Research Square

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Predictors and Diagnostic Threshold Values of Functional Dependency in Individuals Aged 80 and Over: A Retrospective Cross-Sectional Study

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Abstract

Aims

This study assesses functional dependency rates among Balıkesir residents aged 80 and over, identifying cognitive, nutritional, and depressive predictors of this condition.

Method

This retrospective cross-sectional study was conducted at the Healthy Aging Center of Balıkesir State Hospital and included 444 individuals aged ≥ 80 years with complete data (January 2024–December 2025). Functional status was assessed using the Katz ADL and dichotomized as independent (6) versus dependent (< 6). Cognitive function (MMSE/MMSE-E), nutritional status (MNA-LF), and depressive symptoms (GDS-15) were evaluated. Total scale scores were used in analyses. BMI and demographic variables were recorded.

Results

Among 444 oldest-old adults aged ≥ 80 years, 74.55% were women and 70.27% were functionally dependent (Katz ADL < 6). The mean age was 87.21 ± 4.25 years and BMI 26.81 ± 4.31 kg/m²; median MMSE and MNA-LF scores were 25 (22–28) and 26 (24–27), respectively, and mean GDS-15 was 4.23 ± 2.97. Compared with independent participants, dependent individuals were older and had lower cognitive and nutritional scores and higher depressive symptoms ($p < 0.001$), while BMI did not differ ($p = 0.303$); independence was more common in men and in those with ≥ 5 years of education ($p < 0.001$). In multivariable logistic regression, ≥ 5 years of education was inversely associated with dependence (OR 0.313, 95% CI 0.186–0.528), whereas age, BMI, and GDS-15 increased the odds and MMSE and MNA-LF were protective (Nagelkerke $R^2=0.409$; accuracy 79.3%). ROC analyses yielded AUCs of 0.795 for MMSE, 0.712 for MNA-LF, and 0.695 for GDS-15, with optimal cutoffs of ≤ 26 (73.7% sensitivity, 69.7% specificity), ≤ 25 (50.6% sensitivity, 83.3% specificity), and ≥ 4 (65.7% sensitivity, 72.0% specificity), respectively.

Conclusion

Functional dependency is highly prevalent among the oldest old and is influenced not only by chronological age but also by cognitive status, nutritional state, depressive symptoms, and body composition. Even mild cognitive impairment (MMSE ≤ 26) was associated with increased dependency. Higher BMI was linked to functional decline, suggesting that the obesity paradox may not apply to functional independence and that sarcopenic obesity mechanisms may contribute. Preventing functional

dependence in this age group requires a multidisciplinary approach targeting cognitive reserve, nutrition, depressive symptoms, and BMI monitoring.

Introduction

In Türkiye and even worldwide, the phenomenon of aging is becoming increasingly serious, and the proportion of the elderly population is increasing annually. The population aged 65 and over in Turkey has increased by 20.7% over the past five years and reached 10.6% of the total population as of 2024. Population projections indicate that the proportion of the population aged 65 and over will continue to increase, reaching approximately 27.0% by 2060. The literature defines this situation as a demographic transformation process in which Turkey is rapidly advancing toward the status of a 'highly aged society' and emphasizes that it requires fundamental changes in social/health policies [1].

The World Health Organization (WHO) defines healthy aging not only as the absence of disease but also as the process of developing and maintaining "functional capacity" that enables well-being later in life [2]. Functional status is the focal point of healthy aging and is mostly measured by an individual's level of independence in activities of daily living (ADL) [3]. Loss of independence in daily living activities is associated with a decrease in quality of life and an increase in economic burden; increased healthcare and social costs, a greater likelihood of transitioning to institutional long-term care, and an increased risk of mortality may be observed [4, 5].

