



# The prevalence of sarcopenia risk and associated factors in patients aged 65-79 years living in a district of Izmir province of Turkey

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## ABSTRACT

**Objectives:** This study aims to investigate the prevalence of sarcopenia risk and associated factors in a community-dwelling elderly population in a district of Izmir province of Turkey.

**Patients and methods:** This cross-sectional study used a cluster sampling method to define sarcopenia risk and associated factors in population aged 65-79 years in Balçova district and a total of 254 participants (114 males, 140 females; mean age 70.0 years; range 65 to 79 years) were included between October 2014 and December 2014. The dependent variables were low gait speed (LGS), low grip strength (LGrS), having both LGS and LGrS, sarcopenia risk according to the European Group on Sarcopenia for Older People (EWGSOP) algorithm. The independent variables were socio-demographic and socio-economic variables, health-related behavioral factors, and health status variables. The gait speed was measured on a four-meter length with a stopwatch. The grip strength was measured using a hand-held dynamometer. The logistic regression models were used to identify associated risk factors for sarcopenia.

**Results:** The prevalence of LGS was found to be 45.0%, LGrS to be 49.8%, having both LGS and LGrS to be 30.1%, and sarcopenia risk according to EWGSOP to be 64.8%. The main associated factors of having any sarcopenia risk were increasing age and having a sedentary lifestyle or being underactive.

**Conclusion:** Our study results show that sarcopenia risk is high in a community-dwelling elderly population living in Balçova district of Izmir province of Turkey. Physical activity levels of elderly should be increased to decrease this high burden.

**Keywords:** Elderly, hand strength, prevalence, sarcopenia, walking speed.

Sarcopenia can be defined as loss of muscle function and mass with ageing.<sup>[1]</sup> Before 2010, sarcopenia was defined as loss of muscle mass.<sup>[2]</sup> In 2010, the European Working Group on Sarcopenia for Older People (EWGSOP) emphasized the importance of muscle function, as well and current algorithm includes muscle function (grip strength) and muscle performance (gait speed), while the final step is the muscle mass measurement.<sup>[3]</sup>

The prevalence of sarcopenia ranges from 4 to 27%.<sup>[4]</sup> In the literature, low gait speed (LGS) and low grip strength (LGrS) are both good predictors of adverse health outcomes.<sup>[5-7]</sup> The algorithm is so broadly defined that it catches a huge proportion of

elder population which has been also questioned in several studies.<sup>[8]</sup>

The muscle mass, gait speed, and grip strength decline with an increasing age<sup>[9,10]</sup> and in male gender,<sup>[9]</sup> elderly with a higher level of education,<sup>[11,12]</sup> and due to the marital status,<sup>[13]</sup> higher socio-economic position,<sup>[13,14]</sup> active population,<sup>[10,12]</sup> and having a lower disease burden<sup>[11,12]</sup> are associated with a higher grip strength and gait speed.

Individuals who have LGS and individuals with normal gait speed but have LGrS can be defined as at a sarcopenia risk (SR) based on the algorithm. This group needs to be screened for muscle mass measurement and proposed methods for this measurement may be

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expensive and bring some barriers as a result of aged population.

Over the last couple of decades, Turkey has become a country that has an aging population. It is estimated that 10.2% of the population will be 65 or older by 2023.<sup>[15]</sup> In 2050, this ratio will rise up to 20.8%. In 2015, the Turkish Public Health Institution announced a new action plan on healthy ageing to increase knowledge, attitude, and behavior of physical activity in elder population in Turkey.<sup>[16]</sup> To the best of our knowledge, there is no study investigating the SR in a community-dwelling elderly population in Turkey. Akin et al.<sup>[17]</sup> only reported the mean gait speed and mean grip strength values in a cross-sectional study in an urban population. Previous studies were performed in institutionalized elderly<sup>[18,19]</sup> or outpatient setting.<sup>[20]</sup>

In the present study, we aimed to investigate the prevalence of SR and associated risk factors such as having LGS, having LGrS, or having both LGS and LGrS in a community-dwelling elderly population in an urban district of Izmir province of Turkey.

## PATIENTS AND METHODS

This cross-sectional, analytic study included patients aged between 65 and 79 years living in Balçova district of Izmir province of Turkey between October 2014 and December 2014. According to the Address-Based Population Registration System of the Turkish Statistical Institute (TurkStat), a total of 8,049 individuals were screened. A total of 229 individuals were unable to be interviewed. Two of them died before the visit, while the remaining were unable to be reached after at least three visits as they moved before the date of the visit or rejected to participate. Finally, a total of 254 participants (114 males, 140 females; mean age 70.0 years; range 65 to 79 years) were included. A written informed consent was obtained from each participant. The study protocol was approved by Dokuz Eylül University Faculty of Medicine Noninvasive Research Ethics Board (2014/09-02). The study was conducted in accordance with the principles of the Declaration of Helsinki.

