Ankara Sağlık Bilimleri Dergisi

Journal of Ankara Health Sciences

e-ISSN: 2618-5989

Evaluation of Nutritional Status, Physical Performance, and Sarcopenia in Individuals Aged 60 and Over: Example of Antalya 60+ Refreshment University

60 Yaş ve Üstü Bireylerde Beslenme Durumunun, Fiziksel Performansın ve Sarkopeninin Değerlendirilmesi: Antalya 60+ Tazelenme Üniversitesi Örneği

Hülya Kamarlı Altun[1*], Gökçe Yağmur Güneş Gencer[2], Gülen Suna[1], Büşra Şen[1], Gözde Yılmaz[1]

[1]Akdeniz University, Faculty of Health Sciences, Department of Nutrition and Dietetics, Antalya, Turkey
[2]Akdeniz University, Faculty of Health Sciences, Department of Gerontology, Antalya, Turkey

Article Information

Received: 19.03.2022

Accepted: 20.06.2022

ABSTRACT

Aim: This study aims to evaluate the nutritional status, physical performance, and sarcopenia status of 60+ Refreshment University students. **Subjects and Method:** This cross-sectional study included 214 individuals who attended the 60+ Refreshment University between January and May 2020. Individuals' nutritional status and dietary habits were evaluated using a 24-hour dietary recall and Mediterranean diet adherence scale, and their anthropometric measurements were taken. The physical activity scale for the elderly, the 5 times sit to stand test, and timed up and go test were applied in assessing their physical performance. **Results:** The mean age of the subjects was 66.4±4.4 years, and most of them were women (71.0%). It was found that 38% of the daily energy intake came from carbohydrates and 44.5% from fats, and one out of every four older adults had a low score for adherence to the Mediterranean diet. Only 3.7% of the older individuals were sarcopenic. A weak positive correlation (r=0.143, p=0.037) was found between the physical activity scale for the elderly and Mediterranean diet adherence scale scores. Also, there was a moderately positive correlation between fat-free mass and handgrip strength (r=0.615, p=0.001) and a weak negative correlation between walking speed (r=-0.139, p=0.043) and timed up and go test (r=-0.195, p=0.003). **Conclusion:** It is thought that this study will contribute to the literature for the development of adequate and balanced nutrition and physical activity education models for older people by providing information about the nutritional profiles and physical performances of those studying at Refreshment University.

Keywords: Aged, Mediterranean diet, nutritional status, physical functional performance, sarcopenia,

Article Information

Geliş Tarihi: 19.03.2022

Kabul Tarihi: 20.06.2022

ÖZ

Amaç: Bu çalışma 60+ Tazelenme Üniversitesi öğrencilerinin beslenme durumunu, fiziksel performansını ve sarkopeni durumunu değerlendirmek amacıyla planlanmıştır. **Örneklem ve Yöntem:** Kesitsel tipteki bu araştırma Ocak-Mayıs 2020 tarihleri arasında Akdeniz Üniversitesi Kampüsü 60+ Tazelenme Üniversitesi'nde eğitim gören 214 birey üzerinde yürütülmüştür. Bireylerin beslenme durumlarını ve beslenme alışkanlıklarını değerlendirmek için 24 saatlik geriye dönük besin tüketim kaydı ve Akdeniz diyeti uyum ölçeği kullanılmış ve antropometrik ölçümleri alınmıştır. Fiziksel performansı değerlendirmek için yaşlılar için fiziksel aktivite ölçeği, sandalyeye 5 tekrarlı otur kalk testi ve zamanlı kalk ve yürü testi uygulanmıştır. **Bulgular:** Bireylerin yaş ortalaması 66.4±4.4 yıl ve çoğunluğu kadın (%71.0)'dır. Günlük alınan enerjinin %38'inin karbonhidratlardan, %44.5'inin ise yağlardan geldiği ve her 4 yaşlıdan birinin Akdeniz diyetine uyum skorunun düşük olduğu bulunmuştur. Yaşlı bireylerin sadece %3.7'sinin sarkopenik olduğu görülmüştür. Yaşlılar için fiziksel aktivite ölçeği skorları ile Akdeniz diyeti uyum ölçeği skorları arasında zayıf düzeyde pozitif ilişki (r=0.143; p=0.037) saptanmıştır. Yağsız vücut dokusu ile el kavrama gücü (r=0.615; p=0.001) arasında orta düzeyde pozitif ilişki; yürüme hızı (r=-0.139; p=0.043) ve zamanlı kalk ve yürü testi (r=-0.195; p=0.003) arasında da zayıf düzeyde negatif bir ilişki olduğu belirlenmiştir. **Sonuç:** Bu çalışmanın Tazelenme Üniversitelerinde eğitim gören yaşlı bireylerin beslenme profilleri ve fiziksel performansları hakkında bilgi sağlayarak, yaşlı bireylere yeterli ve dengeli beslenme ile fiziksel aktivite konularında eğitim modellerinin geliştirilmesi için literatüre katkı sağlayacağı düşünülmektedir.

