0.041	0.064	**0.517**
Moderate Malnutrition	0.107	0.076	**0.159**
Severe malnutrition	0.154	0.079	**0.052**
Moderate Malnutrition			
No malnutrition	-0.149	0.057	**0.009**[¥]
Mild Malnutrition	-0.107	0.076	**0.159**
Severe malnutrition	0.046	0.072	**0.521**

Severe malnutrition			
No malnutrition	-0,196	0.060	**0.001¥**
Mild Malnutrition	-0.154	0.079	**0.052**
Moderate Malnutrition	-0.046	0.072	**0.521**

Information on the subject characteristics of the participants in the study were reported as **"mean differences and standard error"** in the table.

¥; Statistical studies were carried out at 95% confidence level.

4.2.2.2. Comparison of Plasma Cholesterol Concentration Level with Malnutrition Groups According to the NRS 2002 Test Results

Table - 23: Comparison of plasma cholesterol concentration level with malnutrition groups according to the NRS 2002 test results

Comparison of Plasma Cholesterol Concentration Level with Malnutrition Groups According to NRS 2002 Test Results

	Malnutrition Groups According to NRS 2002 Test Results			
	No malnutrition	**Mild Malnutrition**	**Moderate Malnutrition**	**Severe malnutrition**
Plasma cholesterol concentration *mean±std deviation* ***(mg / dL)***	185.448 ± 52.467	175.352 ± 45.537	169.571 ± 48.406	161.789 ± 53.432
p Significance Value ¥			**0.039¥**	

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

According to the NRS 2002 Test results, the mean plasma cholesterol level of the patients without malnutrition was found to be 185.448 ± 52.467 mg/dL while that of the patients with mild malnutrition was observed to be 175.352 ± 45.537 mg/dL. According to the NRS 2002 Test results, the mean plasma cholesterol concentration level of the patients in the moderate malnutrition group was found to be 169.571 ± 48.406 mg/dL and that of the patients in the severe malnutrition group was 161.789 ± 53.432 mg/dL (Table 23).

The plasma cholesterol concentrations of the subjects were highest in the patients without malnutrition according to the NRS 2002 Test results and lowest in the patients with severe malnutrition. According to the NRS 2002 Test results, there were statistically significant differences among the malnutrition groups in terms of the means of plasma cholesterol concentration levels (p = 0.039). These mean differences are as shown in Table - 24. According to the table, the plasma cholesterol concentration levels of the patients without malnutrition according to the NRS 2002 test were statistically significantly higher than those of the patients with severe malnutrition (p = 0.011).

Table - 24: Subgroup comparison of malnutrition groups determined according to the NRS 2002 Test results in terms of plasma cholesterol concentration levels

Subgroup Comparison of Malnutrition Groups According to the NRS 2002 Test results in terms of Plasma Cholesterol Concentration Levels

	Mean Differences	***Standard Error***	***p Significance Value*** [¥]
No malnutrition			
Mild Malnutrition	10.097	9.569	**0.292**
Moderate Malnutrition	15.876	8.516	**0.063**
Severe malnutrition	23.659	9.256	**0.011**[¥]
Mild Malnutrition			
No malnutrition	-10.097	9.569	**0.292**
Moderate Malnutrition	5.779	11.409	**0.613**
Severe malnutrition	13.561	11.972	**0.258**
Moderate Malnutrition			
No malnutrition	-15.876	8.516	**0.063**
Mild Malnutrition	-5.779	11.409	**0.613**

Severe malnutrition	7.782	11.148	**0.486**
Severe malnutrition			
No malnutrition	-23.659	9.256	**0.011¥**
Mild Malnutrition	-13.561	11.972	**0.258**
Moderate Malnutrition	-7.782	11.148	**0.486**

Information on the subject characteristics of the participants in the study were reported as **"mean differences and standard error"** in the table.

¥; Statistical studies were carried out at 95% confidence level.

4.2.2.3. Comparison of Malnutrition Groups According to the NRS 2002 Test Results and Blood Urea Nutrition Level

Table - 25: Comparison of malnutrition groups according to the NRS 2002 Test results and blood urea nutrition level

Comparison of Malnutrition Groups According to the NRS 2002 Test Results and Blood Urea Nutrition Level

	Malnutrition Groups According to NRS 2002 Test Results			
	No malnutrition	**Mild Malnutrition**	**Moderate Malnutrition**	**Severe malnutrition**
Blood urea nitrogen mean±std deviation (mg / dL)	133.672 ± 28.394	135.502 ± 23.334	132.116 ± 28.671	123.817 ± 40.411
p Significance Value ¥		**0.255**		

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

Of the patients included in the study, according to the NRS 2002 test results, the mean blood urea nitrogen level of the patients without malnutrition was found to be 133.672 ± 28.394 mg/dL while it was found to be 135.502 ± 23.334 mg/dL in the patients with mild malnutrition. According to the NRS 2002 test results, the mean blood urea nitrogen level of the patients in the moderate malnutrition group was found to be 132.116 ± 28.671 mg/dL while it was found to be 123.817 ± 40.411 mg/dL in the patients with mild malnutrition.

Blood urea nitrogen levels of the subjects were observed to be highest in the mild malnutrition group and lowest in the severe malnutrition group. According to the NRS 2002 Test results, the mean blood urea nitrogen levels in the malnutrition groups were similar. Considering the results of NRS 2002 test, there was no statistically significant difference in terms of blood urea nitrogen levels among the malnutrition groups (p = 0,255) (Table - 25).

4.2.2.4. Comparison of Malnutrition Groups According to NRS 2002 Test Results and Serum Creatinine Level

Table - 26: Comparison of malnutrition groups according to NRS 2002 Test results and serum creatinine level

Comparison of Malnutrition Groups According to NRS 2002 Test Results and Serum Creatinine Level

	Malnutrition Groups According to NRS 2002 Test Results			
	No malnutrition	**Mild Malnutrition**	**Moderate Malnutrition**	**Severe malnutrition**
Serum creatinine *mean±std deviation* ***(mg / dL)***	6.691 ± 2.237	7.636 ± 2.183	6.265 ± 1.934	5.672 ± 1.995
p Significance Value ¥		**0.001**¥		

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

Of the patients included in the study, the mean serum creatinine level of the patients without malnutrition created according to the NRS 2002 test results was found to be 6.691 ± 2.237 mg/dL while that of the patients without malnutrition was found to be 7.636 ± 2.183mg/dL. The mean serum creatinine level of the patients with moderate malnutrition was determined to be 6.265 ± 1.934 mg/dL and it was found to be 5.672 ± 1.995 mg/dL for the patients with severe malnutrition (Table 26).

The serum creatinine levels of the subjects were highest in the mild malnutrition group and lowest in the severe malnutrition group. According to the NRS 2002 test results, there were statistically significant differences among malnutrition groups in terms of serum creatinine level (p = 0.001). These mean differences are as shown in Table 27. According to the table, the serum creatinine levels of HD patients without

malnutrition were statistically significantly higher than those of the patients with severe malnutrition (p = 0.007). The mean serum creatinine level of the patients with mild malnutrition was statistically significantly higher than that of the patients without malnutrition (p = 0.019). The serum creatinine levels of the patients in the moderate malnutrition group were statistically significantly lower than those of the patients in the mild malnutrition group (p = 0.004). The serum creatinine levels of the patients in the severe malnutrition group were statistically significantly lower than those of the patients in the mild malnutrition group (p = 0.0001).