### Definitions

The dependent variables of this study were having LGS, having LGrS, having both LGS and LGrS, and having SR. The LGS was defined as walking equal to or slower than 0.8 m/s.<sup>[5]</sup> The LGrS was defined as having the grip strength lower than 30.0 kg for men and 20.0 kg for women.<sup>[3]</sup> The SR was defined according to the EWGSOP algorithm as having LGS and being able to walk faster with LGrS.<sup>[3]</sup>

### Measurements

The gait speed was measured with a chronometer held by an interviewer (Q&Q Stopwatch, HS 43, Tokyo, Japan). The interviewer instructed as follows: "Walk as you are walking normally in the street; for example, you are going to grocery". When the individual totally passed the first line, the interviewer started chronometer and stopped, when the individual passed the final line, finishing the 4 m length. The gait speed was measured two times and the faster one was used in the analysis.<sup>[3,5]</sup>

The grip strength was measured in the sitting position with a hydraulic hand-held dynamometer (Saehan Hydraulic Hand Dynamometer, SH5001, Changwon, Korea). The elbow of the individual was supported with a pillow, if available. The individual was asked to use his/her dominant hand. The forearm of the individual was flexed 90° and the hand was placed in the neutral position. The individual was asked to squeeze his or her grip as hard as he or she can. The measurement was repeated three times. The highest value was used in the analysis.<sup>[3]</sup>

The independent variables of this study were socio-demographic factors (i.e., age, sex, education level, marital status), socio-economic factors (perception of economic status, working status, house ownership status, social security type, and social class), health-related behavioral factors (i.e., physical activity level, smoking status, and alcohol and protein consumption behavior, perception of appropriateness of environment for physical activity), and health status (number of chronic conditions, number of daily medications, having inpatient care within the last three months, mini-nutritional assessment category,<sup>[21]</sup> and body-mass index category). The education level was classified as primary education and lower and secondary education or higher. The marital status was classified as married and single. The perception of economic status was classified as poor, neither good nor bad, and good. The social security type categories were one of four social security categories which were in use in Turkey (SSK, Emekli Sandığı, Bağ-Kur, and Yeşil Kart), and not having one. The working status was classified as employed and unemployed. The house ownership was classified as own house or rental house. Social class was classified as paid workers or others. If the participant was a retiree, his/her last social class status was used as the social class category. If the participant was not a retiree, but worked for a while, the relevant social class status was used. If the participant did not work ever, the breadwinner's social class was used.

Physical activity was classified as sedentary or underactive, underactive regular light activities and underactive with regular activities, or active using the Rapid Assessment of Physical Activity questionnaire. With the permission from the developer, the language validation was conducted for the steps.<sup>[22]</sup> The forward translations were done by an English teacher and an associate professor of pediatrics who has experience on translation between English and Turkish. After authors agreed on a unified text, the questionnaire was sent to a practicing translator for backward translation. The first part of the questionnaire asks about the weekly frequency and intensity of physical activities and categorizes elderly population into five categories: sedentary, underactive, underactive-regular light activities, underactive regular, active). The participants who met two of following three criteria were thought as consuming protein adequate: one portion of dairy products every day, one portion of legumes once a week, or one portion of white or red meat every day. This adequate protein consumption definition depends on the Nutrition Guide for Turkey.<sup>[23]</sup> The smoking status was classified as smoker or non-smoker. Alcohol consumption behavior was classified as alcohol user or not an alcohol user. The perception of appropriateness of the environment for physical activity was categorized as not appropriate for physical activity, moderately appropriate for physical activity, and not appropriate for physical activity.

The number of chronic conditions was grouped as  $\leq 2$  and  $\geq 3$ . The number of daily medications was grouped as  $\leq 2$  per day and  $\geq 3$  per day. Having inpatient care within the last three months was defined in two categories (Yes or No). The Mini Nutritional Assessment (MNA) was used to assess the nutritional status and the score was grouped as normal, under malnutrition risk, or malnutrition. The body mass index (BMI) was classified as normal ( $<25.0$ ) and overweight or obese ( $\geq 25.0$ ).

