THE AGING MALE
2023, VOL. 26, NO. 1, 2252502
https://doi.org/10.1080/13685538.2023.2252502

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RESEARCH ARTICLE

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# Sarcopenic obesity is not associated with sexual dysfunction in older adults: a cross-sectional study

Filiz Demirdağ[a,b], Burcu Kıvrak Güçer[c] and Esma Nur Kolbaşı[d]

[a]Department of Internal Medicine, Division of Geriatric Medicine, Prof. Dr. Süleyman Yalçın City Hospital, Istanbul, Türkiye; [b]Department of Internal Medicine, Division of Geriatric Medicine, Istanbul Medeniyet University, Istanbul, Türkiye; [c]Department of Psychology, Prof. Dr. Süleyman Yalçın City Hospital, Istanbul, Türkiye; [d]Department of Physiotherapy and Rehabilitation, Istanbul Medeniyet University, Istanbul, Türkiye

## ABSTRACT

**Background:** This study aimed to investigate the frequency of sexual dysfunction (SD) and the association between SD and body composition abnormalities, such as sarcopenia, obesity, and sarcopenic obesity.

**Methods:** Older adults (≥65 years) were included. Sarcopenic obesity was diagnosed by using newly defined ESPEN-EASO diagram. Sarcopenia was diagnosed according to the European Working Group on Sarcopenia in Older People criteria. Obesity was defined using the fat percentile cut-offs suggested by ESPEN-EASO. SD was determined by Arizona Sexual Experience Scale (ASEX).

**Results:** Two-hundred and sixty-seven volunteers (64.4% female, mean age 73.63 ± 6.22 years) participated in this study. One-hundred seventy-eight individuals (66.7%) had SD. It was present in 83.1% and 36.8% of the females and males, respectively ($p < 0.0001$). There was no association between SD and sarcopenia alone (OR: 1.359, 95% CI: 0.650–2.838, $p = 0.415$) or obesity alone (OR: 0.986, 95% CI: 0.543–1.791, $p = 0.963$). Sarcopenic obesity was significantly associated with SD (OR: 9.116, 95% CI: 1.173–70.851, $p = 0.035$). However, this significance was lost after the model was adjusted for gender, marital status, and comorbidities (OR: 4.676, 95% CI: 0.578–37.801, $p = 0.148$).

**Conclusions:** SD was present in 66.7% of the older adults and was not associated with sarcopenia, obesity, or sarcopenic obesity. Further longitudinal studies are needed on this topic.

## KEY POINTS

- The frequency of sexual experience in community-dwelling older adults was only 33.7% and 53.2% in the last 1 year and 5 years, respectively.
- One-hundred seventy-eight individuals (66.7%) had sexual dysfunction (SD).
- The female gender and being a widow/widower were found to increase the odds of SD.
- Sarcopenia, obesity, or sarcopenic obesity were not associated with a higher risk of SD.

## ARTICLE HISTORY

Received 28 May 2023
Revised 22 August 2023
Accepted 22 August 2023
Published online 19 October 2023

## KEYWORDS

Aged; sarcopenia; sexual health; obesity; prevalence

## Introduction

One in 6 people will be over 60 years of age and the number of older adults will be 1.4 billion by 2030 according to a World Health Organization report [1]. Even though the number of studies to enhance well-being in older adults and solutions offered in order to raise their quality of life is increasing, there is still a lack of knowledge when it comes to the sexual life of the elderly.

"*Intimacy is not something that just happens between two people; it is a way of being alive.*" once said the author Liam Dalton [2]. As he said, the continuity of sexual intimacy through the lifespan is vital [3]. Although sexuality is a life-long experience, there is a taboo specific to old age and a belief that sexual life ends, or that it should end in the elderly. In addition to this social taboo, the studies showed that the frequency of sexual intimacy and the interest in sex were diminished after a certain age, mostly in older adults [4,5].

