Investigation of the relationship between chronic musculoskeletal pain and sarcopenia risk in community-dwelling older adults: a cross-sectional study

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Running Title: Chronic pain and sarcopenia risk
The Relationship Between Chronic Musculoskeletal Pain and Sarcopenia Risk in Community-Dwelling Older Adults: A Cross-Sectional Study

ABSTRACT

Background: This study aimed to better understand the relationship between chronic musculoskeletal pain and the risk of sarcopenia in older adults.

Methods: The risk of sarcopenia was assessed in 210 older adults using the strength, assistance with walking, rising from a chair, ascending stairs, and falls (SARC-F) questionnaire. Geriatric pain measures were used to assess pain. We also recorded the pain sites (ankles/feet, wrists/hands, upper back, lower back, neck, shoulder, hips, and knees).

Results: Participant mean age was 72.4±7 years, and 109 (51.9%) of the participants were female. The prevalence rates of sarcopenia and chronic musculoskeletal pain were 60% and 92.9%, respectively. Older adults at risk of sarcopenia had a higher mean age, body mass index, number of comorbidities and falls, presence of chronic pain, pain intensity, and pain sites. Sarcopenia risk was correlated with chronic pain intensity (current and last 7 days) (r=0.506; p<0.001 and r=0.584; p< 0.001, respectively), multisite pain (r=0.442; p< 0.001), and Geriatric Pain Measure score (r=0.730; p< 0.001). Age (OR=1.1; 95% CI=1.0, 1.2), body mass index (OR=1.1; 95% CI=1.0, 1.2), and geriatric pain (OR=1.1; 95% CI=1.0, 1.1) were associated with sarcopenia risk.

Conclusions: The risk of sarcopenia is linked to chronic pain, which frequently occurs in geriatric populations. Our study results also showed that higher pain intensity was associated with a higher risk of sarcopenia. Older adults at risk for sarcopenia often experience chronic musculoskeletal pain, which must be better recognized. Moreover, its significance must be noted in the treatment process.

Key Words: Chronic Pain, Aged, Sarcopenia, Musculoskeletal Pain, Muscular Atrophy
INTRODUCTION

Sarcopenia is a progressive and generalized skeletal muscle disorder characterized by accelerated loss of muscle mass and function in older adults.\textsuperscript{1} It can lead to abnormal gait, balance disorders, falls, fractures, disability, and death in older adults.\textsuperscript{2} The varying reported prevalence rates, from 0.8% to 64.8%, can be attributed to differences in population, lifestyle, age, setting, and culture, as well as the instruments used to diagnose sarcopenia.\textsuperscript{3-7}

One of the most prevalent medical conditions in older adults (≥65 years), chronic pain, is also highly disabling. In older adults, chronic pain impairs mobility, is linked to depression and anxiety, and can damage social and familial ties.\textsuperscript{8} According to estimates, >50% of older adults experience chronic pain and 70% report experiencing pain at multiple sites.\textsuperscript{9} The most common painful conditions affecting older adults are arthritis-related; however, older adults also experience a high incidence of chronic systemic diseases that can cause pain, such as cancer-related, diabetes-related, and post-stroke pain. Additionally, pain may be a stressor that accelerates the decline in health and function as an individual ages. Compared to older adults without pain, those with pain are less physically active, have worse functional mobility, and experience more comorbidities.\textsuperscript{10} The consequences of pain, such as those discussed here, may contribute to increased susceptibility to sarcopenia and other geriatric syndromes that are prevalent in older adults.

Numerous studies have examined the relationships between pain and specific geriatric syndromes, including falls, depression, cognitive decline, and functional limitations.\textsuperscript{11-13} While an increasing number of studies have examined how pain and sarcopenia are connected, so far, the results are inconsistent.\textsuperscript{14-15} Data from a prospective study showed that pain was a strong predictor of sarcopenia, except for knee pain.\textsuperscript{16} In addition, the risk of sarcopenia may change depending on the nature of the pain being experienced, as pain intensity and location significantly affect functional impairments caused by pain. Therefore, the present study
examined the relationship between chronic musculoskeletal pain and the risk of sarcopenia, pain intensity, and pain location in community-dwelling older adults.

MATERIALS AND METHODS

Study design and participants

The population for this cross-sectional research consisted of community-dwelling older adults in Teyyaredüzü District in Giresun and Akçaabat-Söğütlü District in Trabzon, Turkey. The populations of Teyyaredüzü district and Söğütlü neighborhood are 15,576 and 23,189, respectively. According to the information obtained from the Turkish Statistical Institute (Türkiye İstatistik Kurumu, TÜİK), older adults comprised 9.7% of the population in XXXX. Among those, this study included 3760 older adults. The sample size was calculated using Open-epi 3.01 considering the prevalence of sarcopenia risk. Sacar et al. reported a sarcopenia prevalence of 12.7% in Turkey. Therefore, according to this prevalence, a minimum of 164 participants was required, with a margin of error of 5% and a confidence interval of 95%. Based on this prevalence rate, we evaluated 267 community-dwelling older adults for eligibility.