Table - 27: Subgroup comparison in terms of malnutrition groups according to the NRS 2002 Test results and serum creatinine levels

Subgroup comparison in terms of malnutrition groups according to the NRS 2002 Test results and serum creatinine levels

	Mean Differences	***Standard Error***	***p Significance Value ¥***
No malnutrition			
Mild Malnutrition	-0.945	0.401	**0.019¥**
Moderate Malnutrition	0.425	0.351	**0.228**
Severe malnutrition	1.018	0.373	**0.007¥**
Mild Malnutrition			
No malnutrition	0.945	0.401	**0.019¥**
Moderate Malnutrition	1.370	0.475	**0.004¥**
Severe malnutrition	1.963	0.491	**0.0001¥**

Moderate Malnutrition			
No malnutrition	-0.425	0.351	**0.228**
Mild Malnutrition	-1.370	0.475	**0.004¥**
Severe malnutrition	0.593	0.451	**0.190**
Severe malnutrition			
No malnutrition	-1.018	0.373	**0.007¥**
Mild Malnutrition	-1.963	0.491	**0.0001¥**
Moderate Malnutrition	-0.593	0.451	**0.190**

Information on the subject characteristics of the participants in the study were reported as **"mean differences and standard error"** in the table.

¥; Statisticdies were crried out at 95% confidence level.

4.2.2.5. Comparison of Body Mass Index Values of the Patients Participated in the Study with Malnutrition Groups According to the NRS 2002 Test Results

Table - 28: Comparison of Body Mass Index values of the patients participated in the study with malnutrition groups according to the NRS 2002 Test results

Comparison of BMI Values of the Patients Participated in the Study with Malnutrition Groups According to the NRS 2002 Test Results

	Malnutrition Groups According to the NRS 2002 Test Results			
	No malnutrition	**Mild Malnutrition**	**Moderate Malnutrition**	**Severe malnutrition**
BMI (kg / m²) mean ± std deviation	26.794 ± 4.091	25.788 ± 5.086	27.572 ± 10.368	20.492 ± 4.632
p Significance Value ¥			**0.0001¥**	

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

Of the patients included in the study, the mean BMI value of the patients without malnutrition according to the NRS 2002 test was found to be 26.794 ± 4.091 and it was found to be 25.788 ± 5,086 in the patients with mild malnutrition. The mean BMI value of the patients with moderate malnutrition was found to be 27.572 ± 10.368 and that of the patients with severe malnutrition was determined to be 20.492 ± 4.632 (Table 28).

The BMI values of the subjects were highest in the moderate malnutrition group and lowest in the severe malnutrition group. According to the NRS 2002 test, there are statistically significant differences among the malnutrition groups in terms of the mean BMI values (p = 0.0001). These mean differences are as shown in Table - 29. According to the table, the BMI values of the HD patients without malnutrition were statistically significantly higher than those of the patients in the severe malnutrition group (p = 0.0001). The BMI means of the people with mild malnutrition was statistically significantly higher than those of the severe malnutrition group (p = 0.0001). The BMI levels of the patients in the severe malnutrition group were statistically significantly lower than those of the subjects in the moderate malnutrition group (p = 0.0001).

As a result of the study by Erdogan et al, BMI of HD patients at risk of malnutrition was shown to be lower than that of the patients without malnutrition (72).

Table - 29: Subgroup comparison in terms of malnutrition groups according the NRS 2002 Test results and Body Mass Index values of the patients participated in the study

Subgroup Comparison in terms of Malnutrition Groups According to the NRS 2002 Test results and BMI Values of the Patients Participated in the Study

	Mean Differences	***Standard Error***	***p Significance Value*** ¥
No malnutrition			
Mild Malnutrition	1.005	1.095	**0.360**
Moderate Malnutrition	-0.778	0.959	**0.418**
Severe malnutrition	6.301	1.018	-0.778 0.959
Mild Malnutrition			
No malnutrition	-1.005	1.095	**0.360**
Moderate Malnutrition	-1.783	1.295	**0.170**
Severe malnutrition	5.296	1.340	**0.0001**¥

Moderate Malnutrition			
No malnutrition	0.778	0.959	**0.418**
Mild Malnutrition	1.783	1.295	**0.170**
Severe malnutrition	7.080	1.231	**0.0001¥**
Severe malnutrition			
No malnutrition	-6.301	1.018	-0.778
Mild Malnutrition	-5.296	1.340	**0.0001¥**
Moderate Malnutrition	-7.080	1.231	**0.0001¥**

Information on the subject characteristics of the participants in the study were reported as **"mean differences and standard error"** in the table.

¥; Statistical studies were carried out at 95% confidence level.

4.2.3. Statistical Results of Hemodialysis Frequency of the Patients Participated in the Study

4.2.3.1. Comparison of Hemodialysis Frequency and Serum Albumin Levels of the Patients Participated in the Study

Table - 30: Comparison of hemodialysis frequency and serum albumin levels of the patients participated in the study

Comparison of the Hemodialysis Frequency and Serum Albumin Levels of the Patients

	Hemodialysis Frequency of the Patients Participated in the Study		
	Twice per Week	**Three Times per Week**	**Four Times per Week**
Serum albumin (g / dL) *mean±std deviation*	3.823 ± 0.376	3.833 ± 0.344	3.960 ± 0.042
p Significance Value ¥		**0.663**	

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

Of the study participants, the mean serum albumin level was determined to be 3.823 ± 0.376 g/dL in the patients with the HD frequency of twice per week while it was observed to be 3.833 ± 0.344 g/dL in the patients with the HD frequency of three times per week. Also, the mean serum albumin level of those who received HD four times per week was determined to be 3.960 ± 0.042 g/dL (Table-30). The serum albumin levels of the subjects were highest in those who received HD four times per week and lowest in the patients who received HD twice per week. There was no statistically significant difference between the HD frequencies and serum albumin levels of the patients (p = 0.663).

4.2.3.2. Comparison of Hemodialysis Frequency and Plasma Cholesterol Concentration Levels of the Patients Participated in the Study

Table - 31: Comparison of hemodialysis frequency and plasma cholesterol concentration levels of the patients participated in the study

Comparison of Hemodialysis Frequency and Plasma Cholesterol Concentration Levels of the Patients Participated in the Study

	Hemodialysis Frequency of the Patients Participated in the Study		
	Twice per Week	**Three Times per Week**	**Four Times per Week**
Plasma cholesterol concentration (mg / dL) *mean ± std deviation*	175.520 ± 48.520	178.068 ± 52.474	217.500 ± 38.890
p Significance Value ¥		**0.423**	

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

Of the study participants, the mean plasma cholesterol concentration level was found to be 175.520 ± 48.520 mg/dL in the patients with the HD frequency of twice per week while it was determined to be 178.068 ± 52.474 mg/dL in the patients with the HD frequency of three times per week. Also, the mean plasma cholesterol concentration level of those who received HD four times per week was determined to be 217.500 ± 38.890 mg/dL (Table-31). The plasma cholesterol concentration levels of the subjects were highest in those who received HD four times per week and lowest in the patients who received HD twice per week. There was no statistically significant difference between the HD frequencies and plasma cholesterol concentration levels of the patients (p = 0.423).

