

Association Between Oral Health and Probable Sarcopenia in Older Adults: A Cross-Sectional Study

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Background: This study aimed to examine the association between oral health-related quality of life and probable sarcopenia in community-dwelling older adults, and to evaluate the potential role of oral health assessment in routine geriatric care.

Methods: This cross-sectional study included 315 individuals aged ≥ 65 years who were registered with the Home Health Unit and the Geriatric Outpatient Clinic of a tertiary hospital in Türkiye. Oral health-related quality of life was measured using the Geriatric Oral Health Assessment Index (GOHAI). Muscle strength was assessed with a handgrip dynamometer, and probable sarcopenia was defined according to the revised European Working Group on Sarcopenia in Older People (EWGSOP2) criteria as low muscle strength. Additional assessments included the Mini Nutritional Assessment–Short Form (MNA-SF), Strength, Assistance with walking, Rise from a chair, Climb stairs, and Falls (SARC-F) questionnaire, Clinical Frailty Scale (CFS), Katz Index of Independence in Activities of Daily Living, and Mini-Cog test. Correlation, logistic regression, and receiver operating characteristic (ROC) analyses were performed.

Results: Participants had a mean age of 80.8 years (SD 7.5); 43.5% were male. Handgrip strength was positively correlated with GOHAI ($r = 0.376$, $p < 0.001$), MNA-SF ($r = 0.446$, $p < 0.001$), and Mini-Cog ($r = 0.126$, $p < 0.05$), and negatively correlated with age, SARC-F, and frailty. GOHAI correlated positively with MNA-SF ($r = 0.206$, $p < 0.01$) and negatively with SARC-F ($r = -0.134$, $p < 0.05$). In univariate logistic regression, lower GOHAI, lower MNA-SF, older age, polypharmacy, and higher SARC-F scores were significantly associated with probable sarcopenia. In multivariate analysis, GOHAI, MNA-SF and polypharmacy remained independent predictors.

Conclusion: Poor oral health-related quality of life was independently associated with probable sarcopenia in older adults. Incorporating an oral health measure such as the GOHAI into routine geriatric assessment may facilitate early detection of at-risk individuals and support timely, targeted interventions.

Keywords: geriatric assessment, older adults, oral health, polypharmacy, sarcopenia

Introduction

Oral health is a critical component of overall well-being in older adults, yet it remains underrecognized in geriatric healthcare.¹ With advancing age, individuals become increasingly susceptible to oral health problems such as tooth loss, dental caries, xerostomia, and reduced masticatory efficiency.² These conditions can impair chewing and swallowing abilities, resulting in poor nutritional intake, unintentional weight loss, and functional decline.³ Furthermore, poor oral health has been associated with systemic conditions including cardiovascular disease, pneumonia, diabetes, and cognitive impairment.⁴ Despite its broad impact, oral health has not been sufficiently integrated into routine geriatric assessments or multidisciplinary rehabilitation strategies.⁵

Sarcopenia is a geriatric syndrome characterized by the progressive decline in skeletal muscle strength, mass, and/or physical performance.⁶ Sarcopenia screening is commonly initiated using the Strength, Assistance with walking, Rise from a chair, Climb stairs, and Falls (SARC-F) questionnaire; however, due to its limited sensitivity, combining it with objective strength measurements such as handgrip strength may enhance early identification.⁷ According to the revised European Working Group on Sarcopenia in Older People (EWGSOP2), probable sarcopenia is defined as the presence of low muscle strength measured by handgrip dynamometry, with or without reduced muscle mass.⁸ Recent evidence suggests that probable sarcopenia has high diagnostic accuracy for identifying definitive sarcopenia, supporting its role as a pragmatic tool for early

screening and intervention in clinical practice.⁹ The concept of probable sarcopenia, defined by reduced muscle strength or physical performance alone, was introduced to facilitate early detection and promote timely lifestyle-based interventions, particularly in primary care and community settings.¹⁰

Although both poor oral health and sarcopenia are prevalent in older adults and share potential mediating factors such as malnutrition, systemic inflammation, and chronic disease burden, there is limited research examining their direct association using validated oral health–related quality of life measures such as the Geriatric Oral Health Assessment Index (GOHAI). Identifying this association could help refine comprehensive geriatric assessments and improve risk detection. Therefore, the primary aim of this study was to evaluate the association between oral health–related quality of life, measured by GOHAI, and probable sarcopenia in community-dwelling older adults, and the secondary objective was to assess the diagnostic performance of GOHAI for identifying probable sarcopenia and determine its optimal cutoff value using receiver operating characteristic (ROC) analysis. The null hypothesis was that there is no association between oral health–related quality of life and probable sarcopenia in community-dwelling older adults.

