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Investigation of sarcopenia in hemodialysis patients in Adiyaman province

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Abstract

In this study, we aimed to evaluate the presence and frequency of sarcopenia in chronic kidney disease (CKD) patients under hemodialysis treatment, to analyze socio-demographic and clinical factors that may be associated with sarcopenia and to compare them with the control group. This study includes a sample of 61 patients over the age of 18, affected by stage 4 CKD under hemodialysis treatment at least six months, being followed in our CKD outpatient clinic and 55 healthy controls. In all patients, demographic characteristics such as gender and age, anthropometric characteristics such as height, weight, body mass index (BMI), waist circumference, upper arm circumference, hip circumference, calf circumference and skin thickness were measured. Body compositions was determined using a Bioelectrical Impedance Analyzer (BIA). In the evaluation of sarcopenia, hand grip strength with hand dynamometer, walking speed with 6 meter walking test and muscle mass with BIA were analyzed. European Working Group on Sarcopenia in Older People (EWGSOP) criteria were preferred for the diagnosis of sarcopenia. The prevalence of sarcopenia was 5.5% in the control group and 31.1% in the hemodialysis group. The incidence of sarcopenia was significantly higher in patients under hemodialysis treatment than controls. Sarcopenia is common in patients with CKD under hemodialysis treatment. In this patients, sarcopenia was associated with anthropometric measurements such as BMI, waist circumference, arm circumference, hip circumference, calf circumference, skin thickness.

Keywords: Sarcopenia, hemodialysis, anthropometric

Introduction

Sarcopenia is a condition defined as the reduction in muscle mass and power and characterized by skeletal muscle loss. It was recognized that sarcopenia is not limited with the elderly patients although it is frequently defined as age-related reduction in skeletal muscle. Sarcopenia which is associated with falls, mortality and physical performance is not known sufficiently by clinicians.

CKD, is defined as the reduction in kidney functions, indicated with glomerular filtration rate, independently from the underlying cause, for at least three months or renal damage [1].

Sarcopenia is reported to be more frequent among CKD patients as compared to the ones who do not have CKD. Besides, sarcopenia prevalence is stated to be correlated with CKD stages. Sarcopenia triggers physical inactivity together with the loss of skeletal muscle and progression of sarcopenia is accelerated more together with the loss of physical functions sarcopenia and physical inactivity show a synergistic effect. Both physical inactivity and sarcopenia were reported to increase mortality in CKD patients. So sarcopenia has significant clinical effects on the prognosis of CKD [2-3].

The aim of the pesent study was to investigate the presence and prevalence of sarcopenia in CKD patients and to analyse sarcopenia-related socio-demographic and clinical factors and to compare with the control group.

Materials and Methods

Patient and control groups

Ethics committee approval was obtained from Adiyaman University Non-interventional Clinical Studies Ethics Committee (date:26.06.2018, number:2018/5-22).

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This study was conducted with hemodialysis patients over 18 years of age who were admitted to the Internal Medicine and Nephrology Outpatient Clinics of Adiyaman University Training and Research Hospital or were treated in the hemodialysis unit between July 2018 and December 1, 2018, and a healthy control group. The study was carried out in accordance with the Helsinki Declaration. Informed consent was obtained from patient and controls after they had been provided information about the study. Sixty one patients with end stage kidney disease (ESKD) who were receiving hemodialysis treatment constituted the hemodialysis group and 55 healthy individuals constituted the control group. The statistical power of the study was evaluated with G * Power 3.1.9.2. program in a post-hoc way. The statistical power was calculated as 98% when the effect width was d = 0.8, alpha error = 0.05, p two-sided t test in independent groups.

Inclusion criteria

Control group

Healthy volunteers, Being 18 years and above.

Hemodialysis group

ESKD patients 18 years and above who were under hemodialysis treatment for at least 6 months.