### Statistical analysis

The minimum sample size required was calculated as 367 with 95% confidence interval (CI) and 5% error. The sample size was multiplied by a design effect of 1.2, and 10.0% of the calculated sample size was added for non-response. The final estimated sample size was 483. The stratified, cluster sampling was used and clusters were selected with proportional to the population size method from the list of individuals in relevant age from seven neighborhoods in Balçova district of Izmir province.

**TABLE 1**  
Descriptive characteristics of study population

Variable	n	%
<b>Socio-demographic features</b>		
Age group (n=250)		
65-69	130	52.0
70-74	77	30.8
75-79	43	17.2
Gender (n=254)		
Male	114	44.9
Female	140	55.1
Education level (n=254)		
Primary school or lower	159	62.6
Secondary or higher	95	37.4
Marital status (n=250)		
Married	170	69.2
Other	80	30.8
<b>Socio-economic features</b>		
Employment status (n=254)		
Still working, retired	19	7.5
Retired	137	53.9
Working, not retired	12	4.7
Neither retired nor working	86	33.9
Social security (n=249)		
Yes	237	95.2
No	12	4.8
Social class (n=244)		
Paid worker	178	73.0
Other	66	27.0
Economic status perception (n=248)		
Bad	34	13.7
Neither good nor bad	157	63.3
Good	57	23.0
House ownership (n=250)		
On rent	24	9.2
Own or not paying for rent	236	90.8
<b>Health related behaviour and environmental perception for physical activity</b>		
Physical exercise level (n=252)		
Sedentary or under-active	77	30.6
Under-active regular-light activities	132	52.4
Under-active regular or active	43	17.1
Protein consumption status (n=253)		
Adequate	147	58.1
Not adequate	106	41.9
Smoking status (n=253)		
Smoking	213	84.2
Not smoking	40	15.8
Alcohol intake (n=253)		
No	226	89.3
Yes	27	10.7
Environmental perception for physical activity (n=242)		
Inappropriate	79	12.4
Medium	30	20.2
Appropriate	133	12.4
<b>Health status</b>		
Chronic disease number (n=254)		
Two or lower	158	62.2
Three or higher	96	37.8
Inpatient care in last three months (n=254)		
Yes	13	5.1
No	241	94.9
Mini-nutritional assessment screening (n=239)		
Normal	215	90.0
Malnutrition risk or malnutrition	24	10.0
Body mass index (n=240)		
Normal	102	42.5
Overweight or obese	138	57.5

Statistical analysis was performed using the SPSS version 15.0 software (SPSS Inc., Chicago, IL, USA). Descriptive data were expressed in mean  $\pm$  standard deviation, median (min-max), or number and frequency. Logistic regression model was fitted with covariates which were significantly associated with dependent variables in the univariate analysis. Backward step-wise logistic regression was used to predict the risk of having each dependent variable. In each step, one group of covariates was put into the model successively as socio-demographic and socio-economic covariates, health-related behavioral covariates, and health status covariates. Socio-demographic and socio-economic covariates included age, sex, and education status for all four models. Model for LGS and SR according to the EWGSOP included marital status as additional to the former variables. Physical activity level was included in all four models as health-related behavioral factor in the second step. Model for LGrS and SR risk according to the EWGSOP included alcohol consumption and adequacy of protein consumption. In the third step, the number of chronic diseases category was included in all four models. All but having both LGS and LGrS model included the BMI category and all but having LGS model included the malnutrition category. A significant association between the number of daily medication and the dependent variables were observed, although this variable and number of chronic diseases categories indicated similar direction and the number of daily medication variable was not included in any of the four models. The results of the last step in the backward logistic regression models was shown. A  $p$  value of  $<0.05$  was considered statistically significant.