4.2.3.3. Comparison of Hemodialysis Frequency and Blood Urea Nitrogen Levels of the Patients Participated in the Study

Table - 32: Comparison of hemodialysis frequency and Blood Urea Nitrogen levels of the patients participated in the study

Comparison of Hemodialysis Frequency and Blood Urea Nitrogen Levels of the Patients Participated in the Study

	Hemodialysis Frequency of the Patients Participated in the Study		
	Twice per Week	**Three Times per Week**	**Four Times per Week**
Blood urea nitrogen (mg / dL) ***mean±std deviation***	126.079 ± 27.309	133.772 ± 30.514	154.950 ± 19.586
p Significance Value ¥		**0.052**	

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

Of the study participants, the mean blood urea nitrogen level was found to be 126.079 ± 27.309 mg/dL for the patients with the HD frequency of twice per week and 133.772 ± 30.514 mg/dL for those received HD three times per week. The mean blood urea nitrogen level of those received HD four times per week was determined to be 154.950 ± 19.586 mg/dL (Table-32). The blood urea nitrogen levels of the subjects were highest in the subjects who received HD four times per week and lowest in the patients who received HD twice per week. There was no statistically significant difference between the HD frequencies of the patients and the blood urea nitrogen levels ($p = 0.052$).

4.2.3.4. Comparison of Hemodialysis Frequency and Serum Creatinine Levels of the Patients Participated in the Study

Table - 33: Comparison of hemodialysis frequency and serum creatinine levels of the patients participated in the study

Comparison of Hemodialysis Frequency and Serum Creatinine Levels of the Patients Participated in the Study

	Hemodialysis Frequency of the Patients Participated in the Study		
	Twice per Week	**Three Times per Week**	**Four Times per Week**
Serum creatinine ***mean±SD deviation of (mg / dL)***	4.911 ± 1.703	7.027 ± 2.098	8.665 ± 2.397
p Significance Value ¥		**0.0001**¥	

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

The mean serum creatinine level of the patients with the HD frequency of twice per week was determined to be 4.911 ± 1.703 mg/dL while it was found to be 7.027 ± 2.098 mg/dL for the patients with the HD frequency of three times per week. The mean serum creatinine level of the patients who received HD four times per week was determined to be 8.665 ± 2.397 mg/dL. While the serum creatinine levels were found to be quite high in the subjects who received HD four times per week, it was observed to be quite low in the patients who received HD twice per week (Table 33). There were statistically significant differences in terms of mean serum creatinine levels among the HD frequencies ($p = 0.0001$). These mean differences are as shown in Table - 34. According to the table, the serum creatinine levels of renal patients who received HD twice per week were statistically significantly lower ($p = 0.0001$) compared to the renal patients who received HD three times per week. The serum creatinine levels of the renal patients who received HD four times per week were statistically significantly higher than those of the patients who received HD twice per week ($p = 0.010$).

Table - 34: Subgroup comparisons of hemodialysis frequencies of the patients participated in the study in terms of serum creatinine level

Subgroup Comparisons of Hemodialysis Frequencies of the Patients Participated in the Study in Terms of Serum Creatinine Level

	Mean Differences	***Standard Error***	***p Significance Value ¥***
Twice per Week			
Three Times per Week	-2.116	0.298	**0.0001¥**
Four Times per Week	-0.375	1.455	**0.010¥**
Three Times per Week			
Twice per Week	2.116	0.298	**0.0001¥**
Four Times per Week	-1.637	1.437	**0.256**
Four Times per Week			
Twice per Week	0.375	1.455	**0.010¥**
Three Times per Week	1.637	1.437	**0.256**

Information on the subject characteristics of the participants in the study were reported as **"mean differences and standard error"** in the table.

¥; Statistical studies were carried out at 95% confidence level.

In a study conducted to determine the effect of HD treatment plan on malnutrition, the duration of hemodialysis in 80 patients with malnutrition was switched to six days per week for 2 to 2.5 hours instead of three times per week for 4-5 hours. At the end of the one-year follow-up period, a significant increase was noted in serum albumin, prealbumin and cholesterol levels, protein intake, fat-free tissue masses and body weights of patients ($p < 0.05$) and at the end of the study, increasing the hemodialysis treatments of the patients was determined to be an effective method to improve malnutrition (73). In this study, similar to the results of Galland et al., the serum albumin levels, plasma cholesterol concentration levels, blood urea nitrogen levels and serum creatinine levels of the patients who received HD therapy twice a week were the lowest and they were the highest in the patients who received HD therapy four times per

week. However, only the increase in serum creatinine was measured to be statistically significant (p = 0.0001). More studies related to increasing hemodialysis treatments are needed to achieve this positive outcome.

4.2.4. Statistical Results of the Hemodialysis Patients Participated in the Study Related to the Presence of Diabetes Disease

4.2.4.1. Comparison of the Presence of Diabetes Disease with Some Blood Values of the Patients Participated in the Study

Table - 35: Comparison of the presence of Diabetes disease with some blood values of the patients participated in the study

Comparison of the Presence of Diabetes Disease with Some Blood Values in the Patients Participated in the Study

	Presence of Diabetes Disease in the Patients Participated in the Study	
	Present	**Absent**
Serum albumin *mean±std deviation*	3.821 ± 0.333	3.843 ± 0.363
p Significance Value ¥	**0.382**	
Plasma cholesterol concentration *mean±std deviation*	177.51 ± 51.642	178.56 ± 51.743
p Significance Value ¥	**0.913**	
Blood urea nitrogen *mean±std deviation*	132.19 ± 27.458	132.13 ± 31.652
p Significance Value ¥	**0.907**	
Serum creatinine *mean±std deviation*	5.779 ± 1.694	7.092 ± 2.334
p Significance Value ¥	**0.0001**¥	

Information on the descriptive statistical properties of the participants in the study were reported as **"mean ± standard deviation"**.

¥; Statistical studies were carried out at 95% confidence level.

The mean serum albumin level of the patients with diabetes was found to be 3.821 ± 0.333 g/dL while that of non-diabetic patients was 3.843 ± 0.363 g/dL. There is no statistically significant difference between diabetes mellitus level and serum albumin levels of the patients. Being diabetic or non-diabetic did not affect the serum albumin levels of the subjects (p = 0.382).

In the study, the mean plasma cholesterol concentration value of the patients with diabetes was observed to be 177.51 ± 51.642 mg/dL while that of those without diabetes was 178.56 ± 51.743 mg/dL. The presence of diabetes mellitus did not affect the plasma cholesterol concentration values of the subjects, thus there was no statistically significant difference among the groups (p = 0.913).

The mean blood urea nitrogen level of the subjects with diabetes was found to be 132.19 ± 27.458 mg/dL while it was 132.13 ± 31.652 mg/dL for the subjects without diabetes. Blood urea nitrogen levels of the subjects were similar in both groups of patients with and without diabetes disease. There was no statistically significant difference between the groups in terms of the aforementioned value (p = 0.907).

The mean serum creatinine value of the subjects with diabetes who participated in the survey was found to be 5.779 ± 1.694 mg/ dL while that of the subjects without diabetes was found to be 7.092 ± 2.334 mg/dL. The serum creatinine values of the patients with diabetes were statistically significantly lower than those of the patients without diabetes (p = 0.0001) (Table-35).