Exclusion criteria

In control group, the ones who had other diseases tat could influence muscle mass or muscle power (anemia, paralysis, cerebro-vascular disease, poio sequela, malignity, amputation, musculo-sceletal diseases etc.).

Study method

Demographic characteristics of the patients including gender, age, height, weight, body mass index (BMI), waist circumference, upper arm circumference, hip circumference, calf circumference, and anthropometric properties such as skin thickness evaluated by caliper were measured. Muscle mass percentage, fat percentage and visceral fat percentage were evaluated by the bioelectrical impedance method. Total duration of CKD and total hemodialysis time were included in the analyses in hemodialysis patients. The grip strength of the patients was analyzed with a physical hand dynamometer. Anthropometric, bioelectrical impedance measurements and 6 meter walking test were done by the same researcher (A. S.).

For the diagnosis of sarcopenia, objective sarcopenia criteria recommended by the European Working Group on Sarcopenia in Older People (EWGSOP) and frequently preferred in clinical studies were applied. The diagnostic criteria for sarcopenia according to the EWGSOP are given below.

1-Low muscle mass, 2- Low muscle power, 3- Reduced physical performance.

Sarcopenia diagnosis is based on the presence of any of the second or third diagnostic criteria in addition to the first diagnostic criteria. However, the definition made by the Foundation for the National Institutes of Health (FNIH) was also preferred for sarcopenia.

In our study, muscle mass was calculated using the bioelectrical impedance method (Omron body composition monitor, Omron Healthcare®). The measurements were repeated three times, and the data obtained by taking the arithmetic mean were used in the analysis. The total muscle mass (kg) was obtained by multiplying the percentage of body muscle mass found by the body weight, and the skeletal muscle index (SMI) was obtained by dividing the total muscle mass by the square of the height. Body fat percentage was also calculated with the Omron body composition monitor.

Muscle strength was evaluated with a digital hand dynamometer (Baseline smedley digital hand dynamometer). After the patients were informed about the dynamometer, they were allowed to try 3 times. They were then asked to squeeze the hand dynamometer with their maximum force, three measurements were taken in total and the best result was taken.

Physical performance of the patients was evaluated with the 6 meter walking test that was reported to yield successful results to evaluate physical performance. The walking test was performed twice for each patient and the average of the measurements was taken.

Skin thickness was analyzed by a caliper (Holtain Skinfold Caliper). Anthropometric measurements were not preferred in the definition of sarcopenia. However, the relationship between anthropometric measurements and sarcopenia was analyzed. In this way, it was tried to show that simple anthropometric measurements can indicate the presence of sarcopenia.

Data Analysis

Statistical analyzes were performed using SPSS version 20.0 (IBM® Inc, Chicago, USA) package program. Descriptive statistics were summarized as number and percentage in nominal variables, mean and standard deviation in normally distributed numerical variable (duration of CKD and hemodialysis), median and interquartile range (IQR) in non-normally distributed numerical variables (duration of CKD and hemodialysis). The normality distribution of the variables was examined using visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov, Shapiro-Wilk tests). Numerical variables determined according to the state of normal distribution were analyzed using the Independent groups T test between the two groups. Numerical variables that did not show normal distribution were analyzed between the two groups using the Mann Whitney U test. Chi-square analysis was used to compare ordinal data. In the statistical analyzes, comparisons with a p value of less than 0.05 were accepted as statistically significant.

Results

Mean age was 42.0 ± 10.1 years in control group and 46.5 ± 12.1 years in hemodialysis group. Of the patients in control group, 54.5% were females (F/M ratio 1/0.8) and of the patients in hemodialysis group, 39.3% were females (F/M ratio 1/1.5). In hemodialysis patients, the median duration of CKD was 6 years, and the median duration of hemodialysis was 4 years (Table 1). The mean BMI was 26.8 ± 4.8 kg/m^2 in control group and 23.5 ± 4.6 kg/m^2 in hemodialysis group. There was no significant difference between hemodialysis patients and controls with regard to age

(p=0.635) and gender (p = 0.101). However BMI (p <0.001), waist circumference (p = 0.047), hip circumference (p <0.001) and skin thickness (p <0.001) were higher in control group, (Table 1).

