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The effects of the body mass index on the physical function and the quality of life in the elderly

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A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

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abstract

Background: As in all age groups, the prevalence of overweight and obesity is gradually increasing in the elderly. The aim of this study is to examine the effect of the body mass index (BMI) on the physical function and the overall quality of life in the elderly.

Material and methods: 265 community-dwelling older adults (131 women and 134 men) were included. BMI, grip strength (hand-held dynamometer), physical performance (Short Physical Performance Battery, SPPB) and overall quality of life (WHOQOL-BREF) were assessed..

Results: 265 older adults were divided into three groups: normal (n = 66), overweight (n = 116), obese (n = 83). SPPB and WHOQOL-BREF psychological health scores of the normal group were statistically significantly higher than in the obese group (p ≤ 0.005). The WHOQOL-BREF physical health score of the normal and the overweight groups was significantly higher than in the obese group (p≤0.005). Grip strength, SPPB and WHOQOL-BREF physical health scores of older men in all groups were better than in women (p≤0.005).

Conclusions: BMI negatively affects the physical function, physical health and the psychological domain of the quality of life in the elderly. In order to avoid or limit the effects of disability secondary to obesity and promote healthy ageing, the elderly should be encouraged to increase their physical activity and maintain healthy weight.

Key words: body mass index, older adult, physical functional performance, quality of life, disability.

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INTRODUCTION

The population aged 65 years and older worldwide is increasing with developing health services, increasing health awareness and technological developments [1]. However, as in all age groups, the prevalence of overweight and obesity is gradually increasing in the elderly [2]. In a study investigating the prevalence of overweight and obesity of adults over 50 years old from 10 European countries, 60.3% of adults were overweight and 19.2% were obese [3]. Obesity is a significant changeable risk factor and contributor to increased morbidity and mortality due to cardiovascular diseases, diabetes, cancer and chronic diseases [4, 5].

Active life expectancy has increased in all individuals worldwide, especially in the obese and among females [6]. Although the increasing life expectancy is positive for humanity, low quality of life and presence of individual diseases or even the extent of comorbidities can negatively affect an individual's life. Maintaining a healthy weight is important for healthy aging [7]. The functionality of older adults is associated with many factors such as age, chronic diseases, medications, nutritional status, and body mass index (BMI). Elderly people with a BMI ≥ 30 kg/m² are 60% more likely to experience functional decline than individuals with a normal weight [8]. Obese elders are at a higher risk for mobility and functional impairment due to obesity-related comorbid diseases [1, 9], and their quality of life is significantly affected by the decrease in physical functions and limited mobility [10]. In view of the above, the aim of this study is to examine the effect of BMI on the physical function and the overall quality of life in the elderly.

MATERIAL AND METHODS

STUDY DESIGN AND DATA SOURCE

The elderly who applied to the outpatient orthopaedics clinic of the university hospital or who came to the hospital as a patient companion and agreed to participate in the study between the years of May 2019 and December 2019 were assessed. Totally, 450 patients were assessed for eligibility. 132 patients who did not meet the eligibility criteria were excluded from the study. Likewise, 53 elders were excluded because they did not want to continue evaluations (n = 17), felt excessive fatigue during evaluation (n = 4), or due to missing data (n = 32). Finally, 265 elderly participated in the study.

PARTICIPANTS

Two hundred and sixty-five community-dwelling older adults (131 women and 134) men were enrolled in this study. The inclusion criteria were as follows: age ≥ 65 , self-reported lack of difficulty walking for two blocks and climbing 10 steps and performing activities of daily living, ambulation independently or with an assistive device (crutches, canes etc.), a score of ≥ 25 from the Mini-Mental State Examination test. The exclusion criteria were as follows: nursing home residence, concurrent pathologies that affect the ability to perform physical activity or perform everyday tasks (e.g., stroke history, cancer, extremity amputation). The study was approved by the Clinical Research and Ethics Committee of the authors' affiliated institution. Informed consent was obtained from all patients.