The normal sexual function includes five stages of psychological and physiological changes: desire,

CONTACT Filiz Demirdağ filizakcay@gmail.com Department of Internal Medicine, Division of Geriatric Medicine, Prof. Dr. Süleyman Yalçın City Hospital, Eğitim Mah. Fahrettin Kerim Gökay Cad. Kadıköy, Istanbul, Türkiye; Department of Internal Medicine, Division of Geriatric Medicine, Istanbul Medeniyet University, Istanbul, Türkiye

arousal or excitement, plateau, orgasm, and resolution [6]. Problems occurring in one or more of these stages may be defined as sexual dysfunction (SD) [7,8]. There are different prevalence rates of SD reported around the world in the last couple of years. For example, a small sample-sized Korean study found that the frequency of erectile dysfunction was 91.0% and the frequency of female SD was 96.3% in older adults [9]. The prevalence of SD in older women was reported to be 68.8% in Malaysia [10]. An earlier study from Europe reported that 31.2% of the sexually active men experienced erectile dysfunction and lack of sexual interest was prevalent in 36.0% of the women [10]. Considering the importance of sexuality on physical and psychological health was repeatedly reported in the literature [11,12], we believe this is an important matter to investigate.

Sarcopenia is defined as "*a muscle disease rooted in adverse muscle changes that accrue across a lifetime*" [13]. It has been found to be associated with increased odds of adverse events, such as physical disabilities, falls, etc. [14]. The prevalence of both sarcopenia and SD increases with age [14,15]. Even though the association between sarcopenia and SD is started to gain attention from clinicians and researchers, the number of studies research on this matter is still limited. Furthermore, all of the studies investigating the association between these two comorbidities report findings from only one gender or one condition (erectile dysfunction, for instance) [16–19].

Therefore, one of the aims of this study was to investigate the frequency of SD in community-dwelling older adults in Turkey. Another objective was to examine the association between SD and body composition abnormalities, such as sarcopenia, obesity, and sarcopenic obesity. Since there is no study on this topic in the current literature, this study will be the first to investigate the association between sarcopenia, sarcopenic obesity, and SD in both genders.

## Method

This was a cross-sectional study conducted in a single center in Istanbul-Türkiye. Istanbul Medeniyet University Göztepe Training and Research Hospital Clinical Trials Ethics Committee approved the study (date 15 August 2018 – number 2018/0316) and administered according to the Ethical Principles for Medical Research Involving Human Subjects by the Helsinki Declaration. All patients gave written and oral consent prior to the study.

### Participants

The study was carried out in the geriatric outpatient clinic of a university hospital in 2018. Older adults (≥65 years) who were native Turkish speakers were invited to participate in the study. Individuals were excluded from the study if they had severe depressive symptoms on the Geriatric Depression Scale (GDS) and had severe cognitive dysfunction according to the Mini-Mental State Examination (MMSE $<$ 24). Those with infectious diseases, malignancy, steroid use, and unstable cardiac disease were also omitted from the study. Physically dependent patients (immobilized patients, etc.) and those who were living in personal care homes were also excluded.

### Outcome measurements

#### Patient survey form

The survey form was created by researchers from the earlier surveys in the literature [20] including questions on age, gender, education level, comorbidities, marital status, spouse status, and if departed from the spouse or if the spouse is deceased, how long time passed since this separation or death. The presence of sexual activity in the last 1 year and 5 years was also noted.

Anthropometric measurements were taken as circumference measures from the mid-arm, calf, waist, and hip by using a simple meter.

#### Sarcopenic obesity evaluation

The European Society for Clinical Nutrition and Metabolism (ESPEN) and the European Association for the Study of Obesity (EASO) have recently proposed a diagram to diagnose sarcopenic obesity [21]. Evaluation of sarcopenic obesity has been performed based on this diagram in this study. According to this consensus, the assessment of sarcopenic obesity is structured in two levels: screening and diagnosis. At the screening level, body-mass index (BMI) or waist circumference and adverse factors associated with sarcopenia are evaluated [21]. Since our study included Caucasians, cut-off points ≥30 kg/m$^2$ for BMI [22] and ≥102 cm for male waist circumference and ≥88 cm for female waist circumference [22] have been adopted. For the adverse events, cut-off points for SARC-$F$ $>$ 4 points and gait speed $<$ 0.8 m/s have been set [23].