4.2.5. Correlation Comparisons of the Blood Values of the Patients Participated in the Study

Table - 36: Correlation comparisons of the blood values of the patients participated in the study

Correlation Comparisons of the Blood Values of the Patients Participated in the Study

	Correlation Comparisons of the Blood Values of the Patients Participated in the Study			
	Serum albumin	**Plasma cholesterol concentration**	**Blood Urea Nitrogen**	**Serum creatinine**
Serum albumin *r; Correlation Coefficient (n)*	1.000 (281)	0.097 (274)	0.112 (281)	0.063 (281)
p Significance Value ¥	**-**	**0.111**	**0.061**	**0.289**
Plasma cholesterol concentration *r; Correlation Coefficient (n)*	0.097 (274)	1.000 (274)	0.031 (274)	-0.099 (274)
p Significance Value ¥	**0.111**	**-**	**0.613**	**0.103**
Blood urea Nitrogen *r; Correlation Coefficient (n)*	0.112 (281)	0.031 (274)	1.000 (281)	0.341 (281)
p Significance Value ¥	**0.061**	**0.613**	**-**	**0.0001**¥
Serum creatinine *r; Correlation Coefficient (n)*	0.063 (281)	-0.099 (274)	0.341 (281)	1.000 (281)
p Significance Value ¥	**0.289**	**0.103**	**0.0001**¥	**-**

Information of the statistical characteristics of the study participants were reported as **"r; Correlation coefficient (sample size) "** in the table. ¥; Statistical studies were carried out at 95% confidence level.

There was a positive correlation with the coefficient of 0.097 between the serum albumin levels and plasma cholesterol concentration levels of the study participants. When the plasma albumin level of the body increased by one unit, the plasma cholesterol concentration level increased by 0.097 units. This correlation was not statistically significant (p = 0,111). There was a positive correlation between the plasma albumin levels and blood urea nitrogen values of the HD patients participated in the study. When the serum albumin level of the patient increased by one unit, the blood urea nitrogen value increased by 0.112 units. The positive correlation between the serum albumin and blood urea nitrogen levels was not statistically significant (p = 0.061). A positive correlation with the coefficient of 0.063 was observed between the serum albumin and serum creatinine values of the subjects. The correlation between the aforementioned parameters was not statistically significant (p = 0.289). A positive correlation with the coefficient of 0.031 was detected between the plasma cholesterol levels and blood urea nitrogen levels of the subjects in the study. However, this correlation was not statistically significant (p = 0,613). A negative correlation with the coefficient of 0.099 was found between the plasma cholesterol concentration levels and serum creatinine values of the patients. One unit increase in plasma cholesterol concentration resulted in a decrease of 0.099 units in serum creatinine. This negative correlation between plasma cholesterol concentration and serum creatinine levels was not statistically significant (p = 0.103). There was a strong positive correlation with the coefficient of 0.341 between blood urea nitrogen levels and serum creatinine values of the patients participated in the study. One unit increase in the blood urea nitrogen value of the subject caused an increase of 0.341 units in the serum creatinine value. The positive correlation between blood urea nitrogen and serum creatinine levels was statistically significant (p = 0.0001) (Table-36).

In conclusion, the incidence of malnutrition is high in HD patients. Malnutrition is one of the most important factors affecting the mortality and morbidity of the patient. Nutritional treatment is a very important part of malnutrition treatment. In order to be able to start nutritional therapy without delay, the malnutrition risk of patient must be able to be identified before it is late. The NRS 2002 test, also recommended by ESPEN in the literature, can be used to determine if there is malnutrition in the patient because one of the most important differences distinguishing the NRS 2002 test from other tests is its ability to determine the severity of malnutrition in addition to the presence of malnutrition. However, to date, since SGA was frequently used for malnutrition detection in the studies, the number of the studies conducted using the NRS 2002 test is quite few. The number of studies and the number of patients screened using the NRS 2002 test should increase. Also, further studies on the biochemical parameters used to determine malnutrition are needed. For malnutrition screening, if serum albumin level, blood urea nitrogen, serum creatinine level and plasma cholesterol concentration level of patients as well as malnutrition screening tests were used in combination and the results were interpreted concurrently, more significant results in terms of malnutrition would be obtained.

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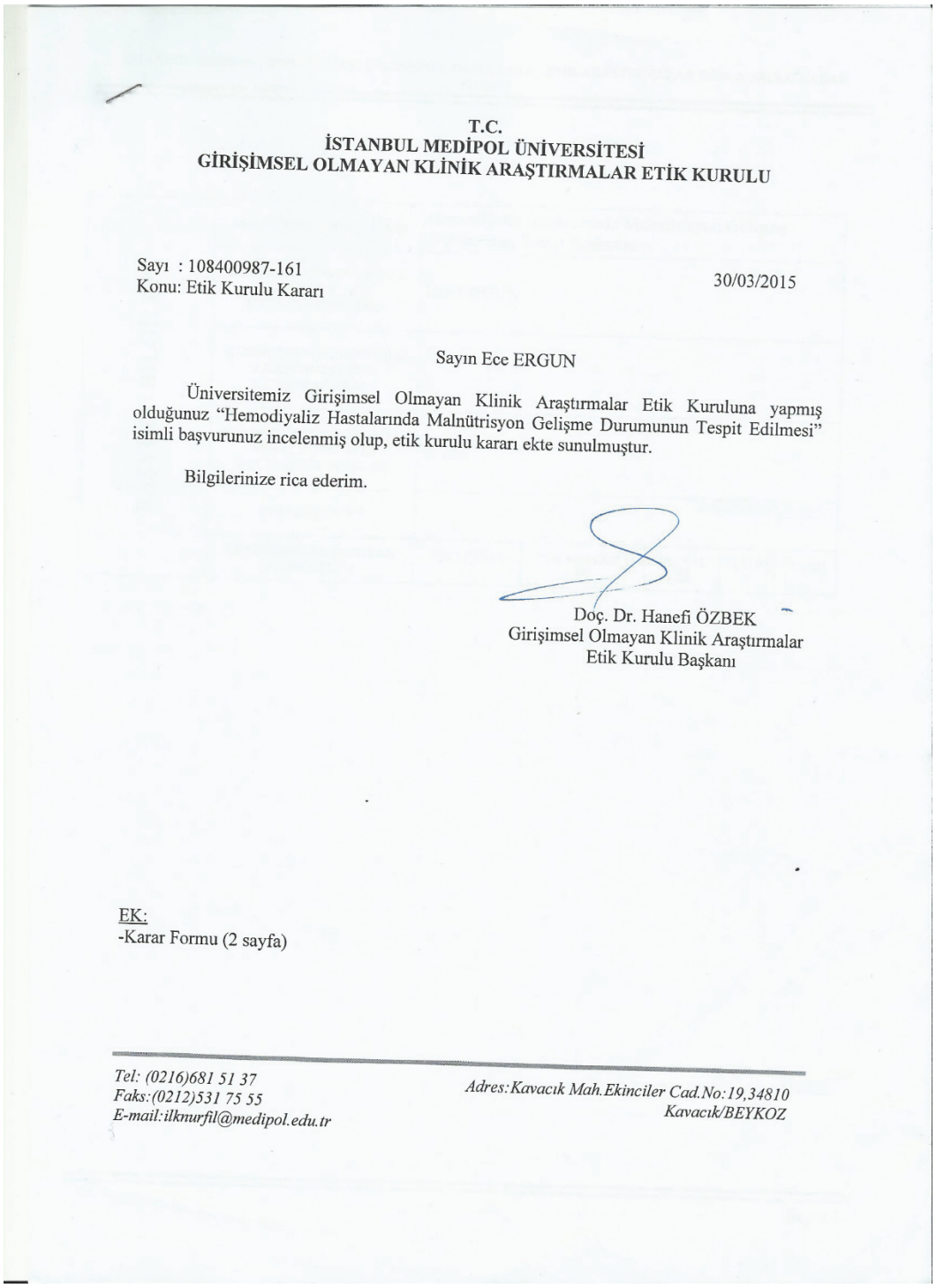
6. ANNEXES

ANNEX - 1

Ethics Committee Approval Form



T.C.
İSTANBUL MEDİPOL ÜNİVERSİTESİ
GİRİŞİMSEL OLMAYAN KLİNİK ARAŞTIRMALAR ETİK KURULU

Sayı : 108400987-161
Konu: Etik Kurulu Kararı

30/03/2015

Sayın Ece ERGUN

Üniversitemiz Girişimsel Olmayan Klinik Araştırmalar Etik Kuruluna yapmış olduğunuz "Hemodiyaliz Hastalarında Malnütrisyon Gelişme Durumunun Tespit Edilmesi" isimli başvurunuz incelenmiş olup, etik kurulu kararı ekte sunulmuştur.