The aging process is a complex period that increases the risk of functional dependency, accompanied by physiological changes, a decline in organ function, and alterations in body composition[6, 7]. In the literature, functional dependency is defined as a multifactorial construct and often occurs concurrently with other geriatric syndromes. Faceted factors such as cognitive performance, nutritional status, and depressive symptoms play decisive roles in elderly individuals' ability to maintain activities of daily living (ADL) [6–8]. In this context, evaluating these geriatric syndromes from a holistic perspective is essential to maintain independence and prevent functional decline in the elderly population.

Older adults are quite heterogeneous, while some individuals maintain high functional capacity, others require extensive support for basic activities. The frailty and multiple disease burdens common in this age group can complicate the clinical interpretation of standard geriatric assessment measures [9]. The literature emphasizes that the clinical validity of standard scales such as the MMSE in the "oldest old" group needs to be reassessed with revised cutoff values on the basis of age and education level and that studies with individuals aged 90 and older show that the diagnostic accuracy of standard threshold values differs in this population [10, 11]. The WHO's Integrated Care for Older People (ICOPE) approach emphasizes the early detection and management of declines in intrinsic capacity to preserve functional ability; this reinforces the need for context-specific evidence and clinically applicable threshold values in the very old age group [12].

In this context, our study aims to determine the rates of functional dependence among individuals aged 80 years and over living in the Balıkesir Province of Turkey and to evaluate the clinical accuracy of

cognitive performance, nutritional status, and depressive mood symptoms in predicting functional independence. Additionally, the study aims to identify independent predictors associated with functional dependency and establish practical threshold values that could support clinical practice.

Materials and methods

Study design and setting

This cross-sectional study was conducted with a retrospective design at the Healthy Aging Center of Balıkesir State Hospital. The Healthy Aging Center serves as an outpatient facility where older adults receive routine follow-ups and comprehensive geriatric assessments.

Participants

The study included all individuals aged 80 years and older registered at the Healthy Aging Center between January 2024 and December 2025 who had no missing information for the study variables. A complete-case analysis was conducted with a total of 444 eligible participants.

Measures

Functional status was assessed via the Katz Index of Independence in Activities of Daily Living (Katz ADL). The Turkish validation study reported a Cronbach's alpha coefficient of 0.83 for the scale [13]. The Katz ADL score ranges from 0 to 6, with higher scores indicating greater independence. For regression and ROC analyses, the Katz ADL was dichotomized as functionally independent (Katz = 6) versus functionally dependent (Katz < 6). Cognitive function was evaluated via the Mini-Mental State Examination (MMSE). Participants with ≥ 5 years of education were assessed via the standardized Turkish version of the MMSE, which has shown high interrater reliability (r = 0.99, kappa = 0.92) [14]. For participants with < 5 years of education, the modified version for the uneducated (MMSE-E) was utilized, which has an internal consistency of alpha = 0.70 [15]. Nutritional status was assessed with the Mini Nutritional Assessment-Long Form (MNA-LF). The total scores for the MNA-LF range from 0–30, and the Turkish version of the MNA-LF has a Cronbach's alpha of 0.701 [16]. Depressive symptoms were evaluated via the 15-item Geriatric Depression Scale (GDS-15). The total score of the GDS-15 ranges from 0–15, with higher scores indicating more severe depressive symptoms, and the Turkish validation of the GDS-15 reported an internal consistency of alpha = 0.92 [17]. For all scales, total scores were utilized in the statistical analyses. Body mass index (BMI, kg/m²) was calculated as weight divided by height squared. Demographic variables, including sex and education level (categorized as < 5 years vs. ≥5 years), were also recorded.

Statistical analysis

Descriptive statistics are presented as the means ± standard deviations (SDs) for normally distributed continuous variables, medians (Q1-Q3) for nonnormally distributed continuous variables, and numbers (percentages) for categorical variables. Normality was assessed via skewness and kurtosis, with values between − 1.5 and + 1.5 considered indicative of an approximately normal distribution [18].

Group comparisons between functionally dependent (Katz < 6) and independent (Katz = 6) participants were conducted via Student's t test for normally distributed variables and the Mann—Whitney U test for nonnormally distributed variables; categorical variables were compared via the chi—square test. Correlations were evaluated via Pearson's (r) or Spearman's (ρ) correlation coefficients, as appropriate.