The diagnostic level included 2 steps: (1) muscle strength changes and (2) body composition changes [21]. Handgrip strength of $<$30 kg for males and $<$20 kg for females has been accepted as a positive diagnosis for sarcopenic obesity [24]. A body percentage of $>$40.7% for females and $>$27.3% for males [25]

as well as a reduced muscle mass defined by (skeletal muscle mass/weight [SMM/W]) with the cut-offs <%37 for males and %27.6 for females [26] have been adopted for the second step of the diagnostic level.

### Sarcopenia evaluation

Sarcopenia was evaluated according to the European Working Group on Sarcopenia in Older People (EWGSOP2) criteria [14]. EWGSOP2 assesses the reduction in three aspects to diagnose sarcopenia: muscle strength, quantity, and performance. The handgrip strength was evaluated with Takei© Hand-held Dynamometer. Three measurements were taken from each hand in a sitting position and the highest score was recorded as muscle strength. The cut-offs were adopted from the EWGSOP2 criteria, i.e. <27 kg for males and <16 kg for females [14]. If handgrip strength was below these cut-off points, "probable sarcopenia" was confirmed.

The muscle quantity was measured with TANITA© TBF 300 bio-impedance analysis (BIA). Measurements were taken barefoot after at least 8 h of fasting. The cut-offs for appendicular lean mass index (kg/m$^2$) (ALMi) for the Turkish population were taken from a previous study [27], i.e. 9.2 kg/m$^2$ for men and 7.4 kg/m$^2$ for women. If a reduction in both muscle strength and quantity was confirmed, the individual was considered as having "sarcopenia."

Finally, muscle performance was measured with gait speed by using the 4-Meter Walk Gait Speed Test [28]. The cut-off point for gait speed was decided to be <0.8 m/s [14]. If the gait speed was also decreased, it was categorized as "severe sarcopenia." Patients with probable sarcopenia were also included as having sarcopenia in this study.

### Obesity assessment

Obesity was diagnosed by using the cut-off points for fat percentage defined in the sarcopenic obesity assessment [21].

### Arizona sexual experience Scale (ASEX)

ASEX has been developed by Laukes McGahuey et al. [29] and it has been found to be reliable and valid for detecting SD in the Turkish population [30]. It is a six-point Likert scale evaluating sexual desire, sexual arousal, vaginal lubrication/penile erection, capacity to reach orgasm, and satisfaction after orgasm. The total score is between 5 and 30 points and higher scores indicate more SD. In this study, an ASEX score of >19, any one item with a score of >5, or any three items with a score of >4 were considered as having SD [29].

### Statistical analysis

Statistical analyses were performed by using Statistical Package for Social Science version 20.0 (IBM SPSS Statistics, Armonk, NY). Descriptive statistics are reported as means ± standard deviations for continuous variables. Categorical and binary variables are reported as numbers and frequencies. Shapiro–Wilk test was used to investigate the distribution of all data. All data including categorical and continuous data were normally distributed. Comparisons between the two genders were made by using the Independent Samples *T*-test in continuous variables since the data was parametric and the chi-square test in categorical variables. The associations between SD, sarcopenia, obesity, and sarcopenic obesity were analyzed using binary logistic regression analyses. $p < 0.05$ was set as significance.

## Results

Two-hundred and sixty-seven volunteers (64.4% female, mean age 73.63 ± 6.22 years) participated in this study. The flowchart of the study is presented in Figure 1.

Table 1 represents the socio-demographic and clinical characteristics of the study participants. Interestingly, there was no association between age and SD (OR: 1.008, 95% CI: 0.968–1.051, $p = 0.691$). The distributions of marital status were 65.9% married, 3.4% single/divorced, and 30.7% single/widow-widower. The mean time for being single was 174.16 ± 136.01 months. Binary logistic regression analysis revealed that there was an association between marital status and SD ($p = 0.041$). However, this association was only present in widows/widowers (OR: 2.088, 95% CI: 1.150–3.789, $p = 0.015$). Among the comorbidities, only ischemic heart disease was found to be associated with SD (OR: 1.919, 95% CI: 0.643–2.431, $p < 0.0001$).