Anahtar Kelimeler: Yaşlı, Akdeniz diyeti, beslenme durumu, fiziksel fonksiyonel performans, sarkopeni,

doi: 10.46971/ausbid.1090317 Research article (Araştırma makalesi)

***Sorumlu yazar/Corresponding author:** Hülya Kamarlı Altun, hkamarli@akdeniz.edu.tr

Introduction

The older population in the world is increasing day by day. The World Health Organization states that by 2030, one in every six people worldwide will be aged 60 years or over (WHO, 2021). With the increase in life expectancy, the aging population has started to rise in Turkey and in the world. The United Nations Department of Economic and Social Affairs data shows that older people's share of the global population is expected to increase from 9.3% to 16% by 2050 (United Nations Department of Economic and Social Affairs Population Division, 2020).

Aging, a physiological and dynamic process, causes biological and psychological changes in individuals, and it leads to biological changes in the human body and affects mood, environmental attitudes, physical performance, social activity, and nutrition (Dziechciaz & Filip, 2014). Older adults have an increase in adipose tissue due to a decrease in body weight and lean tissue mass, and they experience more frequent falls and fractures due to the decreased calcium in their bones. In addition, limitations in joint flexibility and joint movements in older adults also cause a decrease in physical activity (Tieland et al., 2018; JafariNasabian et al., 2017). Muscle mass declines with age, and this loss increases by 1% to 2% annually from the age of 50 and is over 50% in individuals aged 80 and over compared to young adults (Kalyani et al., 2014; Bijlsma et al., 2013). The term "sarcopenia" describes such loss of muscle mass, muscle strength, and function in older adults (Edwards et al., 2015). The European Working Group on Sarcopenia in Older People (EWGSOP) defines sarcopenia as a syndrome characterized by progressive and generalized loss of skeletal muscle, loss of muscle strength, and functional impairment of the muscles (Cruz-Jentoft et al., 2019). The risk of sarcopenia emerges as a serious health problem in older people, as it is expected that muscle mass and muscle strength and, thus, muscle function will deteriorate.

Therefore, sarcopenia is considered a critical health problem in frailty, disability, morbidity, and mortality (Marzetti et al., 2017; Tsekoura et al., 2017). For older adults diagnosed with sarcopenia, muscle mass, muscle strength, and physical performance should be evaluated at regular intervals (Sökmen & Dişcigil, 2017). Although sarcopenia is affected by numerous fixed factors such as gender, its relationship with modifiable factors such as individuals' dietary habits and physical activity status is also noteworthy (Denison et al., 2015). Sarcopenia can also be prevented, and active aging is facilitated in older adults by changing negative nutritional habits and physical inactivity. In recent years, "Universities of the Third Age" have been established abroad and "Refreshment (Tazelenme) Universities" in Turkey to allow active and healthy aging for older people at an optimum level (Huang, 2006). Under the 60+ Refreshment University, established for the first time on the Akdeniz University Campus in Turkey, for lifelong learning, older individuals are provided educational opportunities and support in leading a healthier and more physically and mentally active life (Tufan, 2016). This study aims to evaluate the nutritional status, physical performance, and sarcopenia in Akdeniz University 60+ Refreshment University students.

Subjects and Methods

Study Population and Design

The population of this cross-sectional study consisted of 752 older individuals over 60 years who were actively attending the Akdeniz University Campus, 60+ Refreshment University. The study's sample size was 254 individuals at a 95% confidence interval, as calculated using a known population sample. Data collection began in January 2020. However, the study was terminated in May 2020 with a sample of 214 due to the onset of the COVID-19 pandemic in March 2020,

followed by curfews for individuals over the age of 65, and the interruption of face-to-face education. The study included male and female individuals over 60 years who did not have a disease that may affect their muscle structure. Those with a blood pressure of >130/90, those who faced an acute medical problem or trauma in the last one month, experiencing severe neurological and orthopedic conditions, suffering from vertigo or any balance problems, having a pacemaker or platinum in their body, failing to comply with the study protocol and engaging in insufficient cooperation were excluded from the study before the tests. This study was conducted according to the guidelines outlined in the Declaration of Helsinki. Informed consent was obtained from all participants. Ethics committee approval of the study was obtained from Akdeniz University Faculty of Medicine Clinical Research Ethics Committee (on the date of 05/08/2019 and decision number of 70904504/345).