Bilgilerinize rica ederim.

Doç. Dr. Hanefi ÖZBEK
Girişimsel Olmayan Klinik Araştırmalar
Etik Kurulu Başkanı

EK:
-Karar Formu (2 sayfa)

Tel: (0216)681 51 37
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Kavacık/BEYKOZ

BAŞVURU BİLGİLERİ					
	ARAŞTIRMANIN AÇIK ADI	Hemodiyaliz Hastalarında Malnütrisyon Gelişme Durumunun Tespit Edilmesi			
	KOORDİNATÖR/SORUMLU ARAŞTIRMACI UNVANI/ADI/SOYADI	Ece ERGUN			
	KOORDİNATÖR/SORUMLU ARAŞTIRMACININ UZMANLIK ALANI				
	KOORDİNATÖR/SORUMLU ARAŞTIRMACININ BULUNDUĞU MERKEZ	Bursa			
	DESTEKLEYİCİ	-			
	ARAŞTIRMAYA KATILAN MERKEZLER	TEK MERKEZ ☐	ÇOK MERKEZLİ ☒	ULUSAL ☒	ULUSLARARASI ☐

İSTANBUL MEDİPOL ÜNİVERSİTESİ GİRİŞİMSEL OLMAYAN KLİNİK ARAŞTIRMALAR ETİK KURULU KARAR FORMU

	Belge Adı	Tarihi	Versiyon Numarası	Dili
Değerlendirilen Belgeler	ARAŞTIRMA PROTOKOLÜ/PLANI	12.03.2015		Türkçe ☒ İngilizce ☐ Diğer ☐
	BİLGİLENDİRİLMİŞ GÖNÜLLÜ OLUR FORMU	12.03.2015		Türkçe ☒ İngilizce ☐ Diğer ☐
Karar Bilgileri	**Karar No: 147**	**Tarih: 30.03.2015**		
	Yukarıda bilgileri verilen Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu başvuru dosyası ile ilgili belgeler araştırmanın gerekçe, amaç, yaklaşım ve yöntemleri dikkate alınarak incelenmiş ve araştırmanın etik ve bilimsel yönden uygun olduğuna **"oybirliği"** ile karar verilmiştir.			

İSTANBUL MEDİPOL ÜNİVERSİTESİ GİRİŞİMSEL OLMAYAN KLİNİK ARAŞTIRMALAR ETİK KURULU	
BAŞKANIN UNVANI / ADI / SOYADI	Doç. Dr. Hanefi ÖZBEK

Unvanı/Adı/Soyadı	Uzmanlık Alanı	Kurumu	Cinsiyet		Araştırma ile ilişki		Katılım *		İmza
Prof. Dr. Şeref DEMİRAYAK	Eczacılık	İstanbul Medipol Üniversitesi	E ☒	K ☐	E ☐	H ☒	E ☒	H ☐	
Prof. Dr. Tangül MÜDOK	Histoloji ve Embriyoloji	İstanbul Medipol Üniversitesi	E ☐	K ☒	E ☐	H ☒	E ☒	H ☐	
Doç. Dr. Hanefi ÖZBEK	Farmakoloji	İstanbul Medipol Üniversitesi	E ☒	K ☐	E ☐	H ☒	E ☒	H ☐	
Yrd. Doç. Dr. Sibel DOĞAN	Psiko-onkoloji	İstanbul Medipol Üniversitesi	E ☐	K ☒	E ☐	H ☒	E ☒	H ☐	
Yrd. Doç. Dr. Hüseyin Emir YÜZBAŞIOĞLU	Protetik Diş Tedavisi	İstanbul Medipol Üniversitesi	E ☒	K ☐	E ☐	H ☒	E ☒	H ☐	
Yrd. Doç. Dr. İlknur KESKİN	Histoloji ve Embriyoloji	İstanbul Medipol Üniversitesi	E ☐	K ☒	E ☐	H ☒	E ☒	H ☐	
Yrd. Doç. Dr. Muhammed Fatih EVCİMİK	Kulak-Burun Boğaz	Özel Nisa Hastanesi	E ☒	K ☐	E ☐	H ☒	E ☐	H ☒	

* :Toplantıda Bulunma

ANNEX - 2

Sample of Patient Information Form

Konu : Hemodiyaliz Hastalarında Malnütrisyon Gelişme Durumunun Tespit Edilmesi

Bu çalışma; hemodiyaliz hastalarında malnütrisyon gelişme durumunun tespit edilmesi için yapılmaktadır ve yüksek lisans tezimde kullanılacaktır.

Protein – enerji malnütrisyonu, yetersiz veya dengesiz protein alımına bağlı olarak, vücuttaki yağ ve somatik protein depolarının kaybı, azalmış serum protein depolarının kaybı ve azaltılmış serum protein düzeylerine eşlik eden, vücudun total performans ve fonksiyonlarında bozulmayla ortaya çıkan klinik ve ölçülebilir beslenme durumudur (Gök Oğuz, 2013).

Hemodiyaliz hastalarının beslenme durumları, tedavi sürecini yakından ilgilendirmektedir. Malnütrisyon yaşayan hastaların tedaviye gereken cevabı veremediği görülmekte ve yaşam kalitesi düşmektedir.

Araştırma için kullanılan veri toplama aracı tarafımdan hazırlanan anket ve NRS 2002 testidir. Çalışma gönüllülük esasına dayanılarak yapılmaktadır. Sizin cevaplayacağınız sorular ve hasta dosyanızdaki kayıtlı bilgilerden elde edilen veriler araştırma için bilgi kaynağı olacaktır. Bunun dışında hiçbir şekilde size girişimsel ve deneysel bir uygulama yapılmayacaktır.

Sorulara vereceğiniz cevaplar çalışmanın sonuçlarını olumlu yönde etkileyecektir. Katkılarınız için teşekkür ederim.

Diyetisyen Ece ERGUN

Referans:

Gök Oğuz, E. ve ark., İç Hastalıkları Dergisi, 2013 ; 20 : 121 - 127

ANNEX - 3:

Sample of Patient Consent Form

Konu : Hemodiyaliz Hastalarında Malnütrisyon Gelişme Durumunun Tespit Edilmesi (Yüksek Lisans Tez Çalışması)

Hasta bilgilendirme formunu okudum ve anladım. Veri toplama aracı olarak kullanılan anket ve testlerdeki soruları gönüllü olarak yanıtlamayı ve hasta kayıt dosyamdaki bilgileri araştırmacı ile paylaşmayı kendi rızamla kabul ediyorum.