Materials and Methods

Study Design and Setting

This cross-sectional study was approved by the Clinical Research Ethics Committee of Balıkesir Atatürk City Hospital on 22.08.2024, with decision number 2024/08/40. The study was conducted between September 2024 and April 2025 in the Home Health Unit and Geriatric Outpatient Clinic of a tertiary hospital in Balıkesir, Türkiye. The study adhered to the ethical principles outlined in the Declaration of Helsinki.

Sampling and Participants

Convenience sampling was used in this study. The study population consisted of more than 1500 individuals aged 65 years and older who were registered in the Home Health Unit or the Geriatric Outpatient Clinic (YASAM Center) of a tertiary hospital in Balıkesir, Türkiye. The required sample size for this cross-sectional study was calculated as 315 participants using OpenEpi 3.0 software, based on the formulas proposed by Schaeffer et al.¹¹ A sarcopenia prevalence of 18% was assumed in accordance with previous studies reporting rates between 10% and 27%, with a 5% margin of error and a design effect of 1.¹² After data screening and cleaning, the study was completed with 315 older adults.

Participants were eligible if they were aged 65 years or older, registered in the Home Health Unit or the Geriatric Outpatient Clinic, able to follow instructions, and had sufficient active range of motion ($\geq 90^\circ$ elbow flexion) in their dominant arm. Exclusion criteria included acute pathology of the dominant upper limb (neck, shoulder, elbow, or hand); arthritis or gout affecting the elbow, wrist, or hand; severe cognitive impairment or inability to understand the study information or provide informed consent; and presence of advanced organ failure (renal, hepatic, respiratory, or cardiac) or active infection.

Data Collection

Data were collected between September 2024 and April 2025 from participants who met the inclusion criteria. Participants were interviewed either during home visits or at the outpatient clinic, after obtaining informed consent. Data collection was conducted by trained healthcare professionals and researchers using both self-administered questionnaires and face-to-face interviews. Participants could complete the forms independently or with verbal assistance. A structured 14-item questionnaire on sociodemographic and clinical characteristics was developed by the researchers based on a literature review. Additionally, the following validated tools were administered: the Geriatric Oral Health Assessment Index (GOHAI), handgrip strength measurement using a dynamometer, Mini Nutritional Assessment–Short Form (MNA-SF), Clinical Frailty Scale (CFS), Katz Index of Independence in Activities of Daily Living, Mini-Cog, and the SARC-F questionnaire.

Measures

Comprehensive Geriatric Assessment and Measures

The number of medications used by each participant was recorded. Polypharmacy was defined as the regular use of five or more medications.¹³ Frailty was assessed using the Clinical Frailty Scale (CFS), a 9-point clinical tool that categorizes

older adults from “Very Fit” to “Terminally Ill.”¹⁴ Functional status was measured using the Katz Index of Independence in Activities of Daily Living, which evaluates six fundamental daily tasks and scores participants as either independent or dependent for each task.¹⁵ Cognitive impairment risk was evaluated using the Mini-Cog test, where a score of ≤ 2 indicates a high risk and a score of ≥ 3 indicates a low risk for cognitive impairment.¹⁶ Nutritional status was assessed using the Mini Nutritional Assessment–Short Form (MNA-SF). A score of 12–14 indicates normal nutrition, 8–11 reflects a risk of malnutrition, and 0–7 indicates malnutrition.¹⁷ Risk of sarcopenia was evaluated using the SARC-F questionnaire. Scores ≥ 4 were considered indicative of high risk, while scores < 4 represented low risk.¹⁸

Diagnosis of Probable Sarcopenia

Probable sarcopenia was diagnosed according to the EWGSOP2 criteria, which emphasize low muscle strength as the primary parameter for identifying sarcopenia.⁸ According to these guidelines, salient features of sarcopenia assessment include muscle strength, muscle quantity/quality, and physical performance; in this study, muscle strength was prioritized as it is the most sensitive and earliest detectable marker of sarcopenia. Low muscle strength has been shown to be strongly associated with adverse health outcomes such as falls, disability, hospitalization, and mortality in older adults, making it an essential first step in diagnosis. Handgrip strength was selected as the measurement method because it is a validated, simple, quick, and non-invasive tool that correlates well with overall muscle strength and functional status.

Handgrip strength was measured using a digital hand dynamometer (Camry; Zhongshan Camry Electronic Co Ltd; Zhongshan; China). Participants were seated with back support, hips and knees flexed at 90°, and the dominant arm positioned with the shoulder adducted, elbow flexed at 90°, and wrist in a neutral position. For bedridden individuals, the head of the bed was raised to achieve a semi-upright posture. Each participant was instructed to exert maximal effort using the dominant hand. Three measurements were taken, and the highest value was recorded.¹⁹ Cutoff values specific to the Turkish population were applied: < 17.1 kg for males and < 11.9 kg for females were considered indicative of low muscle strength.²⁰