Data Collection

A questionnaire that included socio-demographic characteristics, health status, dietary habits, Mediterranean diet adherence scale (MEDAS), physical activity scale for the elderly (PASE), and 24-hour dietary recall was applied to the subjects by face-to-face interview technique. Walking speed, handgrip strength, and muscle mass measurements were made according to the diagnostic criteria of the EWGSOP, and whether they were sarcopenic or not was evaluated (Cruz-Jentoft et al., 2019). Furthermore, various anthropometric measurements [height (cm), body weight (kg), upper-middle arm (cm), waist and hip circumference (cm)] were taken, and body compositions (Tanita BC418) to evaluate with bioelectrical impedance analysis (BIA) using a body analyzer. Ten-meter walking test (10MWT) timed up and go (TUG) test, and 5 times sit to stand test (5XSST) were performed to evaluate physical performance. Body mass indexes (BMI) of all subjects were calculated and evaluated using the formula of body weight (kg)/height2 (m2).

Instruments

Mediterranean Diet Adherence Scale (MEDAS); This scale is a 14-item scale used in the study of Martínez-González et al. (2012) titled PREDIMED investigating the Mediterranean-type dietary habits in the primary prevention of cardiovascular diseases. The Turkish validity and reliability studies of the scale were performed by Pehlivanoğlu et al. The scale includes questions about the type of oil used in meals, the amount of olive oil consumed daily, fruit and vegetable portions, margarine-butter and red meat consumption, and weekly consumption of wine, legumes, fish, seafood, white meat, snacks, and nuts (Özkan Pehlivanoğlu, 2020). 1 or 0 points are given for each question asked depending on consumption. A score of ≤5 indicates low adherence, 6-9 moderate adherence, and ≥10 high adherence (Martinez-Gonzalez et al., 2012).

24-Hour Dietary Recall; The nutritional status of the subjects was reviewed through a 24-hour dietary recall. A food catalogue with photographs was used in determining the type and portion size of foods and beverages consumed (Rakıcıoğlu, 2012). The data obtained from the food consumption record were entered into the Nutrition Information System (BeBIS) software program, and the total energy, carbohydrate, fat, and protein amounts of the diets were calculated.

Physical Activity Scale for the Elderly (PASE); In 2011, Turkish validity-reliability studies of the scale developed by Washburn et al. (1999) in 1993 were performed by Ayvat (2011). The scale measures the leisure time, housework, and work-related physical activity levels and intensity of older individuals in the last week. The PASE activity frequencies and intensities are multiplied, and the total PASE score is calculated by adding the scores obtained for each activity. As PASE

scores increase, the level of physical activity also increases (Ayvat, 2011; Washburn et al., 1999).

Evaluation of Handgrip Strength; A hand dynamometer was used for grip strength. Individuals were asked to squeeze the dynamometer three times as strong as they could with their dominant hand. Then, these values were averaged out. According to the diagnostic algorithm of EWGSOP, women with a grip strength of less than 16.0 kg and men with than 27.0 kg were evaluated to have 'low grip strength' (Cruz-Jentoft et al., 2019).

Evaluation of Muscle Mass; The fat-free mass index (FFMI), obtained by dividing the fat-free mass (FFM) in BIA by the square of one's height, was used to assess the muscle mass of individuals. <17kg/m^2 and <15 kg/m^2 were considered as "low muscle mass" for men and women, respectively (Cederholm et al., 2019).

Assessment of Physical Performance; The physical performances of the older adults were investigated through the 10MWT, TUG test, and 5XSST. 10MWT: The subject was asked to walk at their own regular pace in the 10-meter area (using their walking aid, if any), and the time spent was recorded (Shubert et al., 2006). TUG Test: the person was asked to get up from their chair, walk 3 meters at a safe and regular speed, then walk back and sit on the chair again, and the time spent was recorded (Lin et al., 2004). 5XSST: while the individual was sitting on the chair with their arms crossed on their chest (right hand on the left shoulder, left hand on the right shoulder), they were asked to sit on and stand from the chair 5 times as fast as possible, and the time spent was recorded (Lord et al., 2002).

Statistical Analysis

Statistical Analysis The data obtained from the study were analyzed via the SPSS 25.0 Statistics package program. The qualitative data was presented in numbers (n) and percentages (%), and quantitative data in mean, standard deviation, median, minimum, and maximum values. The suitability of the quantitative variables to normal distribution was reviewed using the "Kolmogorov-Smirnov" test. Independent t-Test was applied to compare normally distributed variables, and Kruskal Wallis Test and Mann–Whitney U Test were to compare data that were not normally distributed. The relationships between PASE scores, MEDAS scores, mid-upper arm circumference (MUAC), FFM, handgrip strength, 10MWT, TUG score, energy intake, and protein percentages were defined by the Spearman correlation test. The significance level was accepted as $p<0.05$ in all statistical analyses.