Ad Soyad :

İmza :

ANNEX - 4:

Sample of Questionnaire Form

Bu çalışma hemodiyaliz hastalarında malnütrisyon gelişme durumunu tespit etmek amacıyla yapılmaktadır. Bu araştırmaya katılmayı kabul ettiğiniz ve zaman ayırdığınız için teşekkür ederim.

Diyetisyen Ece ERGUN

1- Doğum Tarihiniz :

2- Cinsiyetiniz : ( ) Kadın ( ) Erkek

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

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

5- Boyunuz : …….. cm

6- Kuru Ağırlığınız : ……. Kg

7- 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)

8- 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

9- 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

10- Haftalık hemodiyalize giriş sıklığınız nedir ?

( ) 1. Haftada 1 kez
( ) 2. Haftada 2 kez
( ) 3. Haftada 3 kez
( ) 4. Haftada 4 kez

11- Serum albümin seviyeniz :

12- Total kolesterol seviyeniz :

13- Kan üre azotu (BUN) seviyeniz :

14- Kreatinin seviyeniz :

15- Diyabet hastalığınız var mı ? ( ) Evet ( ) Hayır

ANNEX - 5:

Sample of NRS 2002 Test

Nutritional Risk Screening (NRS 2002)

Table 1 Initial screening

		Yes	No
1	Is BMI <20.5?		
2	Has the patient lost weight within the last 3 months?		
3	Has the patient had a reduced dietary intake in the last week?		
4	Is the patient severely ill ? (e.g. in intensive therapy)		

Yes: If the answer is 'Yes' to any question, the screening in Table 2 is performed.
No: If the answer is 'No' to all questions, the patient is re-screened at weekly intervals. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.

Table 2 Final screening

Impaired nutritional status		**Severity of disease (≈ increase in requirements)**	
Absent **Score 0**	Normal nutritional status	Absent **Score 0**	Normal nutritional requirements
Mild **Score 1**	Wt loss >5% in 3 mths or Food intake below 50–75% of normal requirement in preceding week	Mild **Score 1**	Hip fracture* Chronic patients, in particular with acute complications: cirrhosis*, COPD*. *Chronic hemodialysis, diabetes, oncology*
Moderate **Score 2**	Wt loss >5% in 2 mths or BMI 18.5 – 20.5 + impaired general condition or Food intake 25–60% of normal requirement in preceding week	Moderate **Score 2**	Major abdominal surgery* Stroke* *Severe pneumonia, hematologic malignancy*
Severe **Score 3**	Wt loss >5% in 1 mth (>15% in 3 mths) or BMI <18.5 + impaired general condition or Food intake 0-25% of normal requirement in preceding week in preceding week.	Severe **Score 3**	Head injury* Bone marrow transplantation* *Intensive care patients (APACHE>10).*
Score:	+	**Score:**	**=Total score**
Age	if ≥70 years: add 1 to total score above	**=age-adjusted total score**	

Score ≥3: the patient is nutritionally at-risk and a nutritional care plan is initiated
Score <3: weekly rescreening of the patient. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.

NRS-2002 is based on an interpre-tation of available randomized clinical trials.
*indicates that a trial directly supports the categorization of patients with that diagnosis. Diagnoses shown in *italics* are based on the prototypes given below.
Nutritional risk is defined by the present **nutritional status** and risk of impairment of present status, due to **increased requirements** caused by stress metabolism of the clinical condition.

A nutritional care plan is indicated in all patients who are

(1) severely undernourished (score=3), or (2) severely ill (score=3), or (3) moderately undernourished + mildly ill (score 2 +1), or (4) mildly undernourished + moderately ill (score 1 + 2).

Prototypes for severity of disease
Score=1: a patient with chronic disease, admitted to hospital due to complications. The patient is weak but out of bed regularly. Protein requirement is increased, but can be covered by oral diet or supplements in most cases.
Score=2: a patient confined to bed due to illness, e.g. following major abdominal surgery. Protein requirement is substantially increased, but can be covered, although artificial feeding is required in many cases.
Score=3: a patient in intensive care with assisted ventilation etc. Protein requirement is increased and cannot be covered even by artificial feeding. Protein breakdown and nitrogen loss can be significantly attenuated.

ANNEX - 6

Cronbach's Alpha

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	276	98,2
	Excluded[a]	5	1,8
	Total	281	100,0

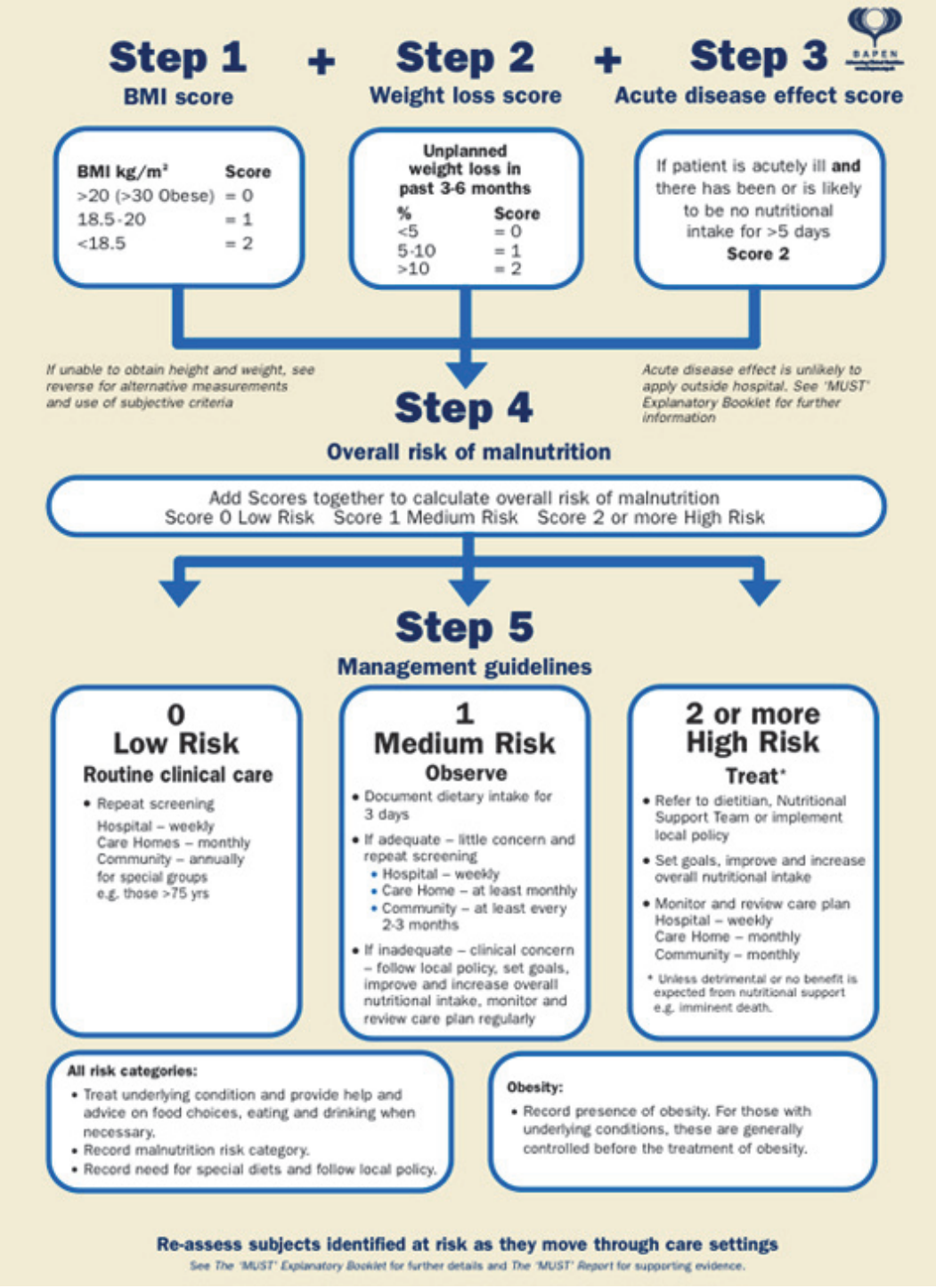
a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,714	6