Independent factors associated with functional dependence (Katz < 6) were examined via multivariable logistic regression (backward stepwise likelihood ratio method), with the results reported as odds ratios (ORs) and 95% confidence intervals (CIs). Model fit was assessed via the Omnibus test, Hosmer–Lemeshow goodness-of-fit test, and Nagelkerke R^2.

Receiver operating characteristic (ROC) analyses were performed to evaluate the discriminative ability of selected measures (e.g., the MMSE, MNA-LF, and GDS-15) for predicting functional dependence (Katz < 6). The area under the curve (AUC) with 95% CI was calculated, and optimal cutoff values were determined via the Youden index, with corresponding sensitivity and specificity values reported.

All analyses were performed via IBM SPSS Statistics (version 30.0; IBM Corp., Armonk, NY, USA). A two-sided p value < 0.05 was considered statistically significant.

Results

Overall, the study included 444 participants, most of whom were female (74.55%) and had < 5 years of education (70.05%). Functional dependence, defined as KATZ < 6, was common (70.27%), whereas 29.73% were functionally independent (KATZ = 6). The mean age was 87.21 ± 4.25 years, the mean BMI was 26.81 ± 4.31 kg/m², and the mean KATZ score was 4.6 ± 1.37. The median MMSE and MNA-LF scores were 25 (22–28) and 26 (24–27), respectively, and the mean GDS-15 score was 4.23 ± 2.97 (Table 1).

Table 1
Baseline characteristics of the participants

Characteristic	Overall (n = 444)
Sex	
Female	331 (74.55)
Male	113 (25.45)
Educational status	
< 5 years	311 (70.05)
≥ 5 years	133 (29.95)
Functional status (KATZ)	
Independent	132 (29.73)
Dependent	312 (70.27)
Age, years	87.21 ± 4.25
BMI, kg/m²	26.81 ± 4.31
KATZ score	4.6 ± 1.37
MMSE score	25 (22–28)
MNA-LF score	26 (24–27)
GDS-15 score	4.23 ± 2.97

The values are presented as the means ± SDs, medians (Q1–Q3), or n (%).

KATZ functional independence was defined as a score of 6; functional dependence was defined as < 6. Abbreviations: BMI, body mass index; MMSE, Mini-Mental State Examination; MNA-LF, Mini Nutritional Assessment–Long Form; GDS-15, Geriatric Depression Scale.

Participants with functional dependence (KATZ < 6) were older than those who were independent (87.89 ± 4.37 vs 85.61 ± 3.48 years; $p < 0.001$) and had lower cognitive performance and nutritional status (MMSE scores: 24 (19–27) vs 28 (26–29), $p < 0.001$; MNA-LF scores: 25 (23–27) vs 27 (25.5–28), $p < 0.001$). Depressive symptom scores were higher in the dependent group (GDS-15: 4.79 ± 3.01 vs 2.9 ± 2.4, $p < 0.001$), whereas BMI did not differ significantly between the groups (26.93 ± 4.57 vs 26.51 ± 3.63 kg/m²; $p = 0.303$) (Table 2).

Table 2
Clinical and geriatric assessment measures by functional status (KATZ)

Characteristic	Independent (n = 132)	Dependent (n = 312)	p value
Age, years	85.61 ± 3.48	87.89 ± 4.37	[a]<0.001
BMI, kg/m²	26.51 ± 3.63	26.93 ± 4.57	[a]0.303
MMSE score	28 (26–29)	24 (19–27)	[b]<0.001
MNA-LF score	27 (25.5–28)	25 (23–27)	[b]<0.001
GDS-15 score	2.9 ± 2.4	4.79 ± 3.01	[a]<0.001

The values are presented as the means ± SDs or medians (Q1–Q3). p values were calculated via Student's t test (a) or the Mann–Whitney U test (b). Abbreviations: BMI, body mass index; MMSE, Mini-Mental State Examination; MNA-LF, Mini Nutritional Assessment–Long Form; GDS-15, Geriatric Depression Scale.