Results

The mean age of the subjects was 66.4±4.4 years, and the majority of them were female (n=152; 71.0%) and married (n=130; 60.7%). Based on the subjects' self-statements, 80.4% (n=172) had at least one chronic disease, and 71.5% (n=153) used regular medication for such disease. The most common diseases in older adults with chronic diseases were hypertension (38.3%), diabetes (19.6%), bone and joint diseases (18.7%), cardiovascular diseases (14.9%), and stomach diseases (14.0%). Considering their educational background and socioeconomic characteristics, about three-quarters of them were university (37.4%) and high school graduates (35.5%). 22.4% graduated from primary and secondary schools, and 4.7% had postgraduate degrees. 81.6% were retired and, therefore, income and expenditure levels of most subjects were equal (n=147; 68.7%) (Data not shown). Older adults' dietary habits and nutrition knowledge proved that most of them did not receive any previous education on nutrition (65.0%), they obtained information mainly from dietitians (33.6%) and

mass media such as radio, television, and newspapers (35.5%) and that almost half of them (49.5%) thought they were adequately nourished (Table1). Most subjects had two or three main meals and two snacks a day (50.0%; 48.6%; 34.6%, respectively). About half of the participants skipped the main meals (47.2%), and nine out of ten skipped snacks (89.7%). The most frequently skipped main meal and snacks were lunch and mid-morning, respectively. Most subjects skipping the main meal stated that they skipped meals as they did not have such habits (30.6%) and lacked appetite (29.4%) (Table 1).

When the food consumption of the subjects is examined, energy intake and carbohydrate, protein, and fat percentages of their diets were 1365.4±418.2 kcal, 38.1±9.53%, 17.2±3.83%, and 44.5±8.36%, respectively. The mean MEDAS score was 7.58±1.76, and only one out of four people had low adherence to the Mediterranean diet (MD) (26.6%) (Table 1).

Table 1. Evaluation of the Dietary Habits, Energy and Nutrient Intakes of Older Adults and Their Mediterranean Diet Adherence

Nutritional habits	**n**	**%**		**n**	**%**
Have you ever taken nutrition education?			**Adherence to Mediterranean Diet**		
Yes	75	35.6	Low	57	26.6
No	139	65.0	Moderate	92	43.0
Where do you reach nutrition information?			High	65	30.4
			Reason for skipping meals		
Dietitian	72	33.6	Anorexia	47	29.4
Doctor/Nurse	21	9.8	Loneliness	18	11.3
Friend	10	4.7	Absence of habit	49	30.6
Radio/TV/Newspaper	76	35.5	School/course/sports activities	31	19.4
Internet/Social media	25	11.7	For not prepared	1	0.6
Other	10	4.7	For forgetting	6	3.8
Do you think you are getting adequate nutrition?			Other	8	5.0
			Number of snacks		
Yes	106	49.5	0	54	25.2
No	28	13.1	1	64	29.9
Variable	80	37.4	2	74	34.6
Number of main meals			≥3	22	10.3
			Snacks skipping status		
1	3	1.4	Yes	192	89.7
2	107	50.0	No	8	3.7
3	104	48.6	Sometimes	14	6.5
Meal skipping status			**Skipping snacks***		
Yes	101	47.2	Mid-morning	90	42.1
No	54	25.2	Afternoon	76	35.5
Sometimes	59	27.6	Night	42	19.6
Skipping meal					
Breakfast	11	5.1			
Lunch	130	60.7			
Dinner	19	8.9			

Dietary Intake of energy and macro-nutrients and MEDAS Score	**Min-Max (Median)**	**X±SD**
Energy (kkal/day)	617.2 – 2936.6 (1307.7)	1365.39±418.21
Protein (g/day)	18.6 – 123.1 (52.4)	55.78±17.70
Protein (%)	9 – 29 (17)	17.15±3.83
Lipids (g/day)	24.8 – 154.7 (64.2)	67.45±22.79
Lipids (%)	21 – 75 (44)	44.48±8.36
Carbohydrates (g/day)	13.5 – 325.3 (119.3)	128.25±55.39
Carbohydrates (%)	6 – 69 (38)	38.07±9.53
MEDAS Score	3 – 12 (8)	7.58±1.76

*The total number is greater than n due to participants could choose more than one response.

Table 2 shows the anthropometric measurements of older individuals. The subjects' mean body weight, height, and body mass index (BMI) were 71.9±11.5kg, 159.4±7.8cm, and 28.2±3.8 kg/m^2, respectively. Approximately half of the subjects were overweight (n=115; 53.7%) based on their BMI values, and one out of every four older adult was obese (27.6%).

