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Exploring the relationship between decreased functionality rating and lower admitted anthropometrical indices in geriatric medical patients

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Abstract

Aims: This study seeks to investigate the correlation between diminished functionality and reduced anthropometric indices in geriatric medical patients, wherein ageing is associated with a physiological decline in organ or tissue function, diminished regulatory capacity, decreased reserves, or increased vulnerability to diseases or loss of abilities.

Methods: The study was conducted at the King Hussein Medical Centre in Amman, Jordan, focusing on geriatric patients admitted for medical treatment. It used a retrospective observational design from January 2003 to May 2024, examining patients' functional status assessments using the Geriatric Functionality Rating Scale (GFRS). The study also investigated the regressional association between patients' GFRS scores and factors like body mass index and geriatric nutritional risk indexes. Independent variables like age, gender, admission duration, and comorbidity were also examined. The study used a significance level of $p<0.05$ for statistical significance.

Results: This retrospective observational study evaluated 641 geriatric patients who were medically admitted, revealing that approximately 45.71% (293 patients) were categorised as having higher functionality, as indicated by a geriatric functionality rating scale (GFRS) exceeding 30, and consequently classified as the self-sufficient cohort or Group I. Conversely, roughly 54.29% (348 patients) were classified as exhibiting diminished functionality, as seen by a GFRS ≤30, and thus considered either self-sufficient or necessitating designated institutional care in Group II.

Conclusion: This study demonstrated a positive regression association between the two primary geriatric assessment tools: the GNRI for malnutrition evaluation and the GFRS for functionality and dependency assessment. The ageing of patients and male gender adversely affected the functionality of geriatric patients. The regulation of nutritional supplements is a critical issue in clinical practice that necessitates recognition and intervention from both physicians and other collaborative medical personnel.

Keywords: Geriatric Functionality; Geriatric Functionality Assessment Score; Body Mass Index; Elderly With Wasting Syndrome; Patients Hospitalised For Medical Treatment

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1. Introduction

The increasing older demographic acknowledges ageing as a natural phenomenon; yet, it may also result in suboptimal health conditions. The health situation is chiefly accountable for the decline in functionality among the aged. Nonetheless, a reduced capacity for independent functioning in daily tasks is strongly correlated with impaired rehabilitation potential, resulting in a lower quality of life and increased mortality rates. The dimensions of functionality include physical mobility, activities of daily life, and the maintenance of social activities and connections. The general functioning may indicate an individual's morbidity and overall health condition [1-4].

The Geriatric Functional Rating Scale (GFRS) is a tool employed to assess the functional abilities of elderly people, facilitating the identification of persons who can operate independently, those requiring partial or complete support, and those need institutional care. The measure evaluates physical, mental, and functional capacities, community support, living conditions, familial and social relationships, and financial status [5-7].

Malnutrition is a common geriatric syndrome that often coexists with other indicators of overall geriatric disabilities, such as functional impairment, frailty, and comorbidity. This condition is typically linked to the detrimental cycle of reduced protein synthesis and increased muscle hypercatabolism relative to anabolism, thereby elevating the risk of sarcopenia in this specific cohort [8-10].

Decreased anthropometric indices, mostly indicated by body mass index, may denote nutritional deficiency diseases, notably significant sarcopenia linked to ageing or chronic wasting syndromes, such as cachexia, coupled with comorbidities. The correlation between body mass index and reduced functionality in elderly adults is most pronounced when BMI is below 18.4 kg/m^2. Reduced functioning correlates with diminished anthropometric index values in elderly individuals. Reduced anthropometric indices correlate with diminished functionality in medical inpatients. Increased utilisation of hospital treatment by individuals with lower anthropometric indices, which were practically imperceptibly low, was also recorded [11-13].