MEASUREMENTS

The patients' demographic data (age, gender, education, dominant upper extremity, marital status, etc.) were recorded. The dominant hand was determined by asking the preferred hand in daily activities such as writing, eating and handling heavy objects. Physical functions (grip strength, chair stand, gait speed, and balance tests) and the quality of life (patient-reported) were evaluated.

BMI was calculated from height and weight (kg/m^2). BMI categorization was done according to the World Health Organization (WHO) standards: normal weight ($18.5\text{--}24.99 \text{ kg}/\text{m}^2$), overweight ($25\text{--}29.99 \text{ kg}/\text{m}^2$) and obese ($\geq 30 \text{ kg}/\text{m}^2$) [11].

Grip strength was evaluated with a Jamar hand-held dynamometer. The measurement was performed when the person was sitting straight, with the upper arm in a neutral position and at 90° flexion of the elbow. The forearm was held in a neutral position and the wrist at a 0 to 30° extension. Measurements were performed bilaterally (dominant and non-dominant). Three measurements were performed with one-min intervals and the mean of three measurements was calculated.

The Short Physical Performance Battery (SPPB) test is used as a predictive tool for possible disability, nursing home and hospital admission. It is a valid and objective tool for measuring the physical function in older persons, particularly muscle strength of lower extremities [12]. SPPB consists of three sets: a timed repeated chair sit-to-stand test, hierarchical assessment of standing balance, and eight-foot (2.44 m) walking speed at usual pace [13]. A SPPB score of less than 10 has been reported to predict all-cause mortality [12]. Compared to those who scored 10–12, those who scored 4–6 are 2.9–4.9 times more likely to have a mobility-related disability and 1.5–2.1 times higher than those who scored 7–9 [14]. SPPB score categories (0–3: very low physical function, 4–6: low physical function, 7–9: moderate physical function, 10–12: high physical function) according to the cut-points provided by Guralnik et al. in their original work [13].

The World Health Organization Quality of Life Instrument, Short Form (WHOQOL-BREF) is one of the most useful generic forms that provide a brief assessment of the quality of life. It comprises 2 items from the Overall Quality of Life and 4 major domains, which measure physical health (7 items), psychological health (6 item), social relationships (3 item), and environment domains (8 item). The range of the component scores is 0–100, with higher scores reflecting a more favourable health status [15].

STATISTICAL ANALYSIS

The data was analysed using SPSS 24.0 (IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.) package program. Continuous variables are given as mean \pm standard deviation, median (minimum and maximum), and categorical variable values are presented as absolute numbers and percentages. Homogeneity of the variances among the groups was tested with Levene's test. All data were homogeneous ($p \geq 0.05$), and the Bonferroni method was used for multiple comparisons. Normality of data distribution was assessed by the Kolmogorov-Smirnov test. Spearman's Rank correlation coefficient was used to determine the relationships between the BMI and the physical function and the quality of life variables. The Mann-Whitney U test was used to compare the means by gender. Statistical significance was defined at the 5% ($p \leq 0.05$) level.

RESULTS

According to WHO classification, 265 older adults were divided into three groups: normal, overweight and obese (Fig. 1). The normal group consisted of 66 elders (mean age 70.48 years; 22 women and 44 men); the overweight group consisted of 116 elders (mean age 70.98 years; 55 women and 61 men), and the obese group consisted of 83 elders (mean age 69.80 years; 54 women and 29 men). 29.4% of the elderly had very low and low physical function (normal: 18.2%, overweight: 31.1%, obese: 36.1%); 47.9% had moderate physical function (normal: 50%, overweight: 46.6%, obese: 48.2%), and 22.6% had high physical function (normal: 31.8%, overweight: 22.4%, obese: 15.7%) (Table 1).

The comparisons of grip strength, SPPB and WHOQOL-BREF scores of the groups are shown in Table 2. SPPS and WHOQOL-BREF physical health and psychological health scores of the normal group were statistically significantly higher than in the obese group ($p \leq 0.05$). The WHOQOL-BREF physical health score of the overweight group was significantly higher than in the obese group ($p \leq 0.05$). There was no statistically significant difference between the groups in dominant and non-dominant side grip strength and WHOQOL-BREF social relationships and environment scores ($p < 0.05$).