Table 2. Antropometric Measurements and Body Composition of Older Adults

Antropometric Measurements	Min-Max (Median)	X̄±SD
Weight (kg)	43.5 – 108.8 (70.8)	71.9±11.5
Height (cm)	144– 181 (158)	159.4±7.8
BMI (kg/m^2)	17.6 – 39.7 (28.0)	28.2±3.8
Fat %	10.7 – 50.3 (33.8)	32.9±7.4
Fat mass (kg)	6.1 – 46.0 (23.8)	23.9±7.4
Fat-free mass (kg)	28.2 – 75.4 (45.5)	47.7±8.8
Waist circumference (cm)	63 – 122 (95.5)	95.5±9.8
Hip circumference (cm)	86 – 132 (103)	104.1±7.9
Waist/hip ratio	0.72 – 1.14 (0.91)	0.92±0.07
MUAC (cm)	15 – 37 (29)	28.7±2.9

BMI; Body mass index, MUAC; Mid-upper arm circumference

Table 3 shows the subjects' physical activity and physical functional performance indicators. For sarcopenia diagnosis, subjects' walking speed was measured according to the EWGSOP diagnostic criteria. 91.6% of the subjects had a walking speed of ≤0.8m/sec, and 8.4% of them had >0.8m/sec. Next, the muscle mass of the individuals with a walking speed of 0.8 m/sec and below was evaluated. It was observed that 4.1% (n=8) of these individuals had low muscle mass. Considering the handgrip strength of the individuals with walking speed >0.8 m/sec, one had low handgrip strength. Finally, muscle mass was measured in individuals with a walking speed of >0.8m/sec and low handgrip strength, and none of them had low muscle mass. According to the EWGSOP diagnostic criteria, eight subjects (3.7%) had sarcopenia (data not shown).

Table 3: Evaluation of Physical Activity and Physical Performance Indicators of Older Adults

Physical Activity and Physical Performance Indicators	Min-Max (Median)	X̄±SD
PASE Score	7.31 – 546.9 (113.3)	127.4±80.1
Walking Speed (10MWT)	4.03 – 15.6 (6.67)	6.73±1.13
TUG score	5.0 – 13.1 (7.56)	7.59±1.35
5XSST score	4.93 – 15.9 (9.44)	9.60±2.11
Hand grip strength- dominant side	8.5 – 59.6 (25.4)	26.5±7.77

PASE: the Physical Activity Scale for the Elderly, 10MWT: 10-Meter Walk Test, TUG: Timed Up and Go test, 5XSST: 5 Times Sit to Stand test.

The PASE scores, handgrip strength, walking speed, TUG score, MEDAS score, and dietary protein percentages were compared based on the age groups of the subjects. The PASE scores (p=0.001), and MEDAS scores (p=0.032), dietary protein percentages (p=0.039) were significantly higher, and 5XSST scores (p=0.03) were significantly lower in subjects aged 60-65 and below than those aged over 65 (Table 4). On the other hand, gender-based evaluations showed that women had significantly higher PASE scores (p=0.003), TUG scores (p=0.002), MEDAS scores (p=0.032), and significantly lower handgrip strength (p=0.001) than men (Table 4).

According to the body mass index classification, there were significant differences between the subjects' 5XSST scores (p=0.007). Time spent by obese older adults for 5XSST (10.2±2.17 sec; 9.49±2.13 sec, respectively; p=0.013) was significantly higher than overweight subjects. The time spent by individuals with normal body weight to 5XSST was significantly shorter than obese individuals (8.98±1.72 sec; 10.2±2.17 sec; p=0.004, respectively) (Data not shown).

Table 4: Evaluation of MEDAS Score, Protein Intake, Physical Activity Status, and Physical Performance of Older Adults Based on Gender and Age Groups

Evaluation of Physical Performance and Nutritional Parameters	60–65 age (n=101)	>65 age (n=113)	p	Female (n=152)	Men (n=62)	p
PASE Score	143.9±82.9	112.7±74.8	0.001*	136.3±82.0	105.8±71.4	0.003
Handgrip-Dominant Side	27.1	25.1	0.131	23.2±5.18	34.4±7.39	0.001
TUG Score	7.53	7.64	0.574†	7.77±1.36	7.15±1.23	0.002†
5XSST Score	9.27±2.12	9.90±2.07	0.03*	9.79±2.08	9.14±2.13	0.118
MEDAS Score	7.83±1.72	7.35±1.77	0.032*	7.75±1.78	7.16±1.65	0.032
Protein %	17.7±3.69	16.6±3.82	0.039*	17.4±3.77	16.7±3.94	0.328

PASE: the Physical Activity Scale for the Elderly, TUG: Timed Up and Go test, 5XSST: 5 Times Sit to Stand test. * Mann-Whitney U test †, Independent t-test; p<0.05.

The correlations between the subjects' PASE scores, MEDAS scores, MUAC, FFM, handgrip strength, walking speed, TUG scores, and energy intake were analyzed. There was a weak positive correlation between PASE scores and MEDAS scores (r=0.143, p=0.037) and a weak negative correlation between waist circumference (r=-0.140, p=0.041) and waist-hip ratio (r=-0.187, p=0.006). Moreover, FFM had a weak correlation with MUAC (r=0.279, p=0.001) and dietary energy (r=0.019, p=0.033), and moderately positive correlation with handgrip strength (r=0.615, p=0.001). There was also a weak negative correlation between walking speed time (r=-0.139, p=0.043) and TUG score (r=-0.195, p=0.003) (Table 5).