The walking speed was found to be lower in hemodialysis group as compared to control group (p = 0.002). While there was no difference in walking speed among females (p = 0.101), it was observed to be lower in male hemodialysis patients as compared to male controls (p = 0.002) (Table 2).

Hand grip strength was lower in hemodialysis patients than controls (p <0.001). Hand grip strength was lower in both female and male hemodialysis patients than controls of the same gender (p <0.001) (Table 2).

The percentage of fat mass was significantly lower in hemodialysis group than control group (p = 0.024). When analyzed according to gender, no difference was found in fat percentage between females (p = 0.544) or males (p = 0.101) (Table 2).

Total muscle mass was significantly lower in hemodialysis group than in the control group (p = 0.005). While there was no difference between female hemodialysis patients and female controls (p = 0.140), total muscle mass of male hemodialysis patients was significantly lower than male controls (p <0.001) (Table 2).

The rate of sarcopenia was calculated as 5.5% (n = 3) in control group and 31.1% (n = 19) in hemodialysis group according to the EWGSOP criteria. The rate of sarcopenia was significantly higher in hemodialysis group as compared to control group (p <0.001). The rate of sarcopenia was 5.7 fold higher in hemodialysis group. When estimated according to the FNIH criteria, the rate of sarcopenia was found to be 1.8% (n = 1) in control group and 24.6% (n = 15) in hemodialysis group. The rate of sarcopenia was higher in hemodialysis group as compared to control group also according to FNIH criteria (p <0.001) (Table 3).

In the hemodialysis group, patients with and without sarcopenia did not differ with regard to age (p = 0.634). The BMI of the patients with sarcopenia was significantly lower that of without sarcopenia (p <0.001). Duration of CKD (p = 0.428) and hemodialysis (p = 0.884) were not affected by the presence of sarcopenia. Waist circumference (p <0.001), arm circumference (p = 0.005), hip circumference (p = 0.001), calf circumference (p <0.001) and skin thickness (p = 0.001) were significantly lower in patients with sarcopenia than those of without sarcopenia (Table 4).

Walking speed (p = 0.832), grip strength (p = 0.904), fat mass percentage (p = 0.475) and muscle mass percentage (p = 0.085) were not different between the patients with and without sarcopenia in hemodialysis group. However, in patients with sarcopenia, the percentage of visceral fat mass (p = 0.001), total muscle mass (p <0.001), and muscle mass index (p <0.001) were lower than in patients without sarcopenia (Table 5).

The patients with and without severe sarcopenia did not differ with regard to age in hemodialysis group (p = 0.926). The patients with severe sarcopenia had significantly lower BMI than the patients without severe sarcopenia (p <0.001). Duration of CKD (p = 0.958) and hemodialysis (p = 0.539) were not affected by the presence of severe sarcopenia. Waist circumference (p <0.001), arm circumference (p = 0.038), hip circumference (p = 0.007), calf circumference (p = 0.001), and skin thickness (p <0.001) were significantly lower than in the patients with severe sarcopenia as compared to the ones without severe sarcopenia (Table 6).

In hemodialysis patients, walking speed (p = 0.681), hand grip strength (p = 0.167) and percentage of fat mass (p = 0.676) were not different between the patients with and without severe sarcopenia. However the percentage of visceral fat mass (p = 0.017), muscle mass percentage (p = 0.033), total muscle mass (P <0.001), and muscle mass index (P <0.001) were lower in the patients with severe sarcopenia as compared to the ones without severe sarcopenia (Table 7).