The comparison of the physical function and the quality of life variables of the groups by gender are shown in Table 3. Grip strength, SPPB and WHOQOL-BREF physical health scores of the older men in all groups were better than those of women ($p \leq 0.05$). WHOQOL-BREF psychological health and environment scores of the older men in the normal and the overweight group were better than those of women ($p \leq 0.05$). The WHOQOL-BREF social relationships score of the older men in the overweight group was better than of the women ($p \leq 0.05$). In the obese group, WHOQOL-BREF psychological health, social relationships and environmental scores did not differ by gender ($p < 0.05$).

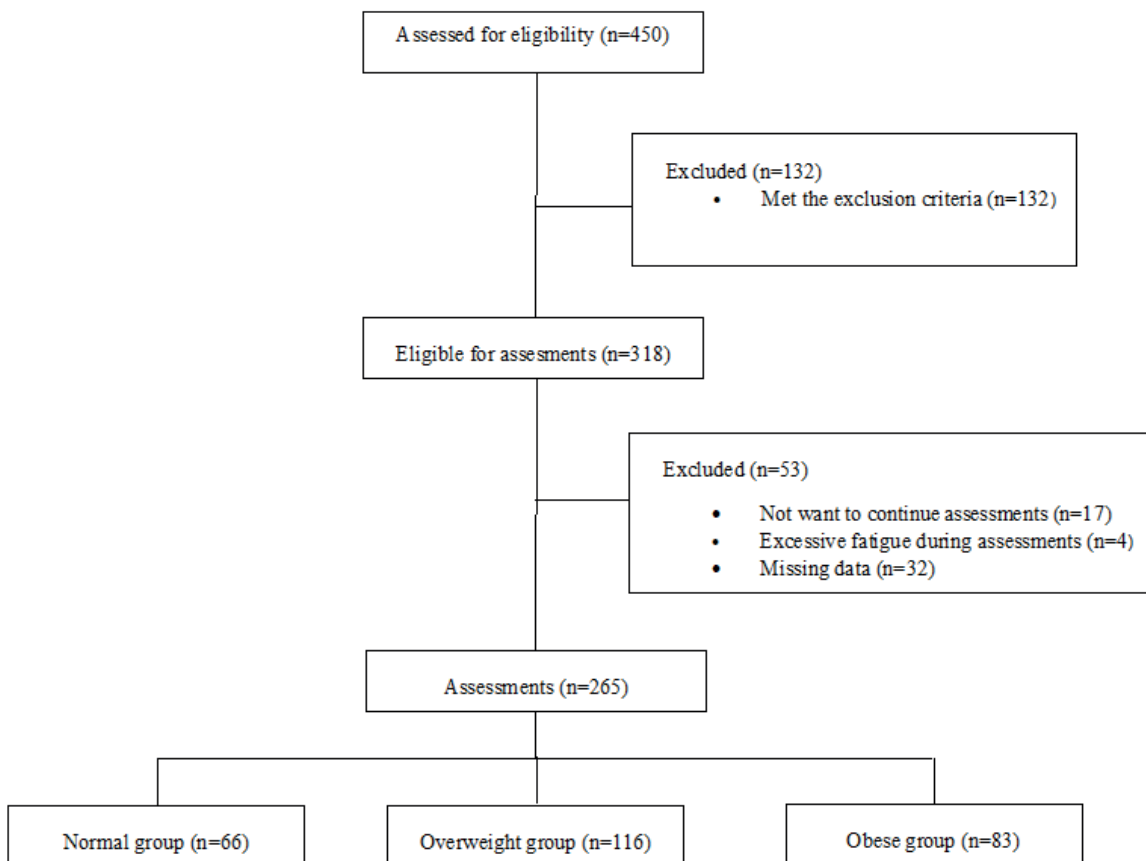


Fig 1. Flow-chart of the study

Table 1. Descriptive characteristics of participants

Variables	Normal (n = 66)		Overweight (n = 116)		Obese (n = 83)	
	Min-max	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Age (y)	65-87	70.48±5.48	65-87	70.98±5.04	65-80	69.80±4.24
BMI (kg/m ²)	18.80-24.97	22.81±1.72	25.25-29.97	27.60±1.34	30.04-40.86	33.72±2.73
	n	%	n	%	n	%
SPPB-summary scores						
0-3	2	3.0	6	5.2	10	12.0
4-6	10	15.2	30	25.9	20	24.1
7-9	33	50.0	54	46.6	40	48.2
10-12	21	31.8	26	22.4	13	15.7
Dominant extremity						
Right	54	81.8	93	80.2	74	89.2
Left	12	18.2	23	19.8	9	10.8
Gender						
Female	22	33.3	55	47.4	54	65.1
Male	44	66.7	61	52.6	29	34.9
Education						
Illiterate	8	12.1	22	19.0	18	21.7
Elementary education	28	42.4	68	58.6	47	56.6
Secondary education	9	13.6	9	7.8	10	12.0
High school	12	18.2	5	4.3	4	4.8
Associate degree	3	4.5	3	2.6	1	1.2
Bachelor degree	6	9.1	7	6.0	3	3.6
Master's degree	-	-	2	1.7	-	-
Marital status						
Single	2	3.0	-	-	-	-
Married	50	75.8	94	81	59	71.1
Widow	14	21.2	22	19	24	28.9