Table 5. The Correlation Between the Subjects' PASE Scores, MEDAS Scores, MUAC, FFM, Handgrip Strength, Walking Speed, TUG Score, and Energy Intake

Variables	PASE Score	MEDAS Score	MUAC	FMM	Handgrip Dominant Side	10MWT	TUG Score	Energy
PASE Score	1							
MEDAS Score	0.143*	1						
MUAC	0.058	-0.074	1					
FMM	-0.075	-0.085	0.279†	1				
Handgrip dominant side	0.061	0.079	0.162*	0.615**	1			
10MWT	0.099	0.098	-0.060	-0.139*	-0.114	1		
TUG score	-0.052	-0.099	0.055	-0.195†	-0.225†	0.384†	1	
Energy	0.058	0.086	0.113	0.199†	0.213†	0.028	-0.113	1

FFM; Fat-free mass, MEDAS: Mediterranean diet adherence scale, MUAC; Mid-upper arm circumference, PASE: the Physical Activity Scale for the Elderly, 10MWT: 10-Meter Walk Test, TUG: Timed Up and Go Test. *p<0.05, †p<0.001.

Discussion

An adequate and balanced diet in old age, which is one of the outstanding stages of life, is critical for taking the necessary nutrients into the body, preventing diseases, and protecting and improving health (T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü Sağlıklı Beslenme ve Hareketli Hayat Dairesi Başkanlığı, 2019). Physiological changes due to old age such as decreased sense of taste and smell, tooth loss, swallowing problems, loss of appetite, and poor digestion and absorption of nutrients, socioeconomic factors, psychological factors such as loneliness and depression, diseases, and multiple drug use affect the nutritional status of older individuals (Yabancı et al., 2012).

There is a decrease in the food consumption of older individuals due to the physiological changes and/or loss of appetite caused by aging (Clegg & Williams, 2018). According to the 2010 data of the Turkey Nutrition and Health Survey (TNHS), 76.3% of individuals aged 65-74 and 74.9% of individuals over the age of 75 consume three main meals. On the other hand, TNHS 2017 data shows that 96% of individuals aged 65 and consume at least two main meals (T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü, 2014, 2019). Studies on older people's dietary habits propose that most individuals (75.3-93.8%) consume at least three main meals a day, and the most skipped meal is lunch (T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü, 2019; Hoca & Türker, 2017; Yabancı et al., 2012; Aksoydan, 2006). This study determined that 48.6% of the individuals consumed three main meals and that the most skipped meal was lunch. Considering the gender of the subjects, 53.2% of men and 48.7% of women consumed two main meals, and 45.7% of men and 50% of women consumed three main meals (data not shown). When comparing the study results with the literature, it was understood that individuals consumed two main meals instead of three main meals, and lack of habits and anorexia affected main meal consumption. Providing nutrition education that emphasizes the importance of main meal consumption, especially in old age, will prevent nutritional problems in the future.

Particular attention should be paid to energy, macro, and micronutrient intakes to ensure the healthy aging of older adults by reducing the risk of mortality and morbidity. There are many studies in the literature evaluating the nutritional status of older individuals (Hoca & Türker, 2017; T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü, 2014, 2019). One of these studies showed that daily dietary energy intake was 1960.4±512.9kcal in men and 1523.6±352.1kcal in women, and mean daily protein intake was 78.5±24.9g in men and 61.3±21.5g in women (Hoca & Türker, 2017). In TNHS 2010 data, the average energy intake of individuals aged 65-74 is 1705.5±680.8kcal in men and 1408.7±616.8kcal in women. TNHS 2019 data also suggested that individuals aged 65 and over had similar energy intakes (M:1729.6±631.8kcal, F:1351.3±482.3kcal). In this study, daily dietary energy intake was 1316.2±366.2kcal for women and 1485.9±507.9kcal for men (data not shown). It is known that the energy requirement of older adults may decline due to the decrease in basal metabolic rate and physical activity. Although the values in the study were above the resting metabolic rate for individuals in this age group, they were lower than both the recommended energy requirement and the literature. (T.C. Sağlık Bakanlığı Halk Sağlığı Genel Müdürlüğü Sağlıklı Beslenme ve Hareketli Hayat Dairesi Başkanlığı, 2019). It is recommended that 45-60% of the daily energy intake is from carbohydrates, 20-35% from fats, and 10-20% from proteins in the Turkey Dietary Guidelines for healthy older adults. We found that 17.15% of daily energy intake comes from protein and is within recommended ratios (M: 16.7%; F: 17.4%). However, we found that %38.1% of the daily energy intake from carbohydrates was lower than recommended (M: 39.8%; F: 37.4%), and 44.5% of the daily energy intake from fats was higher than recommended (F: 45.1%; M: 43.0%). Considering that the study subjects mostly (35.5%) obtained their nutritional

information from media sources, popular nutrition recommendations or dietary information obtained from such means negatively affected the energy and nutrient intakes.