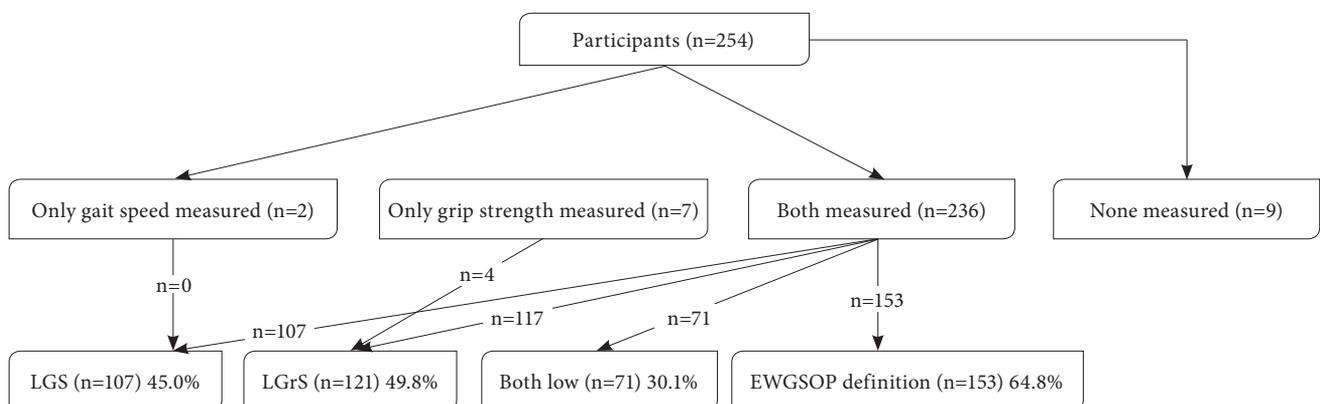
## RESULTS

A total of 53% of the study population accepted to participate in the study and a total of 254 were interviewed (response rate: 52.6%). Of the participants, 62.6% had primary or lower education status, 68.0% were married, 53.9% were retired and were not working, 4.8% had no social security, 73.0% was paid workers, 63.3% perceived their economic status as neither good nor bad, and 72.8% were owners of their residents (Table 1).

Overall, 52% of them were underactive with moderate physical activity, 58.1% were consuming adequate protein, 54.9% were non-smokers, 89.3% were not consuming alcohol, and 55.0% perceived their environment as appropriate for physical activity.

A total of 38% participants had  $\geq 3$  chronic conditions, 5.1% had inpatient care within the last three months, 43.7% were consuming  $\geq 3$  daily medication, and 10.0% were under malnutrition risk or had malnutrition.

A total of 46% of the participants had LGS, 49.8% had LGrS, 30.1% had both LGS and LGrS, and 64.3% were at SR according to the EWGSOP (Figure 1). In logistic regression model (Table 2), one-year increase in age and being sedentary or underactive relative to being active or underactive with regular activities significantly predicted each SR group (OR: 1.1, 1.2, 1.2, 1.2, 95% CI [1.1-1.2, 1.1-1.3, 1.1-1.3, and 1.1-1.4, respectively]). Female sex rather than male sex significantly predicted all risk group, but having both LGS and LGrS (OR: 1.9, 3.0, 4.4, 95% CI: 1.0-3.6, 1.6-5.4, and 2.0-9.5, respectively). Having education status equal or lower than primary education relative to having elementary or higher education significantly



**Figure 1.** Flow diagram of sarcopenia risk prevalence.

**TABLE 2**  
Logistic regression model of each sarcopenia risk

Variables	LGS		LGrS		Having both LGS and LGrS		Sarcopenia risk according to EWGSOP	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age (continuous)	1.1	1.1-1.2	1.2	1.1-1.3	1.2	1.1-1.3	1.2	1.1-1.4
Gender								
Female (Ref: Male)	1.9	1.0-3.6	3.0	1.6-5.4	1.8	0.9-3.5	4.4	2.0-9.5
Education Level								
Primary school or lower (Ref: Secondary school or higher)	2.4	1.2-4.4	NS		1.4	0.7-2.9	2.3	1.2-4.7
Physical activity								
Sedentary or under-active (Ref: Under-active regular or active)	3.1	1.2-8.1	5.2	2.0-13.5	6.2	2.0-19.8	3.1	1.3-7.4
Malnutrition status								
Malnutrition or malnutrition risk (Ref: Normal)		*	4.8	1.6-14.4	3.3	1.3-8.9	NS	
Chronic disease number								
3 or higher (Ref: 2 or lower)	2.0	1.1-3.6	NS		NS		NS	

LGS: Low gait speed; LGrS: Low grip strength; EWGSOP: European Working Group on Sarcopenia in Older People; OR: Odds ratio; CI: Confidence interval; \* Not in the model; NS: Non-significant.

predicted having LGS and SR according to the EWGSOP (OR: 2.4, 2.3, 95% CI: 1.2-4.4 and 1.2-4.7, respectively). Having malnutrition or being at malnutrition risk significantly predicted LGrS and having both LGS and LGrS (OR: 4.8, 3.3, 95% CI: 1.6-14.4 and 1.3-8.9, respectively). Having  $\geq 3$  chronic diseases relative to having  $\leq 2$  significantly predicted LGS (OR: 2.0, 95% CI: 1.1-3.6).