Table 2. Comparisons of grip strength, SPPB and WHOQOL-BREF scores of the groups

Variables	Normal (n=66)	Overweight (n=116)	Obese (n=83)	p
	Mean ±SD	Mean ±SD	Mean ±SD	
Grip strength				
Dominant extremity	29.40±13.28	29.97±16.65	25.58±13.3	0.104
Non-dominant extremity	26.15±12.86	26.57±15.98	22.91±13.06	0.182
SPPB	8.54±1.94	7.76±2.22	7.12±2.63	0.001^a
WHOQOL-BREF				
Physical health	66.40±18.16	65.02±15.60	58.48±17.84	0.007^{a,b}
Psychological health	67.88±14.27	63.83±15.69	61.29±15.60	0.034^a
Social relationships	65.97±16.00	63.50±17.59	59.89±17.49	0.093
Environment	64.83±13.47	63.82±15.26	61.75±14.64	0.414

SPPB: Short Physical Performance Battery, WHOQOL-BREF: World Health Organization Quality of Life Instrument Short Form. ^a: normal vs. obese, ^b: overweight vs. obese

Table 3. Comparison of the physical function and the quality of life variables of the groups by gender

Variables	Normal		p	Overweight		p	Obese		p
	Women (n=22)	Men (n=44)		Women (n=55)	Men (n=61)		Women (n=54)	Men (n=29)	
	Mean±SD	Mean±SD		Mean±SD	Mean±SD		Mean±SD	Mean±SD	
Grip strength									
Dominant extremity	23.99±8.18	32.10±14.55	0.005	21.42±9.73	37.68±17.85	0.000	20.90±11.06	34.31±13.13	0.000
Non-dominant extremity	20.96±6.84	28.74±14.37	0.004	18.34±8.99	33.99±17.28	0.000	18.49±10.29	31.15±13.81	0.000
SPPB	7.57±1.80	9.00±1.84	0.005	7.22±2.20	8.24±2.15	0.012	6.59±2.78	8.10±2.04	0.006
WHOQOL-BREF									
Physical health	58.44±17.13	70.37±17.51	0.011	60.00±17.22	69.55±12.47	0.001	54.83±17.44	65.27±16.80	0.010
Psychological health	58.33±8.23	72.65±14.31	0.000	58.94±16.96	68.24±13.09	0.001	60.42±16.56	62.93±13.74	0.463
Social relationships	63.26±13.95	67.33±16.93	0.304	59.62±20.20	67.01±14.11	0.026	61.11±18.81	57.61±14.78	0.355
Environment	56.56±10.96	69.06±12.74	0.000	59.80±17.08	67.44±12.47	0.008	62.19±13.85	60.92±16.23	0.722