The MD is a nutritional model, which is compatible with a healthy and balanced diet, has a balanced fat pattern, a low glycemic index, and a high antioxidant and fiber content, and includes high consumption of olive oil, fruits, vegetables, legumes, whole grains, and oilseeds. A study evaluated individuals aged 50-69 to the MD adherence between 1985-86 and 2005-6 and found that their MEDAS decreased and was associated with reduced olive oil consumption (Veronese et al., 2020). Another study determined that the MEDAS score was 8.3±2.0, with 68.4% of the participants having a moderate MD and 6.3% with low adherence to MD (İnce, 2019). In our study, the mean MEDAS score of the older adults was 7.6±1.8 (moderate). It was thought that the reason for the low adherence of one out of every four people (26.6%) to the MD might be the high ratio of energy coming from fat. Individuals should be advised to eat more fruits, vegetables, and whole grains under healthy, balanced, and adequate nutrition recommendations in line with the MD.

Adherence to the MD is associated with a better functional level in older individuals, and increased adherence to the MD is associated with a slower decrease in lower extremity mobility of the body over time (Shahar et al., 2012; Milaneschi et al., 2011). Another Finnish study proposes that the Scandinavian diet pattern, characterized by fruits, vegetables, grains, low-fat dairy, and fish, is significantly associated with better skeletal muscle strength in older women (Perälä et al., 2016). Our study also showed that older people's adherence to the MD increased along with their physical activity score.

The mean BMI values of the older adults were 28.2±3.8kg/m2. Yabancı et al. (2012) the mean BMI values of the older subjects were 26.3±4.5kg/m2 and 24.9±3.1kg/m2 in men and women, respectively. Aksoydan (2006) showed in her study that 71.4% of males and 52.8% of females had a BMI value ranging between 18.5-24.9kg/m2. A study conducted in Northern Cyprus showed that the mean BMI was 29.8±4.7kg/m2 in men and 32.4±5.9kg/m2 in women (Hoca & Türker, 2017). Studies carried out in Universities of the Third Age (Refreshment Universities) suggest that the average BMI values vary between 26-29 kg/m^2 (Kaplanová et al., 2018; Zając-Gawlak et al., 2016). The BMI values of individuals aged 65 and over should be between 22-26 kg/m2 (Arslan & Çakıroğlu, 2019). However, it is seen that the average BMI value determined in the study is above this value. Higher BMI values may be due to the high dietary fat consumption, although the daily energy intake is low.

In another study examining anthropometric measurements, women's waist circumference was 85.3±11.5cm, waist/hip ratio 0.83±0.07, body fat percentage 37.8±7.0%, body fat mass 26.8±8.8kg, and FFM 42.4±4.2kg, and in males, they were 94±12.6cm, 0.93±0.07, 26.3±8.9%, 22.3±10.8kg, and 59.2±8.0kg, respectively (Zając-Gawlak et al., 2016). In another study conducted only on women, body fat percentage was 35.1±5.5%, waist/hip ratio was 0.94, and FFMI was 17.0±1.1kg/m2 (Kaplanová et al., 2018). In the study conducted by Hoca and Türker (2017), waist/hip ratio and MUAC were 1.0±0.1 and 28.2±2.67cm in males and 0.9±0.1 and 28.8±3.54cm in females, respectively. In this study, waist circumference, body fat mass, body fat percentage, FFM and MUAC values were 100.9±8.3cm, 20.5±6.6kg, %25.4±5.8, 58.6±6.8kg, and 28.7±2.5cm for males, and 93.4±9.6cm, 25.2±7.3kg, %35.9±5.6, 43.3±4.6kg, and 28.7±3.1cm for females, respectively (data not shown). As age progresses, metabolic rate slows down, and physical activity decreases in elderly individuals. As a result, there is a decrease in FFM and an increase in body fat mass (Arslan & Çakıroğlu, 2019). From the

age of 65, the amount of fat in the extremities decreases, and the fat tissue around the abdomen increases (Arslan & Çakıroğlu, 2019; Zając-Gawlak et al., 2016). In our study, the waist circumference of the subjects was higher, especially in women, compared to the literature results. However, other parameters were similar.

