

# The Coexistence Between Probable Sarcopenia, Undernutrition and Frailty in Geriatric Outpatients

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## Abstract

**Objective:** Sarcopenia, undernutrition and frailty are three interrelated geriatric problems with strong associations with mortality and morbidity. This study assesses coexistence of probable sarcopenia, undernutrition and frailty in patients admitted to outpatient clinics in our country.

**Materials and Methods:** The study population consisted of participants over the age of 60 years who applied to the geriatric outpatient clinics of a university hospital between December 2012 and August 2021. All of the participants were screened for frailty using the FRAIL scale, while the mini nutritional assessment-short form was used for undernutrition screening. Hand grip strength was measured using a Jamar hydraulic hand dynamometer, based on the European Working Group on Sarcopenia in Older People definition regional cut-offs (<35 kg <20 kg in males and females, respectively).

**Results:** Included in the study were 438 participants with a mean age of 74+6.7, 129 of whom were male (29.5%). The prevalence of three clinical conditions (probable sarcopenia, undernutrition and frailty) was 48.8% (214), 24.2% (106) and 65.1% (285), respectively. Both probable sarcopenia and undernutrition were detected in 15.5% (68%), and 13.6% (60) of the sample had all three conditions.

**Conclusion:** The majority of patients in the study were either frail (65.1%), probable sarcopenic (48.8%) or undernourished (24.2%), and the coexistence of all three clinical conditions was significant, affecting 13.6% of the total (60). Our study is the first to investigate the overlaps of the three interrelated geriatric syndromes in patients who applied to geriatric outpatient clinics.

**Keywords:** Frailty, geriatrics, malnutrition, probable sarcopenia, sarcopenia

## Introduction

Frailty is a condition characterized by vulnerability and non-resilience to stressors. It is a geriatric syndrome with various important components, including weakness, slowness, low levels of physical activity, exhaustion and weight loss (1,2). The prevalence of frailty varies depending on the screening tool and the features of the patient group (3,4). It is associated with negative clinical outcomes (5-9). Sarcopenia has been defined as the progressive and generalized loss of skeletal muscle mass and strength. Sarcopenia prevalence varies according to the screening tool and the population (8,9). Also, it is associated with negative clinical outcomes (5-9). The European Working Group on Sarcopenia in Older People (EWGSOP2) recently identified low muscle strength as the basic characteristic of

probable sarcopenia, and recommended the use of regional cut-offs for the diagnosis of probable sarcopenia (9). The coexistence and bidirectional relationship of sarcopenia and frailty has been identified in various studies (6,10-14). Malnutrition or undernutrition are consequences of the insufficient consumption of nutrients, and are often associated with inflammatory catabolism (10), and lead to changes body composition. Accordingly, malnutrition plays a key role in the development of both sarcopenia and frailty (11,13,14).

Sarcopenia, frailty and malnutrition are common geriatric syndromes in older adults, and are associated with a wide range of health outcomes in older adults, such as falls, disability, fractures, longer hospitalization duration, recurrent hospitalization requirements, morbidity and mortality (9,10-

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14). These geriatric syndromes often coexist and have similar etiological associations, such as undernutrition, inflammation, hormonal changes, inadequate energy intake and decreased physical activity (10-14).

There have been various studies examining the prevalence of malnutrition, frailty and sarcopenia in specific patient groups and populations, older adult occupants of nursing homes, hospitalized patients and geriatric rehabilitation patients (14-19). Our aim in this study is to investigate the overlaps in these three important geriatric syndromes in geriatric outpatients.