Forty-three older adults did not want to participate in the study, and 14 older adults did not meet the inclusion criteria. Therefore, this study included 210 older adults (Figure 1). The inclusion criteria were age ≥65 years and Mini-Mental State Examination (MMSE) score of ≥24. The exclusion criteria were hearing impairments that could limit communication, presence of depression and neuropathic pain, and unwillingness to participate in the study. The 15-item Geriatric Depression Scale (GDS-15) was used to assess depression. No, mild, moderate, and severe depression, mild were defined as scores of 0–4, 5–8, 9–11, and 12–15, respectively. We applied the Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) pain questionnaire to evaluate neuropathic pain. Among the 24 total point, 12 points or more suggest the presence of neuropathic pain.
Ethics approval and consent to participate

The Ethics Committee of XXXXXX for Clinical Research (Decision Number: XXXX) granted permission for this study, which was conducted according to the guidelines of the Declaration of Helsinki. Before the study started, all of the participants provided written permission.

Outcome Measures

We recorded participant physical and sociodemographic information, including age, BMI (kg/m²), sex, education (years), number of comorbidities (hypertension, asthma, heart attack, cancer, kidney disease, diabetes, chronic lung disease, congestive heart failure, and arthritis), medications, and falls in the previous year. The MMSE was used to determine whether older adults were cognitively capable of participating in this study. In clinical practice and research, the MMSE is frequently used to assess general cognitive function. The possible MMSE scores range from 0 to 30, with higher scores indicating better cognitive performance.21

The responses to the survey question “have you had pain in any part of your body that has lasted for 3 months or more?” were used to determine the presence of chronic musculoskeletal pain.24 Participants who responded "yes" to this question were considered to have chronic musculoskeletal pain. They were then asked, "in what part(s) of your body do you feel this pain?", which choices among the neck, shoulder, upper back, wrists or hands, lower back, hips, knees, ankles, or feet.

Comprehensive pain was assessed using the Geriatric Pain Measure (GPM), a 24-item scale that is easily applied in geriatric outpatients. This scale consists of five dimensions: pain with movement, withdrawal due to pain, pain intensity, pain with strenuous activities, and pain with other activities. Twenty-two scale items are scored in pairs, while the other two are assigned numeric values between 0 and 10. The sum of the ‘yes’ responses yields a score from 0 to 42. The items on the scale are multiplied by 2.38 to normalize the score from 0–100 to obtain the
final GPM score. Total GPM scores of 0–29, 30-69, and 70 points are categorized as mild, moderate, and severe pain, respectively.\textsuperscript{25,26} We recorded pain intensity based on the responses to two questions on the GPM: “(1) If you were to rate your pain on a scale from 0 to 10, with 0 representing no pain and 10 representing the most terrible suffering imaginable, how bad is it right now?” and “(2) How severe was your average pain in the previous 7 days?”.

The SARC-F questionnaire consists of five sections: falls (how many times the individual has fallen in the last year), ambulation (the individual’s capacity to move about their room), rising from a chair (the individual’s capacity to get up from a chair), climbing stairs (the individual’s capacity to climb a flight of 10 stairs), and strength (the individual’s capacity to lift 2.5 kg). The scores range from 0 to 2 points, with 0 meaning no difficulty, 1 meaning some difficulty, and 2 meaning great difficulty or inability. For falls, score of 0, 1, and 2 correspond to 0, 1–3, and ≥4 falls in the last year, respectively. Individuals with summed scores of the five component scores of ≥4 points from a possible range of 0–10 points are considered to be at risk for sarcopenia.\textsuperscript{27}

\textbf{Statistical Analyses}

We performed the statistical analysis using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY, USA). The normality of the distribution of the variables was checked using the Shapiro–Wilk test. Numbers and percentages were used to represent categorical variables, whereas means and standard deviations were used to represent continuous variables. The chi-square test for categorical variables was used to compare the sarcopenia risk (SARC-F<4/≥SARC-F) and pain (mild, moderate, and severe) groups. Both independent samples t-test and Mann–Whitney U tests were used to compare continuous variables. The Pearson correlation coefficient was used to calculate the correlations between SARC-F scores and pain assessments (GPM total score, pain intensity today and in the last 7 days, and multisite pain). The correlations were graded as follows: 0.81–1.00, very strong; 0.61–0.80, strong; 0.41–
0.60, moderate; and 0.40, weak.\textsuperscript{28} We applied multivariate logistic regression analyses to determine the association between chronic musculoskeletal pain and sarcopenia risk (SARC-F). We observed no multicollinearity between the independent variables according to the variance inflation factor (VIF) and correlation coefficient values. Statistical significance was set at \( p < 0.05 \).