Table 1. Measurements and analyses of socio-demographic and anthropometric data

		Control n=55	Hemodialysis n=61	P
Age (year)	**Mean±SD**	45.6 ± 9.9	46.5 ± 12.1	0.635*
	N (%)			
Gender	**Female**	30 (54.5)	24 (39.3)	
	Male	25 (45.5)	37 (60.7)	
BMI (kg/m²)	**Mean±SD**	26.8 ± 4.8	23.5 ± 4.6	<0.001*
Waist circumference (cm)	**Mean±SD**	91.8 ± 13.2	87.1 ± 12.0	0.047*
Arm circumference (cm)	**Mean±SD**	28.6 ± 3.7	25.6 ± 3.6	<0.001*
Hip circumference (cm)	**Mean±SD**	104.7 ± 8.6	97.7 ± 8.6	<0.001*
Calf circumference (cm)	**Mean±SD**	37.1 ± 3.5	32.6 ± 3.7	<0.001*
Skin thickness (mm)	**Mean±SD**	26.1 ± 6.4	15.7 ± 7.5	<0.001*
CKD duration (year)	**Median (IQR)**	-	6 (9.5)	-
Hemodialysis duration (year)	**Median (IQR)**	-	4 (4.8)	-
Dialysis frequency (number/week)	**Median (IQR)**	-	3(0)	-

*T test in independent groups, **The chi-square test, SD: Standart Deviation, BMI: Body Mass Index, kg/m²: kilogram/square meter, CKD: Chronic Kidney Disease

Table 2. Analysis of sarcopenia variables and body component

		Control	Hemodialysis	P
	Mean±SD	0.76 ± 0.15	0.67 ± 0.15	0.002
Walking speed (m/s)	**Female**	0.72 ± 0.17	0.65 ± 0.12	0.101
	Male	0.81 ± 0.12	0.68 ± 0.16	0.002
	Mean±SD	31.8 ± 13.4	20.5 ± 8.1	<0.001
Hand grip strength (kg)	**Female**	22.3 ± 5.1	15.5 ± 5.5	<0.001
	Male	43.3 ± 11.1	23.8 ± 8.0	<0.001
	Mean±SD	7.7 ± 4.1	6.5 ± 3.8	0.13
Percantage of visceral fat (%)	**Female**	6.9 ± 3.0	7.3 ± 3.8	0.544
	Male	8.6 ±5.0	6.0 ± 3.8	0.101
	Mean±SD	31.3 ± 10.7	26.4 ± 12.3	0.024
Percentage of fat mass (%)	**Female**	37.6 ± 9.3	35.9 ± 10.2	0.544
	Male	23.9 ± 6.9	20.2 ± 9.4	0.101
	Mean±SD	31.5 ± 6.5	31.7 ± 8.7	0.924
Percentage of muscle mass (%)	**Female**	27.5 ± 5.2	26.8± 8.6	0.735
	Male	36.4 ± 4.2	34.8 ± 7.4	0.336
	Mean±SD	23.2 ± 6.2	19.8 ± 6.1	0.005
Total muscle mass (kg)	**Female**	18.6 ± 3.5	16.6 ± 5.9	0.140
	Male	8.7 ± 3.9	21.9 ± 5.4	<0.001
	Mean±SD	8.3 ± 1.6	7.3 ± 1.9	0.004
Muscle mass indexi (kg/m²)	**Female**	7.3 ± 1.4	6.8 ± 2.1	0.381
	Male	9.5 ± 1.1	7.6 ± 1.8	<0.001

*T test in independent groups, Kg:Kilogram, m:Meter, cm: Cantimeter, kg/m²: kilogram square meter, SD: Standart Deviation

Table 3. Assessment and analysis of sarcopenia severity between groups

		Control	Hemodialysis	P
	N(%)	3 (5.5)	19 (31.1)	< 0.001
Sarcopenia (EWSGOP criters)	**Female**	2 (6.7)	4 (16.7)	-
	Male	1 (4.0)	15 (40.5)	-
	N(%)	1 (1.8)	15 (24.6)	<0.001
Sarcopenia (FNIH criters)	**Female**	0	5 (20.8)	-
	Male	1 (4)	10 (27.0)	-