## Materials and Methods

Included in this retrospective study were patients aged  $\geq 60$  years who applied to the geriatric outpatient clinics of a university hospital between December 2012 and August 2021. During this period, geriatric outpatients underwent a comprehensive geriatric evaluation where possible, although some could not be fully assessed for such reasons as the lack of available staff, refusal to give consent and factors relating to the general condition of the patient (stroke, neuropathy, severe peripheral artery disease, severe hearing problems, severe vision problems, advanced dementia, acute severe illness, deterioration in general condition). Patients who could not undergo a comprehensive geriatric evaluation for the stated reasons were excluded from the study. All patients aged 60 years and older, who agreed to participate in a comprehensive geriatric evaluation and were able to perform a comprehensive geriatric evaluation, were included in the study. All measurements were performed by a single physical therapist trained in comprehensive geriatric assessment. The data of 438 patients who could be included in the study were accessed. Prior approval for the study was granted by the İstanbul University, İstanbul Faculty of Medicine Clinical Research Ethics Committee (no: 905439/13.05.2022). The patients' demographic characteristics, number of chronic diseases and drugs used on a regular basis, falls, urinary incontinence, fecal incontinence, constipation, chronic pain and sleep disorders were obtained from the patient files. Polypharmacy was defined as the use of five or more drugs per day (20). Functional capacity was assessed based on the six-item KATZ activities of daily living (ADL) scale and the eight-item LAWTON-BRODY instrumental activities of daily living scale (IADL) (21,22). The participants scored 0 points for activities that could not be performed or that could be performed with assistance, and 1 point for activities that could be performed independently. The ADL scale produces a summary score ranging from 0 (low function, dependent) to 6 (high function, independent), while the summary score of the IADL scale ranges from 0 (low function, dependent) to 8 (high function, independent) (20).

Handgrip strength (HGS) was measured using a Jamar hydraulic hand dynamometer. For the measurement of muscle strength,

the participants were seated in a standard backed chair and asked to squeeze the dynamometer as hard as they could for 2-3 seconds with their arms next to their body and their elbow flexed 90°. Measurements were repeated three times for the two hands and the highest values were recorded (23). Probable sarcopenia was defined based on low HGS using the definition of the EWGSOP2. Low HGS was evaluated by regional cut-offs ( $<35$  kg and  $<20$  kg) (8,9). The probable sarcopenia group was defined HGS, which was evaluated by regional cut-offs ( $<35$  kg and  $<20$  kg).

Frailty was screened using the 5-item FRAIL scale, which measures fatigue, resistance, ambulation, illnesses and weight loss. The participants who scored 0 were considered robust, while 1-2 indicated pre-frail and 2-3 indicated frail (24). Prefrail and frail participants assessed of frailty group.

Malnutrition screening was performed using the mini nutritional assessment-short form (MNA-SF), in which a score of 0-7 points indicate malnutrition, 8-11 points indicate risk of malnutrition and  $>11$  points as normal nutritional status (25). Those with malnutrition and malnutrition risk were assigned to the undernutrition group.

Depressive mood was screened using the 30-item geriatric depression scale-long form, in which 0-10 points is defined as normal, 11-13 points as probable depression and  $\geq 14$  points as absolute depression (26).

For the assessment of chronic pain, the participants were asked if they had endured pain for more than six months. In the presence of pain, they were asked to give a score between 0 and 10 based on a visual analog scale (0: Least severe pain, 10: Most severe pain in their life) (27).

## Statistics

The statistical assessment of the study data was carried out using IBM SPSS Statistics (Version 20.0. Armonk, NY: IBM Corp.). The normality of continuous data was analyzed with a Kolmogorov-Smirnov test. For the descriptive statistics, continuous variables were expressed as mean  $\pm$  standard deviation, median and minimum-maximum values, while categorical variables were expressed as number (of subjects) and percentages. A chi-square test was used to identify any association between the categorical variables on the basis of a univariate analysis. The coefficient of the association between the dependent and independent variables was determined by a regression analysis. Data were expressed as odds ratio and 95% confidence interval. A p-value of  $<0.05$  was considered statistically significant.

## Results

The study was completed with 438 patients with a mean age of  $74 \pm 6.7$ , 129 (29.5%) of whom were male. The prevalence of falls, urinary incontinence, fecal incontinence, constipation, sleep

disorders, depression, chronic pain were recorded as 40.6% (178), 42.9% (188), 4.8% (21), 30.8% (135), 40% (171), 43.2% (189) and 54.8% (240) respectively. The study population’s median ADL and IADL scores were recorded as 6 and 8, respectively.