Sex and education were significantly associated with functional status. Independence was more common among males than females (43.36% vs 25.08%) and markedly more common among participants with ≥ 5 years of education than among those with < 5 years of education (51.88% vs 20.26%); both associations were statistically significant ($p < 0.001$) (Table 3).

Table 3
Associations of sex and educational status with functional status (KATZ)

Characteristic	Independent (n = 132)	Dependent (n = 312)	p value
Sex, n (%)			[a]<0.001
Female	83 (25.08)	248 (74.92)	
Male	49 (43.36)	64 (56.64)	
Education, n (%)			[a] <0.001
< 5 years	63 (20.26)	248 (79.74)	
≥ 5 years	69 (51.88)	64 (48.12)	

The values are presented as n (%). p values were calculated via Pearson's chi-square (a) test.

Age was negatively correlated with BMI, KATZ, MMSE, and MNA-LF scores and positively correlated with GDS-15 scores ($p < 0.05$). The KATZ score was positively correlated with the MMSE and MNA-LF scores and negatively correlated with the GDS-15 score (all $p < 0.001$). The MMSE score was positively correlated with the MNA-LF score and negatively correlated with the GDS-15 score (all $p < 0.001$). BMI was positively correlated with the MNA-LF score ($p = 0.001$) and negatively correlated with the GDS-15 score ($p < 0.001$) (Table 4).

Table 4
Correlations between age, BMI, functional status, and geriatric assessment measures (n = 444)

	Age (year)	**BMI (kg/m²)**	**KATZ score**	**MMSE score**	**MNA-LF score**
BMI (kg/m²)	-0.223 p < 0.001				
KATZ score	-0.282 p < 0.001	0.055 p = 0.243			
MMSE score	-0.249 p < 0.001	0.083 p = 0.079	0.578 p < 0.001		
MNA-LF score	-0.156 p < 0.001	0.153 p = 0.001	0.478 p < 0.001	0.399 p < 0.001	
GDS-15 score	0.102 p = 0.032	-0.004 p = 0.937	-0.335 p < 0.001	-0.388 p < 0.001	-0.306 p < 0.001

The values are correlation coefficients (Pearson's r or Spearman's ρ, as appropriate) with p values. Abbreviations: BMI, body mass index; MMSE, Mini-Mental State Examination; MNA-LF, Mini Nutritional Assessment–Long Form; GDS-15, Geriatric Depression Scale.

Sex was not significantly associated with functional dependence in the multivariable logistic regression model. Having ≥ 5 years of education was associated with lower odds of functional dependence (OR 0.313, 95% CI 0.186–0.528). Increasing age (OR 1.154, 95% CI 1.076–1.238), BMI (OR 1.090, 95% CI 1.024–1.160) and GDS-15 score (OR 1.116, 95% CI 1.008–1.235) were associated with increased odds of dependence, whereas increased MMSE (OR 0.824, 95% CI 0.762–0.892) and MNA-LF scores (OR 0.904, 95% CI 0.821–0.996) were associated with decreased odds. The final model showed acceptable calibration, explained 40.9% of the variance, and correctly classified 79.3% of the participants (Table 5).

Table 5
Factors associated with functional dependence: multivariate logistic regression model (Backward LR) (n = 444)

Predictor	B	Std. Error	OR (95% CI)	p value
Sex (male; ref: female)	-0.463	0.284	0.629 (0.361–1.097)	0.102
Educational status (≥ 5 years; ref: <5 years)	-1.161	0.266	0.313 (0.186–0.528)	< 0.001
Age (year)	0.143	0.036	1.154 (1.076–1.238)	< 0.001
BMI (kg/m²)	0.086	0.032	1.090 (1.024–1.160)	0.007
MMSE	-0.193	0.040	0.824 (0.762–0.892)	< 0.001
MNA-LF	-0.100	0.049	0.904 (0.821–0.996)	0.042
GDS-15	0.109	0.052	1.116 (1.008–1.235)	0.035