*the chi-square test, EWSGOP: The European Working Group on Sarcopenia in Older People, FNIH: The Foundation for the National Institutes of Health

Table 4. Analysis of demographic and anthropometric characteristics in hemodialysis patients with and without sarcopeni

		Hemodiyaliz Sarcopenia (+) N=19	Hemodiyaliz Sarcopenia (-) N=42	P
Age (year)	**Mean±SD**	45.4 ± 1.8	47.1 ± 1.4	0.634*
BMI (kg/m²)	**Mean±SD**	20.0 ± 2.9	25.1 ± 4.4	<0.001*
Waist circumference (cm)	**Mean±SD**	77.2 ± 9.7	91.5 ± 10.3	<0.001*
Arm circumference (cm)	**Mean±SD**	23.7 ± 3.1	26.5 ± 3.5	0.005*
Hip circumference (cm)	**Mean±SD**	92.4 ± 8.0	100.1 ± 7.9	0.001*
Calf circumference (cm)	**Mean±SD**	30.2 ± 3.1	33.7 ± 3.5	<0.001*
Skin thickness (mm)	**Mean±SD**	10.9 ± 3.7	17.8 ± 7.8	0.001*
CKD duration (year)	**Median (IQR)**	6 (6.7)	6 (11)	0.428**
Hemodialysis duration (year)	**Median (IQR)**	4.5 (4.1)	4 (6.3)	0.884**

*T test in independent group, **Mann Whitney U test, BMI: Body Mass Index, CKD: Chronic Kidney Disease, SD: Standart Deviation

Table 5. Analysis of sarcopenia-related functions and bosy components in hemodialysis patients with and without sarcopenia

		Hemodiyaliz Sarcopenia (+) N=19	Hemodiyaliz Sarcopenia (-) N=42	P
Walking speed (m/s)	**Mean ± SD**	0.66 ± 0.10	0.67 ± 0.16	0.832*
Hand grip strength (kg)	**Mean ± SD**	20.3 ± 6.6	20.6 ± 8.8	0.904*
Percentage of visceral fat (%)	**Mean ± SD**	4.2 ± 3.4	7.6 ± 3.6	0.001*
Percentage of fat mass (%)	**Mean ± SD**	24.7 ± 10.0	27.2 ± 13.3	0.475*
Percentage of muscle mass (%)	**Mean ± SD**	28.8 ± 6.9	33.0 ± 9.2	0.085*
Total muscle mass (kg)	**Mean ± SD**	15.8 ± 3.9	21.7 ± 6.1	<0.001*
Muscle mass index (kg/m²)	**Mean ± SD**	5.6 ± 0.9	8.0 ± 1.8	<0.001*

*T test in independent group, SD: Standart Deviation

Table 6. Analysis of demographic and anthropometric characteristics in hemodialysis patients with and without severe sarcopenia

		Hemodiyaliz Severe Sarcopenia (+) N=15	Hemodiyaliz Severe Sarcopenia (-) N=46	P
Age (year)	**Mean ± SD**	46.3 ± 13.8	46.6 ± 11.7	0.926*
BMI(kg/m²)	**Mean ± SD**	20.1 ± 3.1	24.6 ± 4.6	<0.001*
CKD duration(year)	**Median (IQR)**	6 (5)	6 (10)	0.958**
Hemodialysis duration (year)	**Median (IQR)**	5 (4.8)	4 (5.3)	0.539**
Waist circumference (cm)	**Mean ± SD**	77.8 ± 10.2	90.1 ± 11.1	<0.001*
Arm circumference (cm)	**Mean ± SD**	24.0 ± 3.4	26.2 ± 3.5	0.038*
Hip circumference (cm)	**Mean ± SD**	92.6 ± 8.5	99.4 ± 8.1	0.007*
Calf circumference (cm)	**Mean ± SD**	30.0 ± 3.4	33.5 ± 3.4	0.001*
Skin thickness (mm)	**Mean ± SD**	11.2 ± 3.9	17.1 ± 7.9	<0.001