Oral Health Assessment

Oral health-related quality of life was assessed using the Geriatric Oral Health Assessment Index (GOHAI), originally developed by Atchison and Dolan.²¹ The GOHAI consists of 12 items covering three domains: physical function (eg, chewing, swallowing), psychosocial function (eg, worry, discomfort), and pain/discomfort. Each item is scored on a 5-point Likert scale, resulting in total scores ranging from 12 to 60, with higher scores indicating better oral health-related quality of life. The validated Turkish version of the GOHAI, developed by Çınar et al, was used in this study.²²

Statistical Analysis Methods Section

Descriptive statistics were presented as mean $\pm$ standard deviation (SD) for continuous variables and as frequencies (percentages) for categorical variables. The normality of distribution for handgrip strength and GOHAI scores was assessed based on skewness and kurtosis values, in accordance with the criteria suggested by Tabachnick and Fidell.²³ Both variables were found to follow a normal distribution. Independent samples *t*-tests were used to compare means between two groups, while one-way analysis of variance (ANOVA) was used for comparisons involving three or more groups. Duncan’s multiple range test was applied for post hoc analyses. A *p*-value of < 0.05 was considered statistically significant. All analyses were performed using statistical software (SPSS Statistics version 26; IBM; Armonk, NY; USA).

To assess the relationships between dichotomous categorical variables (eg, sex, polypharmacy status, Katz ADL dependency) and continuous variables (handgrip strength and GOHAI scores), point-biserial correlation analyses were conducted using Pearson correlation, which yields equivalent results when one variable is continuous and the other is binary.

Receiver Operating Characteristic (ROC) analysis was used to assess the GOHAI score’s ability to predict possible sarcopenia. Discrimination accuracy was evaluated by the Area Under The Curve (AUC), and the optimal cut-off was determined using Youden’s *J* index. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were reported with 95% confidence intervals. An AUC above 0.70 indicated acceptable discrimination.²⁴

The internal consistency of the GOHAI scale was examined using Cronbach's alpha, with a resulting value of 0.959, indicating excellent reliability.

Binary logistic regression was used to identify factors associated with possible sarcopenia. Variables with univariate $p < 0.20$ or clinical relevance were included in multivariate models, as recommended by Hosmer and Lemeshow.²⁵ Model fit was assessed using the Hosmer-Lemeshow test ($p > 0.05$), and performance via Nagelkerke R^2 , Cox & Snell R^2 , and AUC. Results were reported as ORs with 95% CIs and p-values.

To further evaluate the contribution of oral health to sarcopenia prediction, two multivariate logistic regression models were constructed. In Model 1, the GOHAI score was treated as a continuous variable, whereas in Model 2, GOHAI was dichotomized using the optimal cut-off value (≤ 44.5) determined through ROC analysis. Both models included the following covariates: age, nutritional status (MNA-SF score), functional dependency (Katz Index), polypharmacy (≥ 5 medications), and sarcopenia risk (SARC-F score).

Multicollinearity was assessed by examining the variance inflation factor (VIF) and tolerance values. All variables included in both models had VIF values below 1.1 and tolerance values above 0.90, indicating no multicollinearity concerns.

Results

The study included 315 older adults (137 males, 43.5%; 178 females, 56.5%) with a mean age of 80.78 years ($SD = 7.5$; range: 65–98). Handgrip strength and GOHAI scores were compared across various demographic and clinical variables, including sex, age group, number of chronic diseases, education level, marital status, co-residence status, presence of polypharmacy, frailty (assessed by the Clinical Frailty Scale), functional status (Katz ADL), cognitive function (Mini-Cog), sarcopenia risk (SARC-F), and nutritional status (MNA-SF). Handgrip strength was significantly higher in males ($p < 0.001$), but GOHAI scores did not differ by sex ($p = 0.450$). Participants aged 65–80 had stronger grip strength than those 81–98 ($p < 0.001$). Grip strength also varied significantly by education, nutrition, frailty, and function. GOHAI scores differed only by frailty, SARC-F, and nutrition. Details are shown in Table 1.

Correlation analysis revealed several statistically significant associations. Handgrip strength demonstrated a moderate positive correlation with GOHAI score ($r = 0.376$, $p < 0.01$), suggesting that better oral health-related quality of life was associated with greater muscle strength. Age was negatively correlated with handgrip strength ($r = -0.226$, $p < 0.01$), but

Table 1 Comparison of Handgrip Strength and GOHAI Scores According to Demographic and Clinical Characteristics