The frequency of sexual experience was 33.7% and 53.2% in the last 1 year and 5 years, respectively. One-hundred seventy-eight individuals (66.7%) had SD in this study. 83.1% of the females in the study had SD and it was present in 36.8% of the males. There was a significant difference between genders in terms of SD ($p < 0.0001$). Female gender was found to be associated with increased odds of SD (OR: 8.453, 95% CI: 4.746–15.055, $p < 0.0001$). Table 2 shows the distribution of ASEX based on gender.

The distribution of the study population was 50.6% individuals without sarcopenia or obesity (i.e. healthy) (64.4% female), 26.6% obese patients (53.5% female),

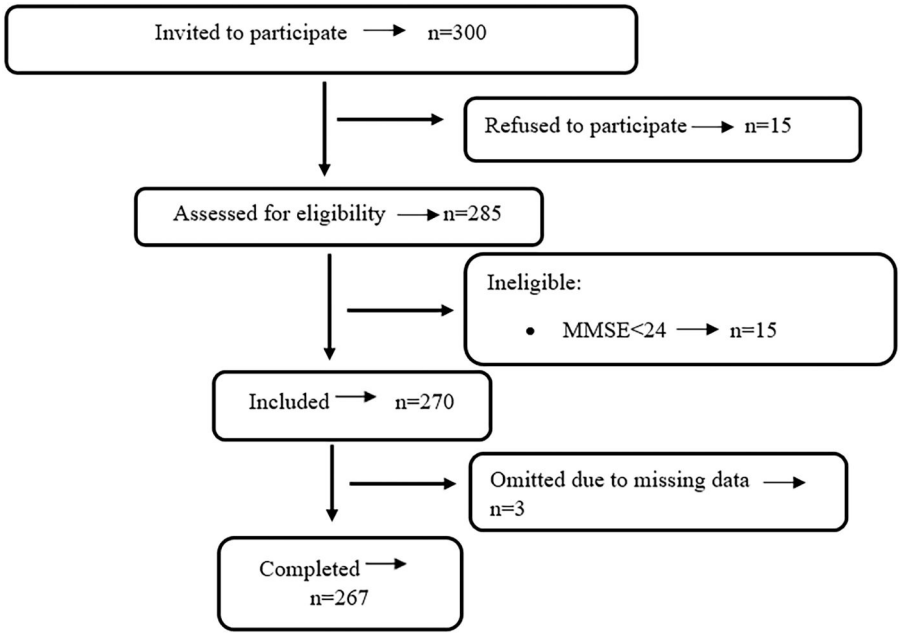


**Figure 1.** Flowchart of the study population.

**Table 1.** Sociodemographic and clinical characteristics of the study population ($n = 267$).

| Characteristics and outcome measures | Female ($n = 172$) | Male ($n = 95$) | $p$ Value |
|---|---|---|---|
| Age (years) | 72.96 ± 6.01 | 74.84 ± 6.45 | **0.018** |
| Education | | | |
| Primary education (*n*, %) | 53 (30.8%) | 10 (10.5%) | **<0.0001** |
| Middle school (*n*, %) | 73 (42.4%) | 42 (44.2%) | |
| High school (*n*, %) | 24 (14.0%) | 11 (11.6%) | |
| College/University (*n*, %) | 22 (12.8%) | 32 (33.7%) | |
| Comorbidities | | | |
| Hypertension (*n*, %) | 124 (72.1%) | 58 (61.1%) | 0.064 |
| Diabetes Mellitus (*n*, %) | 56 (32.6%) | 33 (34.7%) | 0.718 |
| Hyperlipidemia (*n*, %) | 30 (17.4%) | 10 (10.5%) | 0.130 |
| Ischemic Heart disease (*n*, %) | 22 (12.8%) | 29 (30.5%) | **<0.0001** |
| Asthma/COPD (*n*, %) | 7 (4.1%) | 7 (7.4%) | 0.247 |
| Osteoporosis (*n*, %) | 59 (34.3%) | 12 (12.6%) | **<0.0001** |
| Benign prostate hyperplasia (*n*, %) | – | 15 (16.9%) | – |
| Geriatric Depression Scale | 3.75 ± 3.28 | 1.98 ± 2.25 | **<0.0001** |
| Obesity | | | |
| Fat percentage (%) | 37.01 ± 6.18 | 25.64 ± 6.30 | **<0.0001** |
| Body-mass index (kg/m$^2$) | 29.22 ± 5.01 | 27.07 ± 4.42 | **<0.0001** |
| Sarcopenia | | | |
| Hand Grip (kg) | 19.10 ± 4.57 | 32.43 ± 6.66 | **<0.0001** |
| ALMi (kg/m$^2$) | 8.04 ± 1.70 | 11.46 ± 2.34 | **<0.0001** |
