

Inability to perform the five-chair stand test predicts increased risk of sarcopenia in nursing home residents

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Abstract

The proportion of elderly and sarcopenia cases is expected to increase in the coming decades. Early diagnosis of sarcopenia using muscle strength as a criterion is important to prevent adverse health effects. The repetitive chair stand test is an effective tool for assessing muscle strength. Poor test performance may indicate an individual with potential sarcopenia. The aim of this study was to investigate the effect of the ability to perform the five-repetition chair stand test on the prevalence of sarcopenia in residents of western Slovenian nursing homes. 83 candidates (age 83.8 ± 7.6 years, 69% of whom were women) we included in the study. The prevalence of sarcopenia was determined according to European Working Group for Sarcopenia guidelines and the five-repetition chair stand test was used to assess physical performance. Relative risk with a 95% confidence interval was calculated to assess the difference in risk for sarcopenia between the complete rises and the incomplete rises group. 37% of participants were diagnosed as sarcopenic, of whom approximately half were unable to complete the 5-chair stand test. The risk of sarcopenia was twice as high in participants who were unable to complete the test (RR = 2.05 (CI 1.21-3.49); $p=0.0077$). The inability to complete the repeated chair stand test in older adults from nursing homes significantly increases the risk of sarcopenia.

Therefore, this test could be useful in identifying individuals at high risk.

Keywords sarcopenia • aged • nursing homes • physical fitness.

Introduction

The proportion of older people in the total population is expected to increase significantly in the coming decades. By 2100, the over-65s will account for 31.3% of the EU's population (Population structure and aging, 2023). As sarcopenia is directly related to the aging process, it is an issue of growing importance (Boshnjaku, 2022). Sarcopenia is a disorder characterized by loss of skeletal muscle mass and function, often occurring in old age and long-term illness (Sayer & Cruz-Jentoft, 2022). Sarcopenia affects 8% to 36% of older people over 60 years of age (Petermann-Rocha et al., 2021) and is associated with several harmful outcomes, including higher mortality (Beaudart et al., 2017; Xu et al., 2021), falls, functional decline and increased risk of hospitalization (Beaudart et al., 2017). Early diagnosis of sarcopenia is crucial to prevent these adverse outcomes. Focusing on early diagnosis and interventions will reduce the costs associated with sarcopenia (Filippin et al., 2014). Greater muscle strength and physical performance have been associated with less disability (Zanker et al., 2022). The chair stand test has been reported to be an effective tool for assessing muscle strength or physical performance (Cruz-Jentoft, et al., 2019) and shows the predictive ability for sarcopenia (Pinheiro et al., 2016). The use of the chair stand test as a criterion for muscle strength rather than

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grip strength more than doubled the probable prevalence of sarcopenia in all age groups (Johansson, Strand, Morseth, Arnesdatter Hopstock, and Grimsgaad, 2020). Poor performance on the five-repetition chair stand test, especially test incompleteness, may indicate individuals with potentially severe sarcopenia (Dodds et al., 2021).

The aim of this study was to investigate the effect of the ability to perform the five-repetition chair stand test on the prevalence of sarcopenia in residents of western Slovenian nursing homes. We were also interested in whether sarcopenic and nonsarcopenic residents differed in the average time it took them to perform the five-repetition chair stand test.

Method

Participants

During the period from June to October 2019, older adults from six western Slovenia nursing homes were invited to participate in the study of physical fitness and the prevalence of sarcopenia. In order for candidates to participate in the study, they had to meet the following criteria: (1) age of 65 years or older, (2) ability to stand and walk (walking aids permitted), (3) Mini-Mental State Examination score above 18. We enrolled 83 candidates (age 83.8 ± 7.6 years, 69% of whom were women). The study was conducted in accordance with the Declaration of Helsinki and was part of a larger research project approved in advance by the National Medical Ethics Committee of the Republic of Slovenia no. 0120-321/2017-4. Each participant voluntarily provided written informed consent before participating.

Study protocol

In this cross-sectional study, the prevalence of sarcopenia was determined according to the European Working Group on Sarcopenia in Older People (EWGSOP2) guidelines (Cruz-Jentoft et al., 2019). To test the ability to stand up from a chair, 5-chair

stand test was used. Participants were asked to cross their arms across the chest and stand up from the chair once. If the result was positive, they were asked to stand up and sit down again five times as quickly as possible. The time from the first sitting down to the fifth standing up was measured in seconds (s) and the test was recorded as a 5-chair stand test complete. The test was terminated and noted as 5-chair stand test incomplete: (1) when the participant began to use his or her arms, (2) after 1 min if the participant had not completed 5 stand-ups, and if the participant's safety was compromised (Guralnik, et al., 1994). All measurements were performed in nursing homes by trained personnel.

Data analysis

Microsoft Office Excel (MS for Windows 365 MSO, 2017) was used for data collection. Statistical analysis was performed in IBM SPSS 29.0. Data were presented descriptively by median values and ranges. The Independent-Samples Mann-Whitney U test was used to assess differences in the time required to perform the 5-chair stand test between sarcopenic and nonsarcopenic participants. We also calculated the relative risk (RR) with 95% confidence intervals (CI) to assess the difference in risk for sarcopenia between the complete rises and incomplete rises groups.

Results

Sarcopenia diagnosis and performance tests were conducted on 83 participants living in nursing homes in western Slovenia who participated in the cross-sectional study. According to EWGSOP2 guidelines (Cruz-Jentoft et al., 2019), 31 (37%) of them were diagnosed as sarcopenic, of which 16, or about half (51% (95% CI 33%-69%)), were able to complete the 5-chair stand test. In the nonsarcopenic group, 41 of 52 participants (79% (95% CI 65% - 89%)) successfully completed all five stands (Table 1, Figure 1).