Model fit: Omnibus χ^2=150.925, p < 0.001; Nagelkerke R^2=0.409; Hosmer–Lemeshow χ^2=7.437, p = 0.490; overall correct classification = 79.3% (cutoff = 0.50). Abbreviations: BMI, body mass index; MMSE, Mini-Mental State Examination; MNA-LF, Mini Nutritional Assessment; GDS-15, Geriatric Depression Scale; OR, odds ratio; CI, confidence interval.

Receiver operating characteristic (ROC) analyses were performed to evaluate the discriminative ability of the MMSE, MNA-LF, and GDS-15 for functional dependence (KATZ < 6). The area under the ROC curve (AUC) was 0.795 (95% CI 0.750–0.840) for the MMSE, 0.712 (95% CI 0.661–0.763) for the MNA-LF, and 0.695 (95% CI 0.642–0.747) for the GDS-15 (p < 0.001). The optimal cutoff values based on the Youden index were ≤ 26 for the MMSE (sensitivity 73.7%, specificity 69.7%), ≤ 25 for the MNA-LF (sensitivity 50.6%, specificity 83.3%), and ≥ 4 for the GDS-15 (sensitivity 65.7%, specificity 72.0%) (Table 6; Fig. 1).

Table 6
Diagnostic performance of the MMSE, MNA-LF and GDS-15 for functional dependence (KATZ < 6)

Test	AUC	Std. error	p value	95% CI
MMSE score	0.795	0.023	< 0.001	0.750–0.840
MNA-LF score	0.712	0.026	< 0.001	0.661–0.763
GDS-15 score	0.695	0.027	< 0.001	0.642–0.747

AUC, area under the ROC curve; CI, confidence interval; MMSE, Mini-Mental State Examination; MNA-LF, Mini Nutritional Assessment–Long Form; GDS-15, Geriatric Depression Scale-15.

Discussion

In our study, functional dependency was found to be quite high at 70.2% among individuals aged 80 and over. Our results show that functional dependency is shaped by the interaction of many factors beyond biological aging, such as cognitive status, nutritional status, and psychological factors. Dependency increased significantly with increasing age, high BMI, and high depressive symptom scores, whereas educational level (≥ 5 years) (OR 0.313) and cognitive reserve (OR 0.824) were found to be the strongest factors protecting functional capacity. The high diagnostic performance of the MMSE in predicting functional dependency (AUC: 0.795) and its critical threshold value of 26 points revealed the significant impact of even mild cognitive impairment on functional dependency in the oldest elderly population. The identification of BMI as an independent risk factor for functional dependency in our regression model (OR: 1.090) provides noteworthy data on the obesity paradox in the elderly population through functional dependency and highlights the potential importance of further investigating the effect of body composition on functional dependency.

Our findings are consistent with the literature showing that functional dependency increases with age, particularly in the oldest old group, and that the negative effects of aging on activities of daily living are more pronounced in the oldest old group [19, 20]. In the study by Ting Qin and colleagues, educational level was examined differently from the time-based assessment in our study, and it was found that a higher educational level was protective in terms of functional dependence [21]. In general, a high level of education has been considered a protective factor against functional dependency. According to our results, 5 years or more of education was found to reduce the risk of functional dependency by approximately 68.7%. However, there are studies that contradict our findings and the generally accepted view. Handajani and colleagues, in contrast to our study, reported that individuals with lower levels of education were less likely to develop dependency in terms of basic activities of daily living (ADL) [22]. This difference can be explained in several ways. While the population in this study consisted predominantly of middle-aged and young-old individuals, our study consisted of the oldest-old population. The effect of low educational attainment on functional dependency becomes more pronounced in very old individuals, whereas in younger elderly individuals, this effect may be reversed or less pronounced. In other words, while the effect of physical resilience on functional dependency is more dominant in the middle-old and young-old groups, the effect of cognitive reserve may become more dominant in the oldest-old group. Furthermore, the more fragile individuals among the less educated may have been lost at an early age, and the less educated individuals who have reached advanced ages may represent a physically active subgroup. Individuals with low educational attainment may have been forced to work more in physically demanding jobs throughout their lives. As a result, a lifetime of moderate manual labor may have created a kind of physical reserve in older adults in this group. This situation, known as the physical activity paradox, may have led to the preservation of physical capacity due to education-based socioeconomic factors.