Variables		N (%)	Handgrip Strength (Mean $\pm$ SD)	P-Value	GOHAI (Mean $\pm$ SD)	P-Value
Sex	Male	137 (43.5)	20.8 $\pm$ 8.5	< 0.001	45.5 $\pm$ 10.1	0.450
	Female	178 (56.5)	16.5 $\pm$ 6.6		44.7 $\pm$ 3.6	
Age (years)	65–80	144 (45.7)	20.2 $\pm$ 7.8	< 0.001	46.0 $\pm$ 8.9	0.100
	81–98	171 (54.3)	16.7 $\pm$ 7.5		44.3 $\pm$ 9.9	
Number of Chronic Diseases	0–1	79 (25.1)	18.4 $\pm$ 8.5	0.974	44.4 $\pm$ 9.9	0.780
	2	126 (40.0)	18.2 $\pm$ 7.3		45.3 $\pm$ 9.4	
	≥ 3	110 (34.9)	18.4 $\pm$ 7.3		45.3 $\pm$ 9.2	
Education Level	Illiterate	46 (14.6)	17.7 $\pm$ 8.7 ^{a,b}	< 0.001	46.2 $\pm$ 9.4	0.324
	Literate	46 (14.6)	14.9 $\pm$ 6.5 ^a		43.6 $\pm$ 9.6	
	Primary school	123 (39.0)	18.0 $\pm$ 7.9 ^{a,b}		44.6 $\pm$ 9.9	
	Middle school	55 (17.5)	20.9 $\pm$ 7.6 ^c		47.2 $\pm$ 7.3	
	High school and above	45 (14.3)	20.2 $\pm$ 6.6 ^{b,c}		45.1 $\pm$ 9.9	
Marital Status	Married	150 (47.6)	18.9 $\pm$ 7.1	0.220	44.7 $\pm$ 8.4	0.546
	Single	165 (52.4)	17.8 $\pm$ 8.4		45.4 $\pm$ 10.3	

(Continued)

Table 1 (Continued).

Variables		N (%)	Handgrip Strength (Mean ± SD)	P-Value	GOHAI (Mean ± SD)	P-Value
Coresidence	Living alone	37 (11.7)	16.4±9.9	0.164	45.5 ± 10.5	0.843
	With caregiver	15 (4.8)	16.6±5.8		43.8 ± 11.4	
	With family	263 (83.5)	18.7±7.8		45.1±9.2	
Polypharmacy	Yes	136 (43.2)	17.4 ± 7.3	0.074	45.4 ± 9.9	0.583
	No	179 (56.8)	19.0 ± 8.1		44.8 ± 9.9	
Clinical Frailty Scale	Very fit-fit	14 (4.4)	30.3±4.2 ^a	< 0.001	48.14	0.006
	Managing well	47 (14.9)	20.9±6.4 ^b		46.4±6.5	
	Very mild frailty	95 (30.2)	18.2±7.4 ^b		47.4±8.4	
	Mild frailty	82 (26.0)	17.00±8.6 ^c		42.7±8.3	
	Moderate frailty	39 (12.4)	17.0±7.1 ^c		43.3±10.1	
	Severe-very severe frailty	38 (12.1)	15.2±5.3 ^c		43.3±11.3	
Katz ADL Status	Partially dependent	180 (57.1)	13.2 ± 4.5	< 0.001	42.4 ± 10.0	<0.0001
	Independent	135 (42.9)	25.2 ± 5.7		48.7 ± 7.2	
Mini-Cog	High risk	189 (60.0)	17.3±7.7	0.005	44.7±9.9	0.421
	Low risk	126 (40.0)	19.8±7.7		45.6±8.7	
SARC-F Risk Level	High risk	171 (54.3)	15.2 ± 5.2	< 0.001	43.8 ± 9.8	0.008
	Low risk	144 (45.7)	22.0 ± 8.7		46.6 ± 8.8	
Nutritional Status (MNA-SF)	Malnourished	23 (7.3) ^a	10.0 ± 3.6	<0.001	37.9 ± 10.0 ^d	< 0.001
	At risk of malnutrition	77 (24.4) ^b	13.6 ± 5.3		43.2 ± 9.9 ^e	
	Normal	215 (68.3) ^c	20.9 ± 7.5		46.5 ± 8.8 ^e	

Notes: Test statistics: Independent samples t-test for two-group variables; one-way ANOVA with Duncan post-hoc test for variables with ≥3 groups. ^{a–e}Different superscripts indicate significant differences in post-hoc comparisons ($P < 0.05$). Italicized p-values indicate statistical significance.

Abbreviations: SARC-F, Strength, Assistance in walking, Rise from a chair, Climb stairs, and Falls questionnaire; MNA-SF, Mini Nutritional Assessment – Short Form.

not with GOHAI score. MNA-SF scores were positively correlated with both handgrip strength ($r = 0.446$, $p < 0.01$) and GOHAI scores ($r = 0.206$, $p < 0.01$), indicating a link between nutritional status and both outcomes. SARC-F scores were negatively correlated with handgrip strength and GOHAI, while Mini-Cog and education level were positively associated with handgrip strength. Frailty showed a weak negative correlation with grip strength. No significant correlations were observed for polypharmacy or ADL dependency.

ROC analysis identified a GOHAI cutoff of ≤ 44.5 for predicting possible sarcopenia (AUC = 0.707; 95% CI: 0.645–0.769; $p < 0.001$), with 62.5% sensitivity and 70.0% specificity (Table 2 and Figure 1). To our knowledge, this is the first study to investigate the relationship between oral health-related quality of life, assessed by the GOHAI, and probable sarcopenia in a Turkish older adult population, and to identify an optimal GOHAI cut-off value for predicting probable sarcopenia.