| Gait Speed (m/s) | 1.01 ± 0.26 | 1.04 ± 0.35 | 0.441 |
| SARC-F | 2.18 ± 1.93 | 0.91 ± 1.47 | **<0.0001** |
| SMM/W (%) | 29.0 ± 5.48 | 38.87 ± 8.38 | **<0.0001** |
| Anthropometric measurements | | | |
| Upper arm (cm) | 29.72 ± 3.27 | 28.29 ± 3.11 | **0.001** |
| Waist (cm) | 97.86 ± 12.45 | 100.62 ± 11.24 | 0.074 |
| Calf (cm) | 36.60 ± 3.78 | 36.48 ± 3.42 | 0.797 |
| Hip (cm) | 107.64 ± 10.41 | 104.02 ± 6.82 | **0.003** |
| WHR | 0.91 ± 0.09 | 0.96 ± 0.071 | **<0.0001** |

Bold numbers indicate significance ($p < 0.05$).
COPD: chronic obstructive pulmonary disease; ALMi: appendicular lean mass Index; WHR: waist-to-hip ratio.

16.5% sarcopenic patients (68.2% female), and 6.4% sarcopenic obese patients (%100 female). When patients without sarcopenia and obesity were taken as the reference category, there was an association between SD and neither sarcopenia alone (OR: 1.359, 95% CI: 0.650–2.838, $p = 0.415$) nor obesity alone (OR: 0.986, 95% CI: 0.543–1.791, $p = 0.963$). Although, there was a significant association between sarcopenic obesity and SD (OR: 9.116, 95% CI: 1.173–70.851, $p = 0.035$). However, this significance was lost after the model was adjusted for gender, marital status, and comorbidities (i.e. ischemic heart disease) (OR: 4.676,

**Table 2.** Sexual life of the participants based on gender ($n = 267$).

| Characteristics and outcome measures | Female ($n = 172$) | Male ($n = 95$) | $p$ Value |
|---|---|---|---|
| Sexual experience in the Last 1 year ($n$, %) | 42 (24.4%) | 48 (50.5%) | **<0.0001** |
| Sexual experience in the Last 5 years ($n$, %) | 70 (40.7%) | 72 (75.8%) | **<0.0001** |
| ASEX | 22.09 ± 6.35 | 15.17 ± 5.51 | **<0.0001** |
| Drive | 4.39 ± 1.53 | 3.0 ± 1.50 | **<0.0001** |
| Arousal | 4.56 ± 1.41 | 2.93 ± 1.28 | **<0.0001** |
| Lubrication/erection | 4.36 ± 1.51 | 3.44 ± 1.20 | **<0.0001** |
| Orgasm | 4.39 ± 1.54 | 3.0 ± 1.50 | **<0.0001** |
| Satisfaction from orgasm | 4.03 ± 1.82 | 2.91 ± 1.53 | **<0.0001** |

Bold numbers indicate significance ($p < 0.05$).
ASEX: Arizona sexual experience scale.