In a study conducted by Pampolim and colleagues using the Functional Independence Measure (FIM) in a single-center family health unit, the dependency rate was 48.2%, whereas in our study, this rate was 70.2% [23]. This difference is related to the average age in our study. Our logistic regression analysis confirmed that age increases the risk of dependency by 15.4% for each additional year (OR 1.154),

indicating that the nature of functional loss increases with age. Although the Katz scale, which we used to assess functional dependency in our study, is a reliable tool for identifying basic daily activities, it may overlook mild functional limitations and changes in cognitive/social dependency areas. The MIF scale, which has a cognitive subscale, offers a more sensitive assessment. Therefore, when the dependency rate in this study was compared with the rate in our study, despite the difference in the ability to detect dependency between the measurement tools, the dependency rate in our study was quite high. Consequently, if our study had been conducted via a more comprehensive assessment tool such as the MIF, the dependency rate would have been much higher than the rate we determined. In the study by Kupske and colleagues, which included individuals from a family medicine unit with an average age above 90 years, although there was a significant difference between the MMSE scores in the dependent and independent groups, when physical function parameters were added to the regression model, the MMSE score was found to be statistically insignificant in explaining independence in basic daily activities and was removed from the model [24]. This study included only individuals whose cognitive reserve was preserved on the basis of the MMSE. This may have limited the variation in the effect of the cognitive status variable on functional dependence. In our study, which included a more heterogeneous group, preserved cognitive reserve was found to be one of the most important protective factors for functional dependence.

In their cross-lagged analysis with participants whose average age was 71 years, Fu and colleagues assessed daily living activities via the Katz, Lowton, and Brody scales and evaluated cognitive functions via the Montreal Cognitive Assessment (MoCA). They reported that cognitive decline preceded functional dependency and that this effect was more pronounced in individuals with moderate cognitive impairment [25]. Our study also revealed that even mild cognitive impairment is strongly associated with functional dependence. Considering that the MoCA measurement tool used in this study is a more sensitive screening tool than the MMSE in the areas of executive functions and attention, the mild cognitive impairment results in our study may correspond to moderate cognitive impairment on the MoCA, although they may not be an exact match. However, considering that Fu and colleagues' study consisted of individuals aged 47–88 years, the results should be evaluated carefully, as there may be a ceiling effect in terms of functional dependency.

Our study revealed that even small improvements in nutritional status have a protective effect on functional dependence. The fact that each point increase in the MNA-LF score significantly reduces the risk of dependence is consistent with the view that nutrition can prevent functional losses in the geriatric population [26, 27].

The nature of the relationship between depression and functional dependence remains a subject of debate in the literature. Some recent studies emphasize that this relationship is reciprocal [28]. However, stronger evidence suggests that depression is a factor that increases functional dependence [29]. Our results also support this finding. In a study by Jerez-Roig and colleagues, functional impairment was considered a cause of depression, and the risk of depression was found to be 1.58 times greater in those with functional impairment (PR 1.58) [30]. Our results, on the other hand, show the opposite

relationship. Each one-point increase in the depression score increased the functional dependency rate by 11.6% (OR 1.116). In this respect, our results support the view that depressive mood reduces functional capacity in older adults by decreasing motivation and physical activity.