Univariate logistic regression showed that lower GOHAI and MNA-SF scores, older age, higher SARC-F scores, and polypharmacy were significantly associated with possible sarcopenia, whereas chronic disease count, CFS, Mini-Cog, and ADL were not (Table 3).

Table 2 Diagnostic Performance of the GOHAI Score in Predicting Possible Sarcopenia

	Cut off	AUC (%95 CI)	P-Value	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
GOHAI	≤ 44.5	0.707 (0.645–0.769)	< 0.001	62.5	70.0	53.4	77.2

Note: Italicized p-values indicate statistical significance.

Abbreviations: GOHAI, Geriatric Oral Health Assessment Index; AUC, Area Under the Curve; CI, Confidence Interval; PPV, Positive Predictive Value; NPV, Negative Predictive Value.

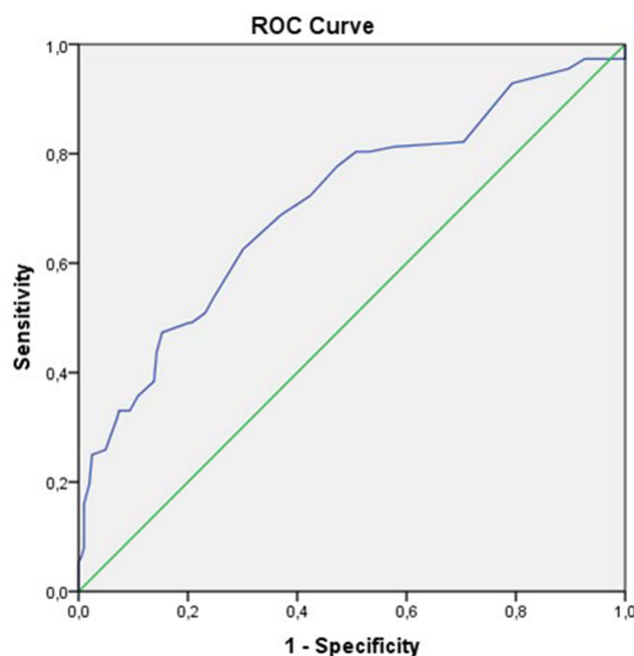


Figure 1 Receiver operating characteristic (ROC) analysis for predicting possible sarcopenia using the GOHAI score.

In multivariate logistic regression models, lower GOHAI scores, lower MNA-SF scores, and the presence of polypharmacy were independently associated with increased risk of possible sarcopenia. In Model 1, each one-point increase in GOHAI score was associated with an 8.2% reduction in the odds of probable sarcopenia (OR = 0.918; 95% CI: 0.889–0.948; $p < 0.001$). In Model 2, having a GOHAI score ≤ 44.5 was associated with a 3.7-fold increased risk (OR = 3.677; 95% CI: 2.099–6.440; $p = 0.001$). This indicates a moderate association between poor oral health-related quality of life and probable sarcopenia. MNA-SF and polypharmacy remained significant in both models, while age was only significant in Model 2. SARC-F and ADL were not significant predictors. Model 1 had slightly better fit indices (Table 4).

Table 3 Univariate Binary Logistic Regression Analysis for Predicting Possible Sarcopenia

Variable	B	P-Value	OR (Exp(B))	95% CI
GOHAI	-0.088	<i><0.001</i>	0.92	0.89–0.94
Age	0.053	<i>0.002</i>	1.06	1.02–1.09
MNA-SF	-0.445	<i><0.001</i>	0.64	0.56–0.73
No.of chronic diseases	-0.006	0.957	0.99	0.80–1.24
CFS	0.140	0.870	1.01	0.86–1.20
Mini-Cog	0.163	0.501	1.18	0.73–1.89
SARC-F	0.521	<i>0.030</i>	1.68	1.05–2.70
ADL	0.401	0.097	1.49	0.93–2.40
Polypharmacy	0.714	<i>0.003</i>	2.04	1.28–3.26

Notes: GOHAI, Age, MNA-SF, Number of chronic diseases and CFS are continuous variables. Reference categories: Mini-Cog = low risk for cognitive impairment; SARC-F = low risk for sarcopenia; ADL = independent; Polypharmacy = no. Italicized p-values indicate statistical significance.

Abbreviations: GOHAI, Geriatric Oral Health Assessment Index; MNA-SF, Mini Nutritional Assessment – Short Form; CFS, Clinical Frailty Scale; Mini-Cog, Mini-Cognitive Assessment; SARC-F, Strength, Assistance with walking, Rise from a chair, Climb stairs, and Falls questionnaire; ADL, Activities of Daily Living (Katz Index); Polypharmacy, Use of ≥ 5 medications.