The prevalence of probable sarcopenia by standard cut-off 19.9% (87) when probable sarcopenia evaluated by regional cut-off its increased to was 48.8% (214) (Table 1). Summarized baseline features of study population according to probable sarcopenia (Table 2).

The prevalence of probable sarcopenia, undernutrition and frailty were 48.8% (214), 24.2% (106) and 65.1% (285) respectively, and 13.6% (60) of the patients suffered from all three conditions. Both probable sarcopenia and undernutrition were detected in 15.5% (68%) of the sample, 36.7% (161) were probable sarcopenic and frail, and 20.3% (89) were undernourished and frail (Figure 1).

### Discussion

In the present study, the prevalence of probable sarcopenia, undernutrition and frailty were recorded as 48.8% (214), 24.2% (106) and 65.1% (285) respectively, and 13.6% (60) of the patients suffered from all three conditions.

**Table 1. Demographic characteristics of patients and prevalence of probable sarcopenia, frailty, undernutrition and geriatric syndrome**

<b>Age</b>	<b>74±6.7</b>
<b>Sex</b>	
Female	70.5% (309)
Male	29.5% (129)
<b>No of medications*</b>	<b>5 (0-17)</b>
<b>Polypharmacy</b>	<b>59.4% (260)</b>
No of diseases*	4 (0-10)
<b>Falls</b>	<b>40.6% (178)</b>
Urinary incontinence	42.9% (188)
<b>Fecal incontinence</b>	<b>4.8% (21)</b>
Constipation	30.8% (135)
<b>Sleep disorders</b>	<b>40% (171)</b>
ADL*	6 (1-6)
<b>IADL*</b>	<b>8 (0-8)</b>
Probable sarcopenia (35/20)	48.8% (214)
<b>Probable sarcopenia (27/16)</b>	<b>19.9% (87)</b>
Frailty	65.1% (285)
<b>Undernutrition (MNA-SF)</b>	<b>24.2% (106)</b>
Depression (GDS)	43.2% (189)
<b>Chronic pain</b>	<b>54.8% (240)</b>

Data are given as mean ± standard deviation or number (percentage) as applicable.  
 \*Data are given as median.  
 MNA-SF: Mini nutritional test-short form, GDS: Geriatric depression scale, ADL: Activities of daily living, IADL: Instrumental activities of daily living

Although there is other almost studies evaluating the co-occurrence of these important syndromes, they were generally conducted with nursing home residents, hospitalized patients or specific patient groups, such as those with cirrhosis or hip fracture (15-17,19,28). To date, there has been no study investigating the overlap of these three geriatric syndromes, while a single study in our country has been conducted in which probable sarcopenia was examined based on the standard cut-off and its relationship with other geriatric syndromes (28). The study recorded the prevalence of probable sarcopenia (standard cut-off), malnutrition and frailty prevalence to be 12.7%, 23.5% and 40.3%, respectively, which are similar to those in the present study. We believe that the differences in the probable prevalence of sarcopenia in the two studies can be attributed to the fact that regional cut-off values were not used (28). The recommended EWGSOP2 standard cut-off values were based on a British cohort, and were defined as 27/16 kg in men and women, respectively (7), although each population may be subject to regional cut-off values. For this reason, it is suggested by EWGSOP2 that each population should have a population specific cut-off value and be evaluated accordingly (9).