ANNEX – 7

Sample of MUST Test



ANNEX – 8

Sample of MNA Test

Mini Nutritional Assessment
MNA®

Cognome: Nome:

Sesso: Età: Peso, kg: Altezza, cm: Data:

Risponda alla prima parte del questionario indicando, per ogni domanda, il punteggio appropriato. Sommi il punteggio della valutazione di screening e, se il risultato è uguale o inferiore a 11, completi il questionario per ottenere una valutazione dello stato nutrizionale.

Screening

A Presenta una perdita dell' appetito? Ha mangiato meno negli ultimi 3 mesi? (perdita d'appetito, problemi digestivi, difficoltà di masticazione o deglutizione)
0 = grave riduzione dell'assunzione di cibo
1 = moderata riduzione dell'assunzione di cibo
2 = nessuna riduzione dell'assunzione di cibo ☐

B Perdita di peso recente (<3 mesi)
0 = perdita di peso > 3 kg
1 = non sa
2 = perdita di peso tra 1 e 3 kg
3 = nessuna perdita di peso ☐

C Motricità
0 = dal letto alla poltrona
1 = autonomo a domicilio
2 = esce di casa ☐

D Nell' arco degli ultimi 3 mesi: malattie acuteo stress psicologici?
0 = sì 2 = no ☐

E Problemi neuropsicologici
0 = demenza o depressione grave
1 = demenza moderata
2 = nessun problema psicologico ☐

F Indice di massa corporea (IMC = peso / (altezza)² in kg/ m²)
0 = IMC <19
1 = 19 ≤ IMC < 21
2 = 21 ≤ IMC < 23
3 = IMC ≥ 23 ☐

☐☐
Valutazione di screening
(totale parziale max.14 punti)

12-14 punti: stato nutrizionale normale
8-11 punti: a rischio di malnutrizione
0-7 punti: malnutrito

Per una valutazione più approfondita, continuare con le domande G-R

Valutazione globale

G Il paziente vive autonomamente a domicilio?
1 = sì 0 = no ☐

H Prende più di 3 medicinali al giorno?
0 = sì 1 = no ☐

I Presenza di decubiti, ulcere cutanee?
0 = sì 1 = no ☐

J Quanti pasti completi prende al giorno?
0 = 1 pasto
1 = 2 pasti
2 = 3 pasti ☐

K Consuma?
- Almeno una volta al giorno dei prodotti lattiero-caseari? sì ☐ no ☐
- Una o due volte la settimana uova o legumi? sì ☐ no ☐
- Oni giorne della carne, del pesce o del pollame? sì ☐ no ☐

0.0 = se 0 o 1 sì
0.5 = se 2 sì
1.0 = se 3 sì ☐.☐

L Consuma almeno due volte al giorno frutta o verdura?
0 = no 1 = sì ☐

M Quanti bicchieri beve al giorno? (acqua, succhi, caffé, tè, latte...)
0.0 = meno di 3 bicchieri
0.5 = da 3 a 5 bicchieri
1.0 = più di 5 bicchieri ☐.☐

N Come si nutre?
0 = necessita di assistenza
1 = autonomamente con difficoltà
2 = autonomamente senza difficoltà ☐

O Il paziente si considera ben nutrito? (ha dei problemi nutrizionali)
0 = malnutrizione grave
1 = malnutrizione moderata o non sa
2 = nessun problema nutrizionale ☐

P Il paziente considera il suo stato di salute migliore o peggiore di altre persone della sua età?
0.0 = meno buono
0.5 = non sa
1.0 = uguale
2.0 = migliore ☐.☐

Q Circonferenza brachiale (CB, cm)
0.0 = CB < 21
0.5 = CB ≤ 21 CB ≤ 22
1.0 = CB > 22 ☐.☐

R Circonferenza del polpaccio (CP in cm)
0 = CP < 31
1 = CP ≥ 31 ☐

Valutazione globale (max. 16 punti) ☐☐.☐
Screening ☐☐.☐
Valutazione totale (max. 30 punti) ☐☐.☐

Valutazione dello stato nutrizionale

24-30 da 24 a 30 punti ☐ stato nutrizionale normale
17-23.5 da 17 a 23,5 punti ☐ rischio di malnutrizione
meno 17 punti ☐ cattivo stato nutrizionale

Ref. Vellas B, Villars H, Abellan G, et al. *Overview of MNA® - Its History and Challenges.* J Nut Health Aging 2006; 10: 456-465.
Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for Undernutrition in Geriatric Practice: *Developing the Short-Form Mini Nutritional Assessment (MNA-SF).* J. Geront 2001; 56A: M366-377.
Guigoz Y. The Mini-Nutritional Assessment (MNA®) *Review of the Literature – What does it tell us?* J Nut Health Aging 2006; 10: 466-487.