SPPB: Short Physical Performance Battery, WHOQOL-BREF: World Health Organization Quality of Life Instrument Short Form

DISCUSSION

The physical function, the quality of life physical and psychological health domains of obese elderly compared to normal elderly were poor. Furthermore, the quality of life physical health domain of overweight elders was better than of the obese ones. Grip strength, social relationships and environment domains of the quality of life were not affected by BMI. In all groups, grip strength, SPPB and the quality of life physical health domain of the older men were better than women. In the normal and overweight group, there was a gender difference in the quality of life psychological health, social relations and environmental domains, while the difference in the obese group disappeared.

Some researchers reported that the optimal BMI range for the elderly should be 25–29.9 kg/m² [16], with an increased risk of mortality in the elderly with a BMI <23 [16] or BMI <25 [17, 18]. However, in many studies up to now [19, 20], it has been reported that the WHO references are valid for “the elderly”, so in our study, we used WHO standards in the BMI category.

Although the level of functional decline in the elderly varies, loss of muscle mass is a common finding in the elderly population [21]. Obesity can directly affect physical functions by a negative impact on the lower limb muscle structure and function [22]. Previous studies reported that high BMI is associated with poor functional outcomes in the elderly living in the community [7, 9, 22–24]. In our study, although there was a decrease in the physical function of overweight elderly compared to the normal group, no statistically significant difference was found. However, the physical function of obese elderly was significantly poor compared to the normal group. In addition, according to the SPPB classification, the 18.2% of the normal group had very low and low physical functions while this rate increased to 31.1% in overweight and almost doubled in obese elders (36.1%). Conversely, 31.8% of the normal group showed a high physical function, while this rate dramatically decreased in the overweight (22.4%) and the obese (15.7%). An increased BMI is associated with lower physical functionality in all age and gender groups [25]. Unsurprisingly, as supported by our study results, the decline in physical functions caused by obesity and obesity-related disabilities is an important issue that needs to be addressed as it may interfere with the independence and activities of daily life.

Overweight and obesity is associated with poor health-related quality of life in the elderly [7, 10, 26], but satisfaction with life is not related to BMI [10]. We evaluated the overall quality of life rather than the health-related quality of life. As a result, the quality of life physical health domain of the obese elderly was poorer than among the normal and overweight elderly. Furthermore, the quality of life psychological health domain of the obese elders was worse than among the normal ones. Although BMI affects the quality of life physical and psychological health, it is not effective on the social relationships and satisfaction with the environmental conditions. We think that this situation reflects positive cultural and religious attitudes toward aging.

Obesity is associated with increased disability and a poorer health status, but disability and self-rated health varies considerably by age and gender [27]. We observed a better physical function among men than among women in all groups, consistent with previous studies [25, 28]. In terms of the quality of life, except for social relationships domain of the normal group, the normal and overweight group showed gender differences in favour of men in all domains. However, there was no gender difference in the obese group, except for the physical health domain score. The fact that the physical health domain of the men in all groups is higher than of the women may be due to their higher physical functions. Regular physical activity is a key component to maintaining muscle strength and preventing further injury. The elderly can be encouraged to do at least 30 minutes of moderate physical activity on most, if not every day of the week, to improve their physical function and overall quality of life.

The limitations of our study include the small number of participants and the different number of participants in the groups, not questioning the nutritional status of the elderly, and the absence of comorbidity questioning. The strengths of our study are that physical activity levels were verified with a valid and objective tool to measure physical function, especially lower extremity muscle strength, in elderly people, and that there was no difference in the average age between the groups.

CONCLUSION

The significantly increased life expectancy is one of humanity's greatest achievements, and the goal is not only to prolong life but also to improve it. As a result, although it differs by sex, increased BMI may negatively affect the physical function, physical health and psychological health in older adults. In order to avoid or limit the effects of disability secondary to obesity and promote healthy ageing, older people should be encouraged to increase their physical activity and maintain healthy weight.

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