**Table 2. Characterises data of study population according to probable sarcopenia**

	<b>Probable sarcopenia (+) (n=214)</b>	<b>Probable sarcopenia (-) (n=224)</b>	<b>Total population (n=438)</b>
<b>Age</b>	<b>77.4±6.8</b>	<b>73.1±6.3</b>	<b>74±6.7</b>
Female	67.3% (144)	73.7% (165)	70.5% (309)
<b>Male</b>	<b>32.7% (70)</b>	<b>26.3% (59)</b>	<b>29.5% (129)</b>
No of medications*	6 (0-17)	5 (0-17)	5 (0-17)
<b>Polypharmacy</b>	<b>65.4% (140)</b>	<b>53.6% (120)</b>	<b>59.4% (260)</b>
No of diseases*	4 (0-8)	3 (0-10)	4 (0-10)
<b>Falls</b>	<b>44.1% (94)</b>	<b>37.5% (84)</b>	<b>40.6% (178)</b>
Urinary incontinence	46.3% (99)	39.7% (89)	42.9% (188)
<b>Fecal incontinence</b>	<b>5.6% (12)</b>	<b>4% (9)</b>	<b>4.8% (21)</b>
Constipation	35% (75)	26.9% (60)	30.8% (135)
<b>Sleep disorders</b>	<b>43.9% (94)</b>	<b>44.4% (77)</b>	<b>40% (171)</b>
ADL*	6 (1-6)	6 (2-6)	6 (1-6)
<b>IADL*</b>	<b>5 (0-8)</b>	<b>8 (0-8)</b>	<b>8 (0-8)</b>
Frailty	75.2% (161)	55.4% (124)	65.1% (285)
<b>Undernutrition (MNA-SF)</b>	<b>31.8% (68)</b>	<b>17% (38)</b>	<b>24.2% (106)</b>
Depression (GDS)	49.5% (106)	37.1% (83)	43.2% (189)
<b>Chronic pain</b>	<b>55.1% (118)</b>	<b>54.5% (122)</b>	<b>54.8% (240)</b>

Data are given as mean ± standard deviation or number (percentage) as applicable.  
 \* Data are given as median.  
 MNA-SF: Mini nutritional test-short form, GDS: Geriatric depression scale, ADL: Activities of daily living, IADL: Instrumental activities of daily living

For example, the regional threshold values for probable sarcopenia specific to our population were determined as 35/20 kg, which is higher than the standard threshold values (8).

In a study of 100 patients who presented to internal medicine outpatient clinics, sarcopenia was identified in 42%, frailty in 33%, cachexia in 32% and malnutrition in 15%. The authors identified at least one syndrome in 63% of this group of outpatients, among which 32% were detected with one syndrome, 11% with two syndromes, 12% with three syndromes and 8% with four syndromes, although most of the sample were gastroenterological and oncological patients (64%) (16). The present study, unlike other studies, was not performed solely with hip fracture or gastroenterological-oncological patient groups. Malnutrition, frailty and sarcopenia are likely to be higher among in-patient groups with hip fractures or those followed up with oncological and gastroenterological problems. Although our study sample consisted of outpatients, the prevalence of sarcopenia was found to be higher, which we attributed to the fact that the diagnostic criteria suggested by EWGSOP2 were used rather than the EWGSOP1 diagnostic criteria, unlike in the study by Gingrich et al. (16).

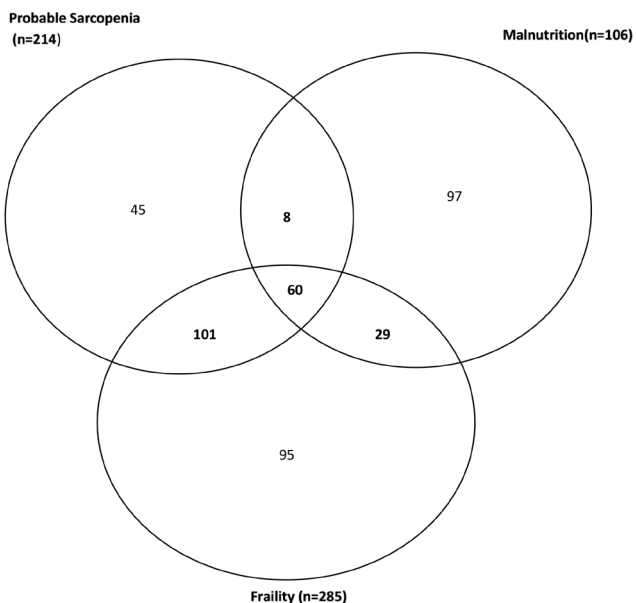
The importance of low muscle strength and regional cut-off values in diagnosing is thus revealed. We believe that the differences in the prevalence of malnutrition and frailty may be attributed to the different tools used for the screening of the two syndromes, and so the results of these studies may not accurately reflect the prevalence of the syndromes in the older people who applied to the outpatient clinic.