## DISCUSSION

This cross-sectional study is the first study to examine the prevalence of SR and affecting factors in a community-dwelling elderly population in an urban district of Turkey. Our study results showed that if EWGSOP algorithm was used in Balcova district, more than half of elderly should be screened for the muscle mass. However, healthcare system would face a burden, if muscle mass screening tests are routinely used to diagnose sarcopenia in daily practice. The prevalence of LGS and LGrS was also high in almost half of individuals aged 65-79 years old in Balcova. The prevalence of having both LGS and LGrS was about one-third of 65-79 years-old group.

Arango-Lopera et al.<sup>[24]</sup> found a LGS prevalence of 77.4% in a Mexican county. In the BELFRAIL study, Legrand et al.<sup>[25]</sup> found a prevalence of 91.0%. In the

aforementioned study, the prevalence of SR according to the EWGSOP was 94.1%. The participants of the BELFRAIL study was  $\geq 80$ . As the population in this study is younger than both studies, a lower prevalence may be acceptable.

Sarcopenia can be diagnosed with expensive tests such as magnetic resonance imaging and computed tomography or cheaper methods such as dual energy X-ray absorptiometry and bioimpedance analysis. All tests require dedicated time which should be spent by both patient and healthcare personnel. The added value of diagnosing sarcopenia in elderly is questionable.<sup>[26]</sup> Carlsson et al.<sup>[27]</sup> designed a randomized-controlled trial and the interventions were physical exercise and protein against control and placebo in activities of daily living in elderly. The authors found no significant increase in the muscle mass at three and six months.

The LGS and LGrS are both valuable indicators of adverse health outcomes. Measuring both indicators are easy, particularly in the primary care setting. These indicators may be more appropriate for monitoring for elderly rather than a complex diagnosis such as sarcopenia. In our study, logistic regression model showed that one-year increase in age and being sedentary or underactive relative to being active or underactive with regular activities predicted all

SR variable. Age is a strong predictor of functional loss.<sup>[10,12]</sup> Li et al.<sup>[12]</sup> found that increased physical activity level was inversely associated with LGS and LGrS. Female sex also predicted all SR group, but having both LGS and LGrS. Li et al.<sup>[12]</sup> found that LGS was significantly higher in men compared to women, although there was no significant difference in LGrS. In addition, Haas et al.<sup>[11]</sup> found that men walked a 98.5-inch span significantly shorter than women and the men's grip strength was significantly higher than women. It is well-documented that higher physical activity level prevents sarcopenia.<sup>[28]</sup> Functional capability differences between men and women are widely accepted. Furthermore, having education status equal to primary school or lower predicts having LGS and SR according to the EWGSOP. In their study, Li et al.<sup>[12]</sup> found elderly having six years or lower education years had significantly higher LGS and LGrS. Probably, more educated individuals may have learned to avoid unhealthy behavior more than less educated ones as the cumulative inequality theory suggests.<sup>[29]</sup> Education is an important value and seems to have a lifelong effect.

In the present study, having malnutrition or being at malnutrition risk also significantly predicted LGrS and having both LGS and LGrS. Malnutrition may have close association with the grip strength rather than the gait speed. This association has been shown in another study conducted in Tokyo, Japan,<sup>[30]</sup> although the underlying biological mechanism have not been discussed. Therefore, further studies are needed to elucidate the biological mechanism. We also found that having more than three chronic diseases predicted also LGS. Li et al.<sup>[12]</sup> showed similar results and Haas et al.<sup>[11]</sup> found that an increased number of chronic diseases was associated with increased walking time. This association has a rational basis, and chronic diseases pose a high burden on health.

The main strength of the present study is that this is the first in Turkey to assess SR, as there is a very limited number of studies worldwide using the same sampling method in a community to examine the SR prevalence and affecting factors. On the other hand, the main limitation is its low attendance rate. A total of 254 (52.6% of target) participants were interviewed. This was handled by comparing age distribution of the participants and study population. The participants were found younger than the universe; therefore, all SRs may be higher in Balçova district. In addition, there is a question in physical activity level whether participants who are in a better

condition in all dependent variables have chance to do physical activity more or doing physical activity prevents them being in the worse group. This is always a major limitation of cross-sectional studies. Furthermore, protein consumption adequacy was attempted to be determined depending on only three questions; however, this may not be the ideal way to obtain the correct answer. In cross-sectional studies, determination of diet is another limitation.

In conclusion, our study results suggest that SR is high in a community-dwelling elderly population living in Balçova district of Izmir province of Turkey. If the EWGSOP algorithm is used in about two-thirds of elderly, advanced diagnostic tests may be required. For the prevention of SR, increased physical activity of elderly should be targeted. Although we found no significant difference between men and women in having both LGS and LGrS, it should be further investigated.

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#### Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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