From a BMI perspective, contrary to the obesity paradox, which suggests that high BMI in older individuals protects against mortality, our findings indicate that high BMI is a risk factor in terms of functional independence [31]. According to our results, unlike being slightly overweight or mildly obese, BMI stands out as an independent continuous variable, and its increase is associated with increased functional dependence. This situation can be explained by the mechanical restrictive effect of increasing body weight on mobility and the loss of muscle quality associated with sarcopenic obesity.

In our study, although there was no significant difference in BMI between the dependent and independent groups in the simple comparison, multivariate logistic regression revealed that increasing BMI was an independent risk factor for functional dependence. Each 1 kg/m² increase in BMI increased the risk of functional dependency by 1.09 times (OR 1.090). This finding contrasts with that of the study by Tufan and colleagues, which was conducted on a male-only population. In Tufan and colleagues' study, low BMI was defined as part of the sarcopenia/malnutrition cycle [32]. Low muscle mass and an accompanying low BMI have emerged as key parameters related to functional status and nutrition. However, regression analysis revealed that advanced age was the only significant factor determining functional status. This difference may be related to methodological differences as well as population characteristics. While Tufan and colleagues studied a group of individuals who were bedridden, excluded, and consisted only of males with a lower mean age (73.1 ± 6.7), our study had a much higher mean age and consisted largely of females (74.5%) and 70% functionally dependent individuals. Furthermore, while our study did not evaluate body composition, Tufan and colleagues assessed body composition via bioimpedance measurements. In a study by Öztürk and colleagues involving patients receiving home health care, high BMI was found to be a protective factor against functional dependence [33]. In this study, activities of daily living were assessed via the Barthel Index. The Barthel Index is known to be more sensitive than the Katz Index, our measurement tool, in measuring the degree of dependence, particularly in tasks requiring mobility. However, because it includes mobility items such as walking and climbing stairs, it may have reflected “protectiveness” in individuals with high BMIs who scored high. Öztürk and colleagues used only bivariate correlation and group comparisons; they did not control for confounding factors such as age and nutrition. However, in our study, although BMI was not significantly correlated, it was seen as a significant risk factor in the regression model after controlling for other parameters. This may indicate that the true negative effect of BMI on functional dependence becomes clear only when other variables, such as nutrition and cognitive status, are controlled for. Although the literature generally associates low BMI with sarcopenia and frailty, our study suggests that in the oldest-old group, the mechanical load and immobility associated with excess weight create a condition similar to sarcopenic obesity, increasing functional dependency. A meta-analysis revealed that sarcopenic obesity increases physical disability (OR 2.92) much more than does sarcopenia or obesity alone [34]. Considering that individuals over the age of 70 should be considered at high risk for sarcopenic obesity and given the average age in our study, BMI remains an independent predictor even

when nutritional status and cognitive function are controlled for, which reinforces our results that increasing BMI is an important risk factor that needs to be managed in this age group in terms of functional losses [35].

Limitations

Our study has several limitations. First, this was a single-center cross-sectional study. The population consists predominantly of women. The effect of the gender factor on the variables should not be overlooked in the interpretation. Body composition was not assessed in our study. The Katz index, which we used as a measurement tool, is a superior tool for determining daily basic activities and may have led to instrumental dependencies being overlooked.

Conclusion

Our study demonstrated that functional dependency is quite high in the oldest old group and that this dependency is not solely related to chronological aging but is shaped by the interaction of cognitive status, nutrition, psychological factors, and body composition. The MMSE cutoff value of 26 points emphasized that functional dependency increases even in individuals with mild cognitive impairment. Our findings regarding BMI suggest that the obesity paradox proposed for mortality in older individuals may not apply in terms of functional independence. An increased BMI in this group may indicate increased mechanical load and possibly sarcopenia, suggesting that functional decline may increase through sarcopenic obesity mechanisms. A multidisciplinary approach is needed to prevent functional dependence in this age group, including early detection and preservation of cognitive reserve, improvement of nutritional status, management of depressive symptoms, and monitoring of BMI.