In a meta-analysis of 8.868 patients (62% women) examining the associations and relationships of probable sarcopenia,

malnutrition and frailty in hospitalized patients, 84% of the sample were frail (prefrail + frail), 37% had probable sarcopenia and 66% had malnutrition (malnutrition + malnutrition risk) (15), although the coexistence of all three syndromes was not examined in the study. The results of the study are similar to those of the present study, except the prevalence of malnutrition. Considering the acute and chronic conditions that require hospitalization, the higher prevalence of malnutrition in this study group can be considered an expected result. The prevalence of probable sarcopenia in our study of outpatients was similar to that recorded in this met analysis of hospitalized patients, in whom the prevalence of probable sarcopenia can be expected to be higher. We believe that this is probably an indication of our superior probable sarcopenia screening based on population-specific cut-off values. It is worthy of note that these three syndromes are associated with a high rate these syndromes in the geriatric patient group making routine visits to the outpatient clinic. Faxén-Irving et al. (17) investigated the prevalence and overlap of malnutrition, sarcopenia and frailty in 92 nursing home residents in a cross-sectional descriptive study. In this nursing home study, 1/3 of the participants were found to be at risk of sarcopenia based on the results of the application of the SARC-F questionnaire, 33% were found to be undernourished and 50% to be frail (frail + prefrail). After confirmatory tests, an association between the three syndromes was detected in 7% (6) of the participants. Similar to this study, the patient group in the present study consisted of predominantly women. In addition, in our study, sarcopenia was evaluated using hand grip strength as a more reliable than SARC-F questionnaire method. Although our study was based on an outpatient sample, the prevalence of probable sarcopenia, frailty and malnutrition were similar to those recorded in Faxén-Irving et al. (17) This difference was ensured by the use of regional cut-off values as suggested by EWGSOP2 (9). The results of our study emphasize the importance of the coexistence and prevalence of these three syndromes, which is higher prevalence's than expected not only in nursing home residents but also in outpatients, and also reveals the need to carefully screen for the others when any of the three syndromes are encountered.

Our study draws attention to the coexistence of three important geriatric syndromes associated with significant mortality and morbidity in elderly patients.

The strength of our study lies in its focus on the geriatric patient population and its revealing of cases of probable sarcopenia that may be hidden when regional thresholds are not applied. Besides, a review of literature reveals this to be the first study to evaluate the overlap of these three geriatric syndromes. For the purposes of the study, the regional cut-off values recommended by EWGSOP2 were used to define probable sarcopenia (9).



**Figure 1.** The coexistence between probable sarcopenia, undernutrition and frailty is shown with a schematic

## Study Limitations

There are some important limitations to our study, such its retrospective design and that lack of patient follow-up data.

## Conclusion

Our study reveals malnutrition, probable sarcopenia and frailty to be common not only in hip fracture patients, nursing home residents or inpatients, but also in routine geriatric patient populations. It emphasizes the importance of screening for the presence of the other conditions when one of these three geriatric giants is encountered in outpatients. It has been shown that the use of regional cut-offs in the evaluation of probable sarcopenia may reveal cases that would otherwise remain hidden.

## Ethics

**Ethics Committee Approval:** The data of 438 patients who could be included in the study were accessed. Prior approval for the study was granted by the İstanbul University, İstanbul Faculty of Medicine Clinical Research Ethics Committee (no: 905439/13.05.2022).

**Informed Consent:** Retrospective study.

**Peer-review:** Externally peer-reviewed.

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