The Geriatric Nutritional Risk Index (GNRI) is a screening instrument for hospitalised senior patients, employing height, weight, and blood albumin levels to forecast nutrition-related problems. It is based on approaches akin to the Patient-Generated Subjective Global Assessment and has demonstrated considerable effectiveness in predicting the nutritional status of elderly people. The Geriatric Functional Rating Scale (GFRS) is an instrument utilised to evaluate the functional capabilities of aged patients, differentiating between individuals who can operate autonomously and those need institutional care. The assessment measures physical, mental, and functional capabilities, community support, living circumstances, interpersonal connections, and financial position. The minimum score is -118, while the greatest score is +101. Scores beyond 40 signify the capacity for independent living without institutional assistance. Patients with scores between 20 and 40 necessitate supportive care but do not require institutionalisation; they may find a day care program advantageous. Patients with scores below 20 necessitate therapy in an appropriate facility [14-17].

Adiposity, or obesity, is mostly assessed either body fat percentile or waist circumference. Anthropometric measures, such as BMI, are more reliant on physical robustness, whereas diminished functionality impacts obesity. Untrained functionally ill individuals with high fat percentiles are easy to encounter. There is an absence of consistent data about the correlation/.n between a decline in functionality and BMI. The objective is to investigate the correlation between diminished functionality ratings and reduced anthropometric indices in elderly patients, positing that a decline in functionality correlates with lower anthropometric indices, which may necessitate the development of a weight loss intervention for geriatric inpatients. Additionally, we aimed to investigate the regression relationship of geriatric body mass indices, as a predetermined anthropometric index in this study, alongside patients utilising validated geriatric nutritional risk tools such as the GNRI tool to predict the likelihood of achieving higher functionality status compared to lower functionality status [18-22].

2. Methods and Materials

This study is a retrospective study conducted on patients admitted to King Hussein Medical Centre at the Royal Medical Services in Amman, Jordan, between 2023 and May 2024. The study focused on geriatric patients aged 65 years or older, encompassing both females and males. Patients were divided into two age groups: those older than 75 years and those aged 65 to 75 years. This study was approved by our institutional review board of the Royal Medical Survives (JRMS) committee on 4 February 27, 2025 under registration number of 1_2/2025 and was finally approved for publication at 26 February 27, 2025.

The observational study encountered a cohort of geriatric medical patients with decreased functionality. The primary study outcome was defined as the relationship between decreased functionality and lower anthropometrical indices. In adjunctive to the geriatric participants' demographics and anthropometrics, the biochemical test of albumin level was evaluated in this study and additionally the evaluated patients' prognostic factors included primarily the patients' functional status and corresponding dependency for assistance as measured by the geriatric functional rating scale (GFRS)., the geriatric nutritional risk grading indicated by the geriatric nutritional risk index (GNRI), the comorbidity burden assessed through the age-adjusted Charlson comorbidity index (AACCI),

The study included chi-square and multiple logistic regression tests for statistical analysis. The primary outcomes of interest were assessed using the geriatric functionality rating scale (GFRS), which was initially categorised into two groups: a higher functionality state, indicated by GFRS>30 and designated as Group I, and a lower functionality status, indicated by GFRS≤30 and designated as Group II. The distribution rates of tested geriatric independent variables across Groups I and II were evaluated using chi-square analysis, with results reported as numerical values (percentages), odds ratios (where statistically significant), and p-values. We conducted a multiple logistic regression analysis to investigate the association between the body mass indexes of the studied patients and geriatric anthropometric impacts, considering other potential confounders in relation to clinical functionality outcomes, particularly the geriatric nutritional risk index (GNRI). This analysis allowed us to explore the regression coefficients, their directional impacts, standard errors, and 95% confidence intervals. Additionally, the sensitivity indices, specificity, sensitivity, and accuracy index were extracted in this work, along with the prediction variability range and a developed multiple logistic regression model.

3. Results

This retrospective observational study evaluated 641 geriatric patients who were medically admitted, revealing that approximately 45.71% (293 patients) were categorised as having higher functionality, as indicated by a geriatric functionality rating scale (GFRS) exceeding 30, and consequently classified as the self-sufficient cohort or Group I. Conversely, roughly 54.29% (348 patients) were classified as exhibiting diminished functionality, as seen by a GFRS ≤30, and thus considered either self-sufficient or necessitating designated institutional care in Group II.