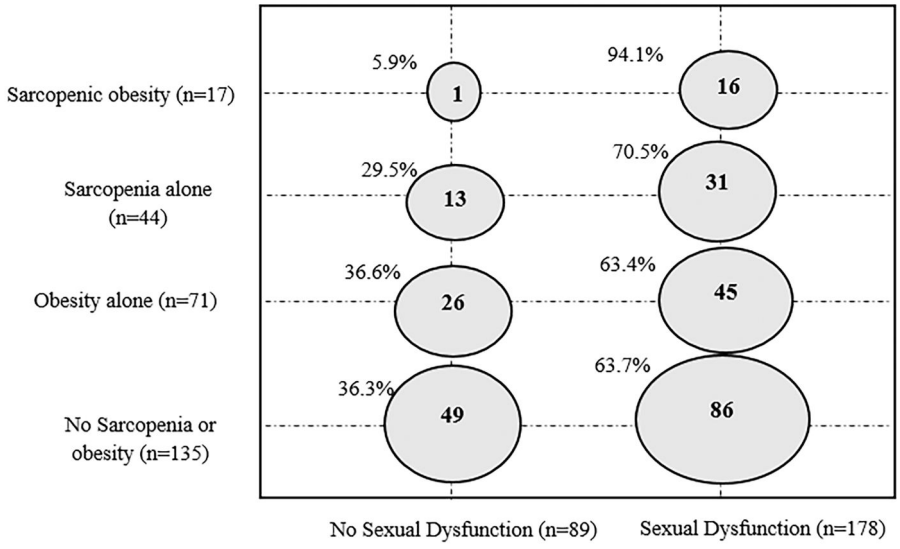


**Figure 2.** Distribution of SD in the study population ($n = 267$).

95% CI: 0.578–37.801, $p = 0.148$). Figure 2 represents the distribution of SD in the overall population.

## Discussion

Our findings revealed that the frequency of sexual experience in the study population was only 33.7% and 53.2% in the last 1 year and 5 years, respectively. One-hundred seventy-eight individuals (66.7%) had SD. The frequency of SD was 83.1% and 36.8% for females and males, respectively. Being a female and a widow/widower were found to increase the odds of SD, in addition to having an ischemic heart disease. There was a significant association between sarcopenic obesity and SD; however, this association was lost after adjusting for confounding factors (i.e. marital status, gender, and comorbidities).

In this study, SD was not found to be associated with obesity alone. There is a major number of studies on the association between obesity and SD in the literature. In one of the earlier studies, it was reported that obesity was found to be associated with a higher risk of erectile dysfunction in males >50 years [31]. Later, it was suggested that SD was more prominent in older men and women who underwent bariatric surgery [32]. The association between SD and obesity was particularly true in the cases of greater adiposity [33]. Similarly, erectile dysfunction was found in severely obese men (>46 kg/m$^2$) in another recent study [34]. However, it was reported in the English Longitudinal Study of Ageing that the frequency of sexual activity did not differ by weight status in both female and male older adults [35]. Similarly, BMI was not found to be associated with SD in a large cohort from Türkiye [36]. Considering the results of these earlier studies, the reason for not finding a significant association between SD and obesity in this study may be due to the proportion of obese individuals. Similarly to the English Longitudinal Study of Ageing, this study consisted of a smaller percentage of obese patients (i.e. 26.6%) compared to other studies that reported a significant association between obesity and SD. Also, the mean BMI and fat percentage in this study are significantly lower than the ones reported

above. There may be a point where obese patients develop SD. Thus, one might carefully interpret our findings, considering this factor.