Table 4 Multivariate Logistic Regression Models for Predicting Possible Sarcopenia

Variable	Model 1 OR (95% CI)	P-Value	Model 2 OR (95% CI)	P-Value
GOHAI (Continuous)	0.918 (0.889–0.948)	<0.001	—	—
GOHAI (≤ 44.5 , Categorical)	—	—	3.677 (2.099–6.440)	0.001
Age	1.039 (0.997–1.082)	0.066	1.043 (1.002–1.086)	0.039
MNA-SF	0.667 (0.573–0.776)	<0.001	0.660 (0.566–0.769)	<0.001
ADL	1.328 (0.748–2.359)	0.333	1.399 (0.796–2.460)	0.243
Polypharmacy	2.753 (1.548–4.895)	0.001	2.663 (1.513–4.685)	0.001
SARC-F	0.807 (0.446–1.458)	0.477	0.781 (0.435–1.403)	0.409

Notes: Model 1: Cox & Snell $R^2 = \%28.8$; Nagelkerke $R^2 = \%39.5$. Model 2: Cox & Snell $R^2 = \%26.5$; Nagelkerke $R^2 = \%36.4$. “—” indicates not included. Italicized p-values indicate statistical significance.

Abbreviations: GOHAI, Geriatric Oral Health Assessment Index; MNA-SF, Mini Nutritional Assessment – Short Form; ADL, Activities of Daily Living (Katz Index); SARC-F, Strength, Assistance with walking, Rise from a chair, Climb stairs, and Falls questionnaire.

Discussion

This study tested the null hypothesis (H_0) that there is no association between oral health-related quality of life and probable sarcopenia in community-dwelling older adults. Our findings did not support this hypothesis. We observed a significant and independent association between lower GOHAI scores and probable sarcopenia, even after adjusting for age, nutritional status, polypharmacy, and functional status. Furthermore, ROC analysis showed that GOHAI demonstrated moderate discriminatory power for identifying individuals at risk, suggesting its potential utility as a simple, non-invasive screening tool in primary care and geriatric settings. The observed association between lower GOHAI scores and probable sarcopenia was of moderate strength, as indicated by an odds ratio of 3.68 in our multivariate analysis.

Lower GOHAI scores were associated with reduced handgrip strength and higher SARC-F scores, both indicators of increased sarcopenia risk. These results are consistent with previous studies reporting a link between poor oral health and muscle weakness in older adults.^{26–28}

In our multivariate analysis, GOHAI remained a significant predictor of probable sarcopenia in both continuous and categorical forms. Nutritional status and polypharmacy were also independently associated. Each one-point increase in MNA-SF score reduced the risk by approximately one-third, in agreement with earlier research highlighting the role of adequate nutrition in preserving muscle mass.^{28–31} Conversely, polypharmacy increased sarcopenia risk 2.7-fold, aligning with findings from a recent systematic review.³²

Handgrip strength declined with advancing age, with each additional year increasing probable sarcopenia risk by 5.5%, consistent with reports from older populations in various settings.^{33,34} The mechanisms likely involve age-related neuromuscular decline, hormonal changes, inflammation, and reduced physical activity. Interestingly, age was not significantly associated with GOHAI scores in our sample, which contrasts with studies reporting lower oral health scores with increasing age but is in line with research suggesting cultural or contextual influences on self-reported oral health.^{35,36}

Although Mini-Cog and CFS scores showed weak correlations with handgrip strength, neither was an independent predictor in the multivariate analysis. This may reflect the early stage of decline in probable sarcopenia, where cognitive and frailty-related impairments are not yet prominent. Nonetheless, evidence suggests that sarcopenia and cognitive decline share common neurodegenerative and inflammatory pathways, and sarcopenia has been linked to higher frailty index scores in large-scale studies.^{37–39} The strengths of our study include a relatively large, well-characterized sample of older adults, the use of both subjective (GOHAI) and objective (handgrip strength) measures, and adherence to EWGSOP2 criteria for probable sarcopenia diagnosis. Additionally, our analysis incorporated a wide range of geriatric assessment tools, enhancing the comprehensiveness of the findings.

Limitations

This study has several limitations. First, due to its cross-sectional design, it is not possible to establish a causal relationship between oral health-related quality of life and probable sarcopenia. Second, the study population consisted

of older adults receiving services from a single tertiary hospital's Home Health Unit and Geriatric Outpatient Clinic, which may limit the generalizability of the findings to broader or more diverse elderly populations. Third, although validated scales such as GOHAI and SARC-F were used, the reliance on self-reported data may have introduced subjective biases. Fourth, muscle mass and gait speed were not evaluated, although they are important components of sarcopenia diagnosis in the EWGSOP2 framework. Fifth, while several relevant variables were included in the regression analysis, other potential confounders such as inflammatory markers, dental examination results, and vitamin D levels were not assessed. Lastly, the functional and cognitive assessments were limited to brief screening tools (Katz Index and Mini-Cog), and more detailed evaluations could provide additional insights.