Declarations

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Authors' contributions: A.A. conceptualized and designed the study, collected the data, performed the analyses, drafted and wrote the manuscript, reviewed and discussed the results, and supervised the study. H.A.A. drafted and wrote the manuscript, supervised the study, and performed critical revision and finalization of the text.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics approval and consent to participate

Ethical approval was obtained from the Balıkesir Ataturk City Hospital Ethics Committee (Date: 15 January 2026, Decision No: [302137216]). The study was conducted in accordance with the principles of the Declaration of Helsinki and the guidelines of Good Clinical Practice. Owing to the retrospective nature of the study, the requirement for informed consent was waived by the Ethics Committee.

Competing interests

The authors declare that they have no competing interests.

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Figures

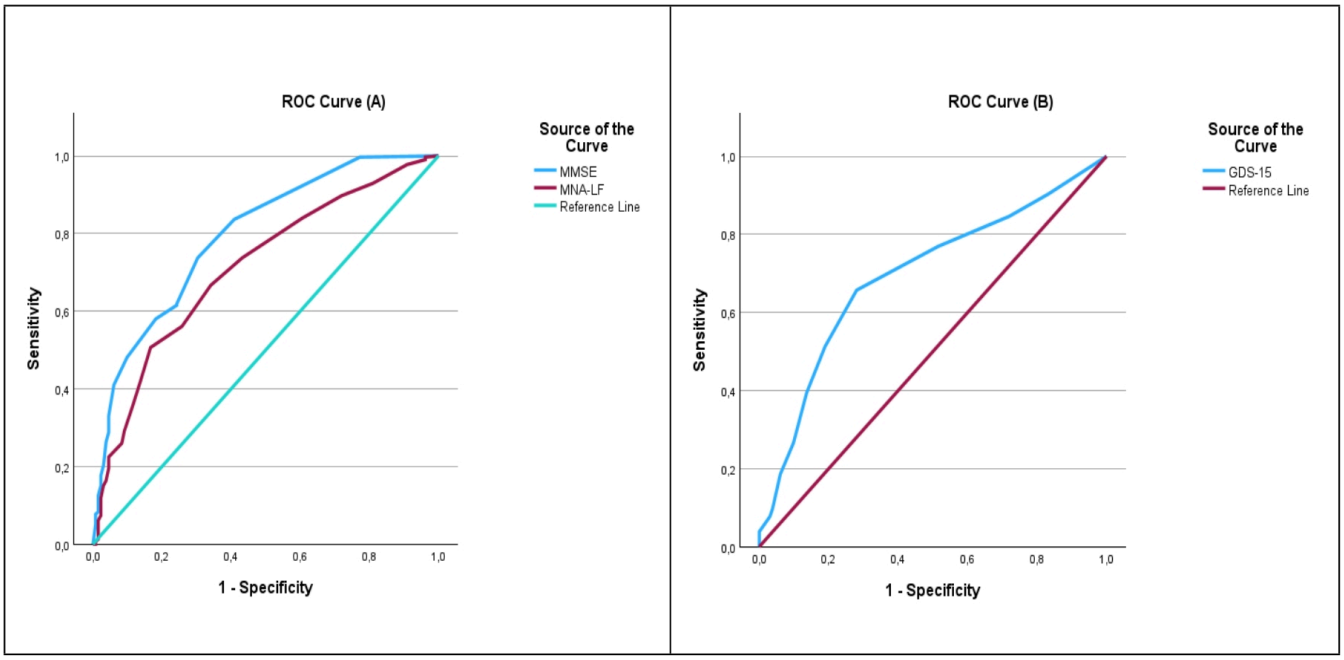


Figure 1

Receiver operating characteristic (ROC) curves for predicting functional dependence: (A) MMSE and MNA-LF scores and (B) GDS-15 score. Abbreviations: MMSE, Mini-Mental State Examination; MNA-LF, Mini Nutritional Assessment-Long Form; GDS-15, Geriatric Depression Scale-15.