Interestingly, we have not found an association between sarcopenia and SD in this study. However, the proportion of the SD in the sarcopenia group was approximately 68%. In a cohort from South Korea [16], erectile dysfunction was associated with sarcopenia. Two other studies from Türkiye also reported a significant association between erectile dysfunction and sarcopenia [17,18]. In another study from Singapore [19], sexual inactivity in middle-aged women was associated with low handgrip strength; however, physical performance was not associated with SD. There may be several reasons for these discrepancies in findings from different studies. First of all, the studies in the literature were conducted on one gender (i.e. females or males). This is the first study to investigate the association between overall sexual function, rather than one aspect of sexual function (i.e. erectile dysfunction) in both genders. The second reason may be the diagnostic criteria used for sarcopenia. For example, Park et al. [16] diagnosed sarcopenia based on the Asian Working Group for Sarcopenia. Another reason might be the sample sizes in the aforementioned studies and the prevalence of sarcopenia in these studies. Also, one might consider our results were driven from pure sarcopenic patients and other studies did not specify whether they had included sarcopenic patients with obesity or any other body composition abnormality.

Finally, there was a significant association between sarcopenic obesity and SD in community-dwelling older adults. However, this association was lost when adjusted for gender, marital status, and comorbidity. This may be a reasonable conclusion to draw since there was no association between sarcopenia, obesity, and SD in this cohort. Also, one must consider the gender distribution in the sarcopenic obesity group. The significance of the first analysis may be mainly originated from patients being female.

Moreover, we would like to draw attention to the high prevalence rate of SD in every group in this study. This may inhibit us from finding a possible association between sarcopenia and SD and drawing a definite conclusion. Further studies with larger populations are warranted to investigate the effect of sarcopenia on the sexual life of older adults.

The main strength of this study was that this was the first study to investigate the association between SD and sarcopenia and sarcopenic obesity in both genders. Another strength was that we used ESPEN-EASO criteria to diagnose sarcopenia, which is the latest diagnostic diagram. Additionally, several aspects of sexual function were assessed rather than one aspect (i.e. erectile dysfunction or arousal). Lastly, our study had a large study population compared to other studies from Türkiye. This study also had some limitations. First of all, this study was a cross-sectional study and this nature inhibited us from a longitudinal observation of the participants. Lastly, the information regarding sexual activity was self-reported and this might lead to a certain bias.

In conclusion, 66.7% of the study population reported an SD, and being female and widow/widower was significantly associated with SD as well as having an ischemic heart disease. There was no association between obesity, sarcopenia, and SD whereas a significant association between sarcopenic obesity and SD was detected. However, this association was lost after adjusting for gender, marital status, and comorbidity. Further, longitudinal studies are needed to investigate the sexual function as a whole entity in both males and females and the effect of body composition abnormalities on sexual activity in both genders.

## Acknowledgments

The authors would like to thank Kübra Yıldız Güler, RDN, and Gözde Balkaya Aykut, MD for their help during the data collection. We also thank our participants for their contributions to science.

## Ethical approval

Istanbul Medeniyet University Göztepe Training and Research Hospital Clinical Trials Ethics Committee approved the study (date 15.08.2018 – number 2018/0316) and administered according to the Ethical Principles for Medical Research Involving Human Subjects by the Helsinki Declaration.

## Consent to participate

Both written and verbal consent were obtained from the participants before the study.

## Consent for publication

It was obtained from the participant.

## Impact statement

We certify that this work is novel since this is the first study to investigate the association between SD and sarcopenia and sarcopenic obesity in both genders.

## Authors' contributions

Conceptualization: ENK, FD, and BKG; Methodology: ENK, FD, and BKG; Formal analysis and investigation: ENK, FD, and BKG; Writing – original draft preparation: ENK and BKG; Writing – review and editing: FD and BKG.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

This research did not receive any funding from agencies in the public, commercial, or not-for-profit sectors.

## ORCID

Filiz Demirdağ http://orcid.org/0000-0002-5751-936X
Burcu Kıvrak Güçer http://orcid.org/0000-0002-3467-982X
Esma Nur Kolbaşı http://orcid.org/0000-0002-5058-2374

## Data availability statement

There are no linked data sets for this article. The data is confidential since the participant of this study were informed upon admission to the hospital that the data would remain confidential and would not be shared with third parties.

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