Future studies should adopt longitudinal designs to clarify causal relationships, include more diverse populations, and consider objective oral health and nutritional assessments alongside detailed frailty and sarcopenia evaluations.

Conclusion

Lower oral health-related quality of life, as measured by the GOHAI, is independently associated with probable sarcopenia in older adults. Poor nutritional status and polypharmacy further contribute to sarcopenia risk. These findings support integrating oral health assessment into geriatric evaluations to facilitate early detection and prevention strategies.

Abbreviations

GOHAI, Geriatric Oral Health Assessment Index; CFS, Clinical Frailty Scale; MNA-SF, Mini Nutritional Assessment–Short Form; ADL, Activities of Daily Living; SARC-F, Strength, Assistance with walking, Rise from a chair, Climb stairs, and Falls; ROC, receiver operating characteristic; AUC, area under the curve; OR, odds ratio; CI, confidence interval.

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Disclosure

No potential conflict of interest was reported by the authors.

References

1. Chan AKY, Chu CH, Ogawa H, Lai EH. Improving oral health of older adults for healthy ageing. *J Dent Sci*. 2024;19(1):1–7. doi:10.1016/j.jds.2023.10.018
2. Oral Health in America: advances and Challenges [Internet]. Bethesda (MD): National Institute of Dental and Craniofacial Research (US); 2021. Section 3B, Oral Health Across the Lifespan: Older Adults. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK578296/>. Accessed August 25, 2025.
3. Cichero JAY. Age-related changes to eating and swallowing impact frailty: aspiration, choking risk, modified food texture and autonomy of choice. *Geriatrics*. 2018;3(4):69. doi:10.3390/geriatrics3040069
4. Kotronia E, Brown H, Papacosta AO, et al. Oral health and all-cause, cardiovascular disease, and respiratory mortality in older people in the UK and USA. *Sci Rep*. 2021;11(1):16452. doi:10.1038/s41598-021-95865-z
5. Wongiam N, Praditpornsilpa K, Vacharaksa A. Comprehensive geriatric assessment for oral care in older adults: a focus group study. *BMC Geriatr*. 2025;25(1):232. doi:10.1186/s12877-025-05854-4
6. Voulgaridou G, Tyrovolas S, Detopoulou P, et al. Diagnostic criteria and measurement techniques of sarcopenia: a critical evaluation of the up-to-date evidence. *Nutrients*. 2024;16(3):436. doi:10.3390/nu16030436
7. Vidal-Cuellar CL, Mas G, Ayamamani-Torres P, Yazawa T, Rosas-Carrasco O, Tello T. Identification of probable sarcopenia based on SARC-F and SARC-CalF in older adults from a low-resource setting. *J Frailty Sarcopenia Falls*. 2022;7(4):222–230. doi:10.22540/JFSF-07-222
8. Cruz-Jentoft AJ, Bahat G, Bauer J, et al. Sarcopenia: revised European consensus on definition and diagnosis. *Age Ageing*. 2019;48(1):16–31. doi:10.1093/ageing/afy169
9. Ueshima J, Maeda K, Shimizu A, et al. Diagnostic accuracy of sarcopenia by “possible sarcopenia” premised by the Asian Working Group for Sarcopenia 2019 definition. *Arch Gerontol Geriatr*. 2021;97:104484. doi:10.1016/j.archger.2021.104484
10. Xie WQ, Xiao GL, Hu PW, et al. Possible sarcopenia: early screening and intervention—narrative review. *Ann Palliat Med*. 2020;9(6):4283–4293. doi:10.21037/apm-20-967
11. Schaeffer RL, Mendenhall W, Ott L. *Elementary Survey Sampling*. 4th ed. Belmont, CA: Duxbury Press; 1990.
12. Petermann-Rocha F, Balntzi V, Gray SR, et al. Global prevalence of sarcopenia and severe sarcopenia: a systematic review and meta-analysis. *J Cachexia Sarcopenia Muscle*. 2022;13(1):86–99. doi:10.1002/jcsm.12889