Per maggiori informazioni : www.mna-elderly.com

ANNEX – 9

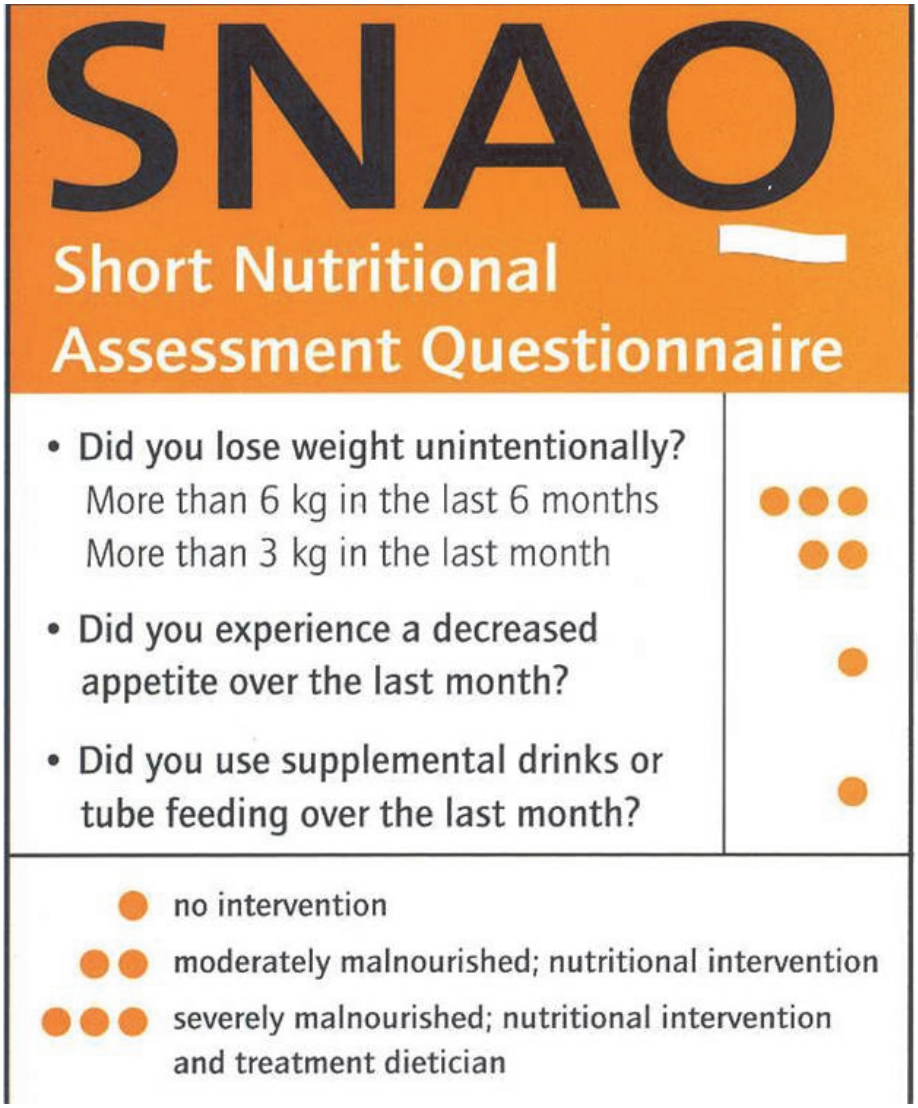
Sample of MST Test

MALNUTRITION SCREENING TOOL (MST)	
Have you lost weight recently without trying?	
No	0
Unsure	2
If yes, how much weight (kilograms) have you lost?	
1–5	1
6–10	2
11–15	3
>15	4
Unsure	2
Have you been eating poorly because of a decreased appetite?	
No	0
Yes	1
Total	

Score of 2 or more= patient at risk for malnutrition.

ANNEX - 10

Sample of SNAQ Test



ANNEX – 11

Sample of SGA Test

Table 1 Features of the SGA[a]

Height:_____ Admit weight:_____ Body mass index:_____

A. History

1. *Weight (wt) change:*
   In the past 2 weeks, weight has: increased/decreased/not changed
   Overall weight loss in the past 6 months: _____ kg: _____%.
2. *Change in dietary intake (relative to normal intake): circle*
   No change Borderline/poor Unable to eat
   If intake has decreased, for how long:_____weeks.
3. *Gastrointestinal symptoms (> 2 weeks): circle all that apply*
   None Nausea Vomiting Diarrhea Anorexia
4. *Functional capacity: circle*
   No change Decreased activities of daily living Bed ridden
5. *Metabolic stress: circle*
   No stress Low/moderate stress High stress

B. Physical examination: check all that apply

_____Triceps and chest subcutaneous fat loss
_____Quadriceps and deltoid muscle wasting
_____Ankle edema
_____Sacral edema
_____Ascites

C. SGA rating: check one

_____A = well nourished
_____B = moderately malnourished
_____C = severely malnourished

ANNEX - 12:

Curriculum Vitae

"PERSONAL INFORMATION''

Name Surname: Ece ERGUN

Identity Number: 26878473296

Place of Birth: Bursa

Date of Birth: 22.06.1991

Telephone Number: 0 537 725 44 58

E - Mail: dyt.ece.ergun @ gmail.com

"EDUCATION STATUS"

-Master Degree:

University Name: Yeditepe University (2013 – 2017)

Institute: Institude of Health Sciences

Department: Nutrition and Dietetics

Language of Instruction: English

-Undergraduate:

University Name: Yeditepe University (2009 – 2013)

Faculty: Faculty of Health Sciences

Department: Nutrition and Dietetics

Language of Instruction: English

-High School:

High School Name:Emine Örnek Anatolian High School-Bursa(2005-2009)

Language of Instruction: Turkish

“FOREIGN LANGUAGES”

LANGUAGE	GENERAL	READING	WRITING	SPEAKING
-English:	Very Good	Very Good	Very Good	Good
-German:	Intermediate	Intermediate	Intermediate	Intermediate

‘’WORKING EXPERIENCE’’

-Özel Paşa Diyaliz Merkezi (August 2016 - currently)

-Özel Yaşam Diyaliz Merkezi (April 2014 - currently)

-Özel A Merkez Diyaliz Merkezi (April 2014 - currently)

-Özel Aka Diyaliz Merkezi (August 2013 - currently)

-Özel Rentıp Diyaliz Merkezi (January 2014 - July 2016)

-Özel Rentıp Gemlik Diyaliz Merkezi (January 2014 - July 2016)

-Özel Rentıp Yıldırım Diyaliz Merkezi (January 2014 - November 2014)

-Özel B-fit Kadın Spor ve Yaşam Merkezi, Kozyatağı Branch (November 2013 – February 2015)

“PUBLICATION”

-‘’Alzheimer's disease and nutrition‘’ named article published in ‘’Actual Medicine’’ september 2013.

“COMPUTER”

- All MS Office programs (Powerpoint- Word- Excel - Outlook etc) – Very good level

“PROJECTS”

- Undergraduate Thesis: Alzheimer's disease in individuals over the age of 65, intoxications that may cause disease and immunotherapeutic therapeutic agents. Nutritional therapy of Alzheimer's disease (2013)

- Final Project: Educate teachers at International Plus Preschool for personal nutrition education (2012).

- Visited kitchens related to mass feeding systems, prepared projects about information about the operation and the institution (2011).

- Educate kindergarten students for healthy nutrition (2010).

- Prepared brochure for elderly nutrition (2010).

- Prepared brochure for kidney diseases nutrition (2010).

“OTHER TRAINING AND COURSES”

-Diyet Atölyesi No:27 (2017)

-Acıbadem Sağlıklı Yaşam Günleri – Sporcu Diyetisyenliği Kursu (2014)

-Bilimin Işığında İşin Aslı Semineri (2013)

-3. Ulusal Sağlıklı Yaşam Sempozyumu (2013)

-Kardiyoloji Diyetisyenliği Kursu (2013)

-Hastalıklarda Diyet Tedavisinin Klinik Uygulamalara Yansıması Sempozyumu (2012)

-Yeditepe Üniversitesi Kariyer Günleri (2012)

-İstanbul Sağlık ve Beslenme Bienali (2012)

-Kendini Tanıma ve Kişisel Farkındalık Semineri (2012)

-Yeditepe Üniversitesi Kariyer Günleri (2011)

-İstanbul Beslenme ve Diyetetik 1. Öğrenci Sempozyumu (2010)

-7.Uluslararası Beslenme ve Diyetetik Kongresi (2010)

-Bebek ve Çocuk Beslenmesi Kursu (2010)

-Yeditepe Üniversitesi Kariyer Günleri (2010)

“INTERNSHIP PLACES”

-İstanbul Kanuni Sultan Süleyman Eğitim Ve Araştırma Hastanesi

-Haydarpaşa Numune Eğitim Ve Araştırma Hastanesi

-Siyami Ersek Eğitim Ve Araştırma Hastanesi

-Özel Medical Park Gebze

-Evrensel Cathering

-Üsküdar Devlet Hastanesi

-Özel Gaziosmanpaşa Hastanesi

-İstanbul Üniversitesi Çapa Tıp Fakültesi Hastanesi

-Haseki Eğitim Ve Araştırma Hastanesi

-Bursa Çekirge Devlet Hastanesi