Table 1. Statistics for the results of 5-chair stand test in sarcopenic and nonsarcopenic nursing home residents

Variable	Sarcopenic residents (n=31)	Nonsarcopenic residents (n=52)	Total residents (n=83)
Median time need for complete the test (s)	18.08	16.75	16.93
Min-Max time need for complete the test (s)	(10.07-30.88)	(7.35-35.95)	(7.35-35.95)

Note: Min – minimal value, Max – maximal value

Among those able to complete the 5-chair stand test, the median time required to repeat five stands

was higher in the sarcopenic group than in the nonsarcopenic group: 18.08 s and 16.75 s,

respectively (Table 1). However, the difference between the groups was not statistically significant ($U=292.00$; $p=0.523$).

The effect of the ability to perform the 5-chair stand test on the prevalence of sarcopenia was assessed by relative risk. The risk of sarcopenia was twice as high in participants who were unable to complete the test (RR = 2.05 (CI 1.21-3.49); $p=0.0077$) (Figure 1).

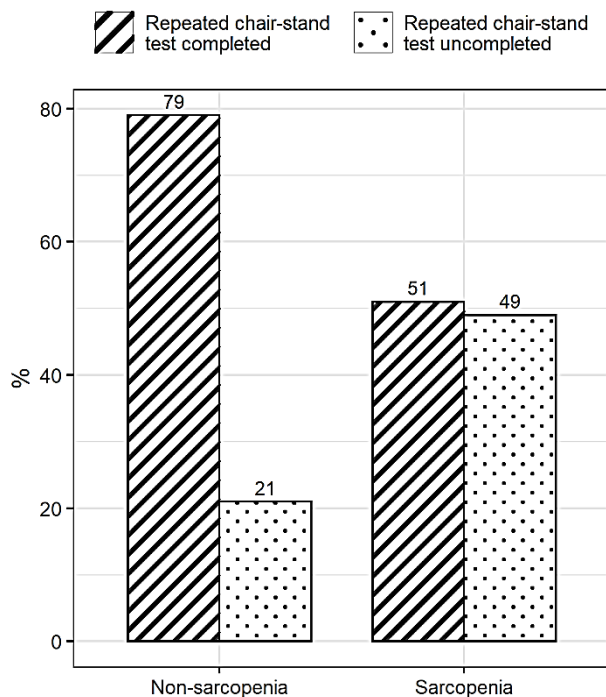


Figure 1. Percentage of sarcopenic and nonsarcopenic nursing home residents who completed the 5-chair stand test

Discussion

In this study, we demonstrated that inability to perform the five-chair stand test predicts an increased risk of sarcopenia in nursing home residents.

The prevalence of sarcopenia depends particularly on the diagnostic criteria applied (Bijlsma et al., 2012). For this reason, data on prevalence in residential facilities vary widely, ranging from 17.7% to 73.3% in long-term care homes (Rodriguez-Rejon et al., 2019). In our study, we found a prevalence rate of 37% for sarcopenia in Slovenian nursing home residents, which is consistent with 38.7% in a similar sample (Urzi, Šimunič, and Buzan, 2017).

Poor performance in the 5-chair stand test indicates decreased lower limb muscle strength.

Performance in this test worsened with an increasing SARC-F score for sarcopenia. A SARC-F score of 4 or higher (a cutoff for detecting sarcopenia) was associated with a mean time of 22s required to repeat the five stands (Dodds et al., 2021). In our study, poorer performance and a longer median time to test completion were observed in sarcopenic nursing home residents compared with nonsarcopenic residents (18.08 s and 16.75 s, respectively), but there was no statistical difference (Table 1). These results are consistent with those of previous studies in which the time required for the test was positively associated with sarcopenia. For each second increase in test performance, the probability of sarcopenia increases by 8% in older women (Pinheiro, et al., 2016). Cesari et al. (2009) suggest a cut-off value of 17.1 s to identify a high-risk group.

With increasing age, the proportion of individuals unable to complete the 5-chair stand test increases strongly. Inability to complete the test leads to the worst outcome on the SARC-F questionnaire (Dodds et al., 2021), an increased risk of injury-related falls (Shea et al., 2018), subsequent falls, and disability in the elderly (Zhang et al., 2013). We found that the risk of sarcopenia was twice as high in nursing home residents who were unable to perform the 5-stand chair test (Figure 1). Similarly, the findings of Doods et al. (2021) suggest that identifying those in whom the 5-chair stand test was not performed and the reasons why are important in studies of sarcopenia. The five-repetition sit-to-stand test is a useful screening tool for sarcopenia even in older people with heart disease (Shikenbaru et al., 2019). Assessment of chair stand performance in the elderly may be a new strategy for predicting parameters useful for the diagnosis of sarcopenia (Yoshico et al., 2022).

In conclusion, the inability to perform the repeated chair stand test in older adults from nursing homes greatly increases the risk of sarcopenia. Thus, this test could be useful in identifying those at high risk and implementing interventions. Resistance training is the first-line treatment for sarcopenia in older adults (Hurst et al., 2022) and has the greatest effect on their quality of life (Shen et al., 2023).

Study limitations

This study has potential limitations. The results obtained may not reflect physical performance and sarcopenia prevalence among all Slovenian nursing home residents. In addition, we included only participants who met specific inclusion criteria.

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Conflict of interest

The authors declare no conflicts of interest.

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