13. Varghese D, Ishida C, Patel P, et al. Polypharmacy. In: *StatPearls*. Treasure Island (FL): StatPearls Publishing; 2025.
14. Rockwood K, Song X, MacKnight C, et al. A global clinical measure of fitness and frailty in elderly people. *CMAJ*. 2005;173(5):489–495. doi:10.1503/cmaj.050051
15. Katz S, Ford AB, Moskowitz RW, et al. Studies of illness in the aged: the index of ADL. *JAMA*. 1963;185:914–919. doi:10.1001/jama.1963.03060120024016
16. Borson S, Scanlan JM, Chen P, et al. The Mini-Cog as a screen for dementia: validation in a population-based sample. *J Am Geriatr Soc*. 2003;51(10):1451–1454. doi:10.1046/j.1532-5415.2003.51465.x
17. Rubenstein LZ, Harker JO, Salva A, et al. Developing the short-form Mini-Nutritional Assessment (MNA-SF). *J Gerontol a Biol Sci Med Sci*. 2001;56(6):M366–M372. doi:10.1093/gerona/56.6.m366
18. Malmstrom TK, Morley JE. SARC-F: a simple questionnaire to rapidly diagnose sarcopenia. *J Am Med Dir Assoc*. 2013;14(8):531–532. doi:10.1016/j.jamda.2013.05.018
19. Roberts HC, Denison HJ, Martin HJ, et al. A review of the measurement of grip strength in clinical and epidemiological studies. *Age Ageing*. 2011;40(4):423–429. doi:10.1093/ageing/afr051
20. Bahat G, Altinkaynak M, Karan MA. Handgrip strength cut-offs to define sarcopenia in Turkish population. *Aging Clin Exp Res*. 2021;33(1):207–208. doi:10.1007/s40520-020-01704-y
21. Atchison KA, Dolan TA. Development of the Geriatric Oral Health Assessment Index. *J Dent Educ*. 1990;54(11):680–687.
22. Çınar AB, Murtomaa H, Clèrehugh V. Validity and reliability of the Turkish version of the Geriatric Oral Health Assessment Index (GOHAI). *Gerodontology*. 2011;28(2):102–110. doi:10.1111/j.1741-2358.2009.00333.x
23. Tabachnick BG, Fidell LS. *Using Multivariate Statistics*. 6th ed. Boston, MA: Pearson; 2013.
24. Hajian-Tilaki K. ROC curve analysis for medical diagnostic test evaluation. *Caspian J Intern Med*. 2013;4:627–635.
25. Hosmer DW, Lemeshow S, Sturdivant RX. *Applied Logistic Regression*. 3rd ed. Hoboken, NJ: John Wiley & Sons; 2013.
26. Motoishi Y, Yamanashi H, Kitamura M, et al. Oral health-related quality of life is associated with physical frailty. *J Gen Fam Med*. 2021;22:271–277. doi:10.1002/jgf2.450
27. Abe T, Tominaga K, Ando Y, et al. Number of teeth and masticatory function are associated with sarcopenia and diabetes mellitus. *PLoS One*. 2021;16(6):e0252625. doi:10.1371/journal.pone.0252625
28. Yun J, Lee Y. Association between oral health status and handgrip strength in older Korean adults. *Eur Geriatr Med*. 2020;11:459–464. doi:10.1007/s41999-020-00318-x
29. Cao W, Zhu A, Chu S, et al. Correlation between nutrition, oral health, and different sarcopenia groups. *BMC Geriatr*. 2022;22(1):332. doi:10.1186/s12877-022-02934-7
30. Chang HP, Wang PC, Wei TC, et al. The prevalence and associated risk factors of possible sarcopenia. *Clin Nutr ESPEN*. 2023;58:668. doi:10.1016/j.clnesp.2023.04.337
31. Sun J, Yuan W, Chen M, et al. Possible sarcopenia and its risk factors in a home for seniors. *Asia Pac J Clin Nutr*. 2023;32(1):70–76. doi:10.6133/apjcn.202303_32(1).0011
32. Pana A, Sourtzi P, Kalokairinou A, et al. Sarcopenia and polypharmacy among older adults. *Arch Gerontol Geriatr*. 2022;98:104520. doi:10.1016/j.archger.2021.104520
33. Wang J, Liu C, Zhang L, et al. Prevalence and associated factor of possible sarcopenia. *BMC Geriatr*. 2022;22(1):592. doi:10.1186/s12877-022-03286-y
34. Yao J, Wang Y, Yang L, et al. Prevalence of probable sarcopenia in community-dwelling older Chinese adults. *BMJ Open*. 2022;12(12):e067425. doi:10.1136/bmjopen-2022-067425
35. Haresaku S, Nakashima F, Hara Y, et al. Associations of oral health-related quality of life with age and oral function. *BMC Oral Health*. 2020;20(1):361. doi:10.1186/s12903-020-01355-5
36. Alshammari M, Baseer MA, Ingle NA, et al. Oral health-related quality of life among elderly with edentulous jaws. *J Int Soc Prev Community Dent*. 2018;8(6):495–502. doi:10.4103/jispcd.JISPCD_202_18
37. Kelaïditi E, Kanellaki MI, Kokkinopoulou I, et al. Cognitive impairment is independently associated with sarcopenia. *Geriatr Gerontol Int*. 2017;17:1048–1056. doi:10.1111/ggi.12839
38. Dong X, Yu Y, Li J, et al. Correlation between sarcopenia and cognitive impairment. *Front Aging Neurosci*. 2024;16:1489185. doi:10.3389/fnagi.2024.1489185
39. Dong Y, Xi Y, Wang Y, Chai Z. Association between sarcopenia and frailty. *J Glob Health*. 2024;14:04163. doi:10.7189/jogh.14.04163

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