With age, muscle fibrils decrease in size and number, which causes a reduction in muscle strength. Normal physiological aging is associated with the loss of FFM known as sarcopenia (Eckstrom et al., 2020). This study showed that as FFM increases, handgrip strength and functional independence (walking speed and TUG score decrease), which are critical sarcopenia diagnostic criteria, also increase. Considering that the study sample was the Refreshment University population, only 3.7% had sarcopenia. Studies in the literature show that the prevalence of sarcopenia in older individuals ranges from 10% to 19.1% (Hai et al., 2017; Lera et al., 2017; Silva Neto et al., 2016). In a study using muscle ultrasonography in a geriatric clinic in Turkey, the prevalence of sarcopenia was 19.5% in men and 13.6% in women (Sökmen & Dişcigil, 2017). A review study proposed that the prevalence of sarcopenia was 11% in men and 9% in women (Papadopoulou, 2020). Modifiable risk factors such as physical activity and nutrition play a significant role in developing sarcopenia. It is predicted that adequate consumption of high-quality protein and physical activity may be excellent strategies to prevent or delay the onset of sarcopenia (Bosaeus & Rothenberg, 2016). A review study on the effects of combined nutrition and exercise interventions in older adults concluded that some studies combining exercise training with diet demonstrated the increased benefits of exercise training as a potential for future interventions; however, it also emphasized that the available evidence is inconsistent (Denison et al., 2015).

In our study, individuals over 65 had lower physical activity levels. It is known that approximately 45% of people over the age of 60 do not meet the recommended level of physical activity, this rate rises to 75% for those aged 75 and over, and it becomes more critical as age increases (Australian Institute of Health and Welfare, 2014; Hallal et al., 2012). Regular physical activity is one of the essential components of healthy aging, and it also helps prevent problems faced by older adults such as pain, decreased mobility, frailty, and cognitive impairment. It should be noted that regular activity programs can also be attended by those at older ages (Eckstrom et al., 2020). For this reason, older individuals should be encouraged to engage in physical activity, as in Refreshment University.

In our study, older individuals' meantime, 5XSST score was 9.27 seconds for those under 65 years old and 9.90 seconds for those over 65 years old. In the literature, the mean values of the 5XSST were 12.1 seconds for those aged 60-69, 12.6 seconds for those aged 70-79, and 12.7 seconds for those aged 80-89 (Bohannon, 2006). An increase was found in the sitting and standing test time with advancing age. It is known that longer sit and stand time is associated with recurrent falls and slower walking speed (Schaubert & Bohannon, 2005). In our study, the duration of the 5XSST, which evaluates the mobility, functional independence, and lower extremity strength of the students of Refreshment University, was shorter. This result shows that Refreshment University may be a proven intervention to prevent the expected increase in 5XSST score with advancing age.

The limitation of the study is that the targeted sample size could not be reached because of the curfews for individuals over the age of 65, and the interruption of face-to-face education by Refreshment University. As far as we know, this is the first study to evaluate the nutritional status and physical performance of elderly individuals in 60+ Refreshment University,

which was established on the Akdeniz University campus for the first time in Turkey to support active aging. It is thought that the results of our study will contribute to future studies on this subject.

Conclusions and Recommendations

With the rapid increase in the older age population in Turkey and worldwide, older adults should be made aware of an adequate and balanced diet, and initiatives should be taken to increase their physical activity levels and provide them with regular exercise training. Refreshment Universities have been established on different campuses in Turkey to achieve active aging, which the World Health Organization has emphasized since 2002. Based on the results of the publications we have reviewed and our study, we can suggest that Refreshment University is a leading example in enabling older adults to lead active and healthy lives in Turkey and the world, and their numbers should be increased. Individuals studying at Refreshment University generally have high educational degrees and income levels, and they should be provided with more training on healthy nutrition and regular physical activity. Thus, it will be possible to prevent physiological problems and diseases.

Ethical Approval of the Study

All procedures performed in studies involving human participants were following the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study protocol was approved by the Akdeniz University, School of Medicine, Clinical Research Ethics Committee (Approval date and no: 05/08/2019 and 70904504/345). Participants gave their written informed consent.

Conflict of Interest

The authors declare that they have no conflict of interest.

Acknowledgment

We would like to thank Prof. Dr. İsmail Tufan, who has facilitated this study and is the founder of 60+ Refreshment University on Antalya Campus, the first exemplary social responsibility project on the engagement of the old age population in life and lifelong learning in Turkey, and the students of the Refreshment University who voluntarily participated in the study.

Author Contributions

Concept – HKA, BŞ, GY; Design – HKA, GYGG, BŞ, GY; Supervision – HKA; Materials; HKA, GYGG, BŞ, GY; Data Collection and/or Processing – HKA, GYGG, GS, BŞ, GY; Analysis and/or Interpretation – HKA, GYGG; Literature Research – HKA, GYGG, GS, BŞ, GY; Writing Manuscript – HKA, GYGG, GS, BŞ, GY; Critical Review – HKA, GYG, GS.

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