*T test in independent group,**Mann Whitney U tesr, SD: Standart Deviation, CKD; Chronic Kidney Disease

Table 7. Analysis of sarcopenia-related functions and body components in hemodialysis patients with and without severe sarcopenia

		Hemodialysis Severe Sarcopenia (+) N=15	Hemodialysis Severe Sarcopenia (-) N=46	P
Walking speed (m/s)	**Mean ± SD**	0.65 ± 0.08	0.67 ± 0.16	0.681*
Hand grip strength (kg)	**Mean ± SD**	18.0 ± 5.2	21.3 ± 8.8	0.167*
Visceral fat percentage	**Mean ± SD**	4.5 ± 3.6	7.2 ± 3.7	0.017*
Percentage of fat mass (%)	**Mean ± SD**	25.2 ± 10.9	26.8 ± 12.9	0.676*
Percentage of muscle mass (%)	**Mean ± SD**	27.9 ± 6.9	32.9 ± 9.0	0.033*
Total muscle mass (kg)	**Mean ± SD**	15.1 ± 3.7	21.4 ± 6.0	<0.001*
Muscle mass index (kg/m²)	**Mean ± SD**	5.5 ± 1.0	7.9 ± 1.8	<0.001*

*T test in independent group, SD: Standart Deviation

Discussion

In our study, investigating the state of sarcopenia in hemodialysis patients in Adiyaman province, patients who received hemodialysis treatment and healthy individuals who applied to the internal medicine and nephrology outpatient clinic were compared and the results were statistically analized. This study showed us that the frequency of sarcopenia in hemodialysis patients is quite high.

The first striking finding of our study was that the rate of sarcopenia was 31.1% according to EWGSOP criteria and 24.6% according to FNIH criteria in hemodialysis patients. The rate of sarcopenia was 13.7 times higher in hemodialysis patients as compared to control group. Similarly, the rate of severe sarcopenia was significantly higher in hemodialysis patients (24.6% & 1.8%). Additionally, the rate of sarcopenia was found to vary between genders, with a frequency of 16.7% in female patients and 40.5% in male patients. Our findings suggested that the rate of sarcopenia was significantly higher in ESKD patients as compared to the general population, and sarcopenia mainly affected male patients. Despite the presence of an ample of studies indicating that the frequency of sarcopenia is increased in CKD patients, there are Few studies available that specifically examined patient groups under hemodialysis treatment [6-7]. The frequencies of sarcopenia reported in these studies were consistent with our findings.

In a study conducted by Yoowannakul et al. in 2018 [3], it was stated that the rate of sarcopenia was 36.7% in the Caucasian race when the EWGSOP criteria were used in 600 hemodialysis patients. In the study, the rate of sarcopenia was found to be 31.3%

in the white when the Foundation for the National Institutes of Health Sarcopenia Project (FNIH) criteria were used. In addition, when only hand grip strength is used, this rate is 67.6% according to FNIH criteria and 80.8% according to EWSGOP criteria.

A total of 645 hemodialysis patients were evaluated in the study conducted by Kittiskulnam et al. in 2018 [4]. In the study, the rate of sarcopenia was evaluated by four different criteria. The rate of sarcopenia was 8.1% when muscle mass/height^2 was used, (12.2% for males, 2.3% for females), 25.3% when muscle mass/body weight was used (27.8% for males, 21.7% for females), and 32.4% when muscle mass/body surface area was used (37.3% for males, 25.5% for females), 25% when muscle mass / body mass index was used (24.9% for males, 25.1% for females). In the study, the rate of low muscle strength was found to be 29.9%, and the rate of low walking speed was found to be 34.5%. In the study of Kim et al. conducted with 96 ESKD patients aged 50 years and above in 2014 , the rate of sarcopenia was found to be 37% in males and 29.3% in females [5]. In the light of these findings, it is understood that the rate of sarcopenia is quite high in hemodialysis patients and therefore it is an important problem for these patients.