**RESULTS**

We recruited a total of 210 older adults with a mean age of 72.4±7.0 years. Most of the older adults were women (51.9\%) and had chronic pain, multisite pain, and sarcopenia risk (60\%). The mean age, body mass index (BMI), proportion of female sex, comorbidities, presence of chronic pain, pain intensity, pain sites, and number of falls were higher in older adults at risk of sarcopenia. The demographic and clinical details of the participants are presented in Table 1.

*Table 1 near here*

In this study, most older adults (48.1\%) experienced moderate pain. The subgroup prevalence of SARC-F scores according to pain severity is shown in Table 2. The SARC-F items and total scores differed among the three pain groups. The severe pain subgroup had more difficulty with the SARC-F items. As pain severity increased, the prevalence of sarcopenia also increased.

*Table 2 near here*

We observed a significant correlation between sarcopenia risk and chronic pain intensity (today and last 7 days), multisite pain, and total GPM score \((p < 0.001)\) (Table 3). Assessment of the distribution of pain sites according to sarcopenia risk showed that older adults at risk of sarcopenia had higher numbers of all pain sites than did those without sarcopenia risk.

*Table 3 near here*

As shown in Table 4, the logistic regression model was statistically significant, \( \chi^2 (3) = 128.534, p < 0.001 \). The model explained 62.1\% (Nagelkerke \( R^2 \)) of the variance in the risk of
sarcopenia. Age, BMI, and GPM were statistically significant variables in the logistic regression model. Increased age, high BMI, and severe pain were associated with increased risks of sarcopenia.

Table 4 near here

In older adults with and without sarcopenia, the knee, lower back, and upper back were the most common sites of pain (Figure 2). Older adults at risk for sarcopenia had more chronic musculoskeletal pain than those without sarcopenia. Knee pain, which is the most common site of pain, was found in 75.4% of older adults at risk of sarcopenia, while it was 35.7% in older adults without sarcopenia risk.

Figure 2 near here

DISCUSSION

In face-to-face interviews with community-dwelling older adults, >50% of the study participants reported having pain for at least three months. In addition, the prevalence of sarcopenia risk, as determined using the SARC-F scale, was 60%. We observed the significant presence and severity of chronic pain in many older adults at risk for sarcopenia. We also demonstrated a significant correlation between chronic pain and the risk of sarcopenia in this cross-sectional study of older adults. As pain severity increased, the prevalence of sarcopenia also increased. Age, BMI, and pain severity increased the risk of sarcopenia. Furthermore, older adults at risk of sarcopenia reported more incidents of knee and multisite pain compared to those without sarcopenia.

In the present study, the risk of sarcopenia increased with advancing age and high BMI and was more prevalent in women than in men. Additionally, the mean age, BMI, and comorbidities were higher in older adults at risk for sarcopenia, in line with the literature. In previous research among older adults, these factors were also associated with an increased risk of sarcopenia.29) The possible explanations for these findings may be the significantly higher skeletal muscle
mass, physical fitness, and muscle strength in men.\textsuperscript{30} In addition, muscle loss starts to increase at 70 years of age.\textsuperscript{31} The loss of muscle mass may be linked to a higher rate of disability, lower functional capacity, basal metabolic rate, and bone mineral density, which may have a detrimental impact on sarcopenia.\textsuperscript{30} Furthermore, aging and obesity induce fat infiltration into muscles. Therefore, advanced age and high BMI may cause sarcopenia by impairing muscle quality and function.\textsuperscript{30,32} In addition to these factors, comorbidities such as diabetes and end-stage organ diseases are also associated with sarcopenia, as they cause losses of muscle mass and strength.\textsuperscript{31} These previous findings support our results related to female sex, age, BMI, and comorbidities.