In a study conducted by Ozkayar et al. in 2014 [6], the rate of sarcopenia was reported to be 20.5% in 166 renal transplant patients. However, in this study, sarcopenia was evaluated by hand grip strength. In another study, Erdogan MK [7] stated that the rate of sarcopenia was 26.7% in 120 renal transplant patients and 5% in the control group, and sarcopenia was significantly higher in renal transplant patients as compared to control group.

Skeletal muscle loss reaches 1% yearly in an adult without CKD [8, 9]. Although there are the same age-related processes in CKD patients, skeletal muscle loss due to disease-related causes is more prominent. This situation can be expected to be more evident in ESKD patients [10]. In the study conducted by Moon et al. [15], stage 1-5 CKD patients were evaluated, and it was stated that the frequency of sarcopenia was 4.3% in Stage I patients, 6.3% in Stage II patients, and 15.4% in Stage III-V patients. In addition, more data are available on sarcopenia and/or loss of skeletal muscle mass in CKD patients, while there are more limited data in patients under hemodialysis treatment.

The higher rate of sarcopenia in male hemodialysis patients in our study was consistent with the findings of other studies. In the study conducted by Moon et al. [11], the rate of sarcopenia was found to be 18.1% in patients with stage 3-5 CKD in male patients and 12.6% in female patients. Kopple et al. [12] stated that the high frequency of sarcopenia in males is more pronounced at low GFR levels compared to females. In a recent study conducted by Zhou et al. [13], 148 stage 3-5 CKD patients were examined, and males were reported to be more susceptible to sarcopenia than women. The higher incidence of sarcopenia in males has been associated with a faster loss of muscle mass. Another mechanism is that the harmful effects of myostatin, which mediates sarcopenia, are more pronounced in men [14].

The correlation between anthropometric measurements and sarcopenia in our study indicates that simple anthropometric measurements may be useful in the early diagnosis of sarcopenia. However, in a study of Halil M. et al., it was reported that measurement errors can be made as the results of anthropometric measurements may also depend on the person performing the measurement, and therefore it is not recommended to be used in the routine diagnosis of sarcopenia [15]. BIA is another method of analysis that used in assessing nutritional status in CKD [16].

BIA, estimates the volume of fat and lean body mass. The test it self is inexpensive, easy to use, readily reproducible and appropriate for both ambulatory and bedridden patients. BIA measurement techniques, used under standard conditions, have been studied for >10 years [17], and BIA results under standard conditions have been found to correlate well with magnetic resonance imaging (MRI) predictions [18]. Therefore, In our study muscle mass was calculated using the bioelectrical impedance method.

No relationship could be shown between sarcopenia and age in our study. However, there is a great deal of evidence that sarcopenia increases with age [19-20]. In addition, it was observed that the duration of CKD or the duration of hemodialysis was not different between patients with and without sarcopenia in our study. Conflicting results have been reported in the literature regarding sarcopenia and the duration of dialysis.

Limitations

The limitation of this study most of the CKD patients' included in our study being in the middle age group and not planning the study in a case-control design rather than a cross-sectional design may have hidden the relationship between sarcopenia and age.

Conclusions

In conclusion, the progression of sarcopenia should be prevented or treated in these patient groups due to the high frequency of sarcopenia in hemodialysis patients. Therefore, patients should be examined in terms of sarcopenia, physical activity habits, and diets and medical treatments should be arranged during their routine controls. Mortality can be reduced, morbidity can be prevented and quality of life may be improved if these measures are applied regularly.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
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Ethical approval
Ethics committee approval was obtained from Adıyaman University Non-interventional Clinical Studies Ethics Committee (date:26.06.2018, number:2018/5-22).

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