We observed a prevalence of chronic pain of 92.9\%, which is consistent with that reported in a previous study of 873 participants >60 years of age. The previous study reported a prevalence of pain of 41.2\% in women and 33.2\% in men, with approximately 88\% of patients aged 60–75 years of both sexes.\textsuperscript{15} In a one-year prospective cohort study, 64 (7.3\%) older people who were followed for one year developed sarcopenia. Sarcopenia was more likely to occur in older adults who reported experiencing pain than in those who did not. Women and men with lower back pain, pain in more than one location, joint pain, and moderate-to-severe pain also had higher risks of sarcopenia, consistent with the results of the present study. Our findings regarding the relationship between chronic pain and sarcopenia risk are supported by the findings of previous studies that also reported associations between chronic pain and functional impairment.\textsuperscript{33-36} This relationship could be cyclic, where long-lasting pain leads to decreased activity, resulting in muscle weakening, further pain, and reduced activity. However, the exact duration for pain to prompt individuals to cease their physical activity and experience muscle loss remains undetermined; therefore, further research is warranted on this subject.

In this study, participants with severe pain had the highest prevalence of sarcopenia. Additionally, high pain severity was associated with an increased risk of sarcopenia. This could
be because participants in the severe pain group were afraid of pain and did not want to perform maximal voluntary contractions. However, arthrogenous muscle inhibition is thought to occur because changes in afferent input from the affected joint cause decreased efferent motor neuron stimulation of nearby skeletal muscles to decrease. 37) Furthermore, the etiology of pain, such as radiculopathy, diabetic polyneuropathy, and knee osteoarthritis, can affect muscular strength and mass.

In the present study, the knee was the most common site of pain. However, we did not collect data on the etiology of pain. In contrast, a previous study reported a significantly increased risk of osteoarthrosis among older adults who were experiencing pain. 15) Additionally, their prospective cohort study investigated the impact of osteoarthritic lower extremity pain on muscle strength and mass in the lower extremity. Scott et al. 37) reported that knee and hip pain as well as more severe knee pain, stiffness, and dysfunction were predictive of a greater decline in lower extremity muscle strength and quality in older women. The primary finding of this study indicates that patient-reported osteoarthritic pain serves as a more accurate predictor of muscle wasting in older adults. This outcome aligns with the findings of a previous study. Foley et al. 38) demonstrated that lower extremity joint pain, stiffness, and dysfunction (but not radiographic osteoarthritis) were associated with declines in muscle parameters over a period of nearly 3 years in women. The association of pain with decreased muscle strength, performance, and quality in these studies may explain the high prevalence of pain in older adults at risk of sarcopenia in our study.

In this study, upper and lower back pain were the most common complaints after knee pain in older adults at risk of sarcopenia. Reduced muscle mass and strength are typical symptoms of age-related skeletal muscle sarcopenia. 1) Alterations in postural alignment often occur to compensate for decreased muscle strength in older adults. 39) An incorrect body position negatively influences muscle function and can cause structural changes in overloaded parts of
the spine, leading to pain, especially in older adults. Additionally, back muscle function influences thoracic spinal compressive loading, which may contribute to the development of upper back pain. Moreover, diminished trunk muscle strength and endurance are linked to lower back pain. These possible causes may partially explain the relationship between sarcopenia. However, additional studies examining these causal relationships are needed.

This study has several limitations. First, as we used SARC-F to assess sarcopenia risk, our results may differ from those of studies involving other populations using different sarcopenia criteria such as those proposed by the European Working Group on Sarcopenia in Older People. Although SARC-F appears to have limited screening capacity for excluding sarcopenia, it is simple, useful, feasible, and does not require sophisticated equipment; in addition, it has been extensively validated in the scientific literature. Tsuji et al. demonstrated the correlation of SARC-F scores with pain disability assessment scale scores, indicating pain-related disability. Second, the cross-sectional nature of this study made it difficult to establish a timeline for the development of sarcopenia and chronic pain. Further prospective cohort studies examining the association between sarcopenia, pain-related factors, and treatment outcomes in older community-dwelling adults with chronic musculoskeletal pain are required. Third, we did not collect information on the causes of pain or its treatment, which remains a key area for future research. Finally, we only included relatively young older adults. Therefore, further research on the association between pain and sarcopenia in older adults is required.

Our findings of a high rate of chronic pain in the older adult population, which was associated with a high risk of sarcopenia, warrant the development of systematic approaches to proactively identify older adults with these conditions. Many older adults experience multisite pain, in addition to high levels of chronic pain, making it especially important to consider this population when designing pain management strategies. Further studies are needed to determine
the timing of sarcopenia and chronic musculoskeletal pain. The results of this study highlight the need for early pain interventions in the management of sarcopenia and the identification of vulnerable populations that might be experiencing pain.

ACKNOWLEDGMENTS

The authors thank all the study participants.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

The authors declared that this study has received no financial support.

AUTHOR CONTRIBUTIONS

Concept: UKS; Design: UKS; Data Collection and/or Processing: UKS, AYŞ; Analysis and/or Interpretation: UKS, AYŞ; Literature Search: UKS; Manuscript Writing: UKS, AYŞ.