Nearly 49.29% (316 patients) achieved favourable outcomes, whereas nearly 50.70% (325 patients) encountered adverse outcomes. This analysis reveals statistically significant changes in distribution rates between the two functionality-based groupings (Group I-II) [p-value=0.002]. A greater distributional rate was noted among females in the higher functionality cohort (Group I), but a higher distributional rate was recorded for men in the corresponding lower functionality cohort (Group II) [165 (56.3%) and 195 (56.0%), respectively].

The geriatric patients in this study were categorised based on age into two groups: those aged below 75 years and those aged 75 years and above. In this study, we found a statistically significant difference in the distributional rates between Group I and II (p-value=0.008), with approximately 56.2% (360 patients) of the tested geriatric population exceeding 75 years of age, and approximately 43.8% (281 patients) aged between 65 and 75 years.

The estimated average length of hospitalisation for the examined elderly patients was 7 days, which was utilised to categorise patients' hospital length of stay (HLOS) into shorter HLOS (<7 days) and extended HLOS (≥7 days). The patients' hospital length of stay (HLOS) demonstrated a statistically significant difference between the two groups (Group I-II), with approximately 51.5% (151 patients) of the evaluated geriatric patients exhibiting a higher functionality status having an HLOS of less than 7 days. In contrast, all geriatric patients classified as having lower functionality, as indicated by a GFRS of 30 or less, had an HLOS of 7 days or more.

This analysis demonstrated statistically negligible changes in distributional rates between Groups I and II (p-value=0.274), with an unadjusted odds ratio of 0.837 (95% CI; 0.61-1.15). Nonetheless, the discrimination criteria for dichotomizing the obesity statuses of senior individuals, as indicated by their measured BMI, were established at 30 kg/m^2. The total distribution rates for higher obesity statuses in this study were about 39% (250 patients), whereas the distribution rates for lower obesity statuses were around 61% (391 patients).

This study demonstrated a statistically significant variation in functional distribution rates among the geriatric patients in Group I and Group II (p-value=0.000). The abstracted distribution rates indicated that approximately 31.4% (201 patients) had an age-adjusted Charlson Comorbidity Index (AACCI) below the threshold of 7 points (lower comorbidity burden), while approximately 68.8% (440 patients) had an AACCI exceeding 7 points (higher comorbidity burden). This study revealed a distribution rate of approximately 87.6% (305 patients) for geriatric patients with a higher comorbidity burden (AACCI≥7) in the lower functionality cohort (Group II). Conversely, it also indicated a distribution

rate of approximately 53.9% (158 patients) for geriatric patients with a lower comorbidity burden (AACCI<7) in the higher functionality cohort (Group I). The chi-square analyses are provided in Table 1 below.

A conducted multiple logistic regression model exhibited a variability range (VR) of 69.1% to 92.4% in predicting the assessed dependent variable; it suggested a heightened probability of diminished functionality status and, therefore, an escalated reliance on institutional care, in contrast to an elevated functionality status and decreased dependence on institutional or specialised facility care. The statistical significance was denoted by $\chi 2$ (8)=35.359, p=0.000, with the resultant specificity (true negative rate or TNR), sensitivity (true positive rate or TPR), and accuracy indices evaluated at 98.6%, 94%, and 96.1%, respectively. Table 2 presents multiple logistic regression analyses for the two independent variables studied in connection to the patients' GFRS.

Table 1 Patients' comparative tested variables across higher functionality cohort (Group I) and lower functionality cohort (Group II).

	Group I GFRS>30 (293, 45.71%)	**Group II GFRS≤30 (348, 54.29%)**	**Overall** 641	**OD**	**P-Value**
Gender					
F	165 (56.3%)	153 (44.0%)	318 (49.6%)	1.643 (95% CI; 1.201-2.247)	0.002
M	128 (43.7%)	195 (56.0%)	323 (50.4%)		
Age (Years)					
<75	145 (49.5%)	136 (39.1%)	281 (43.8%)	1.527 (95% CI; 1.115-2.091)	0.008
≥75	148 (50.5%)	212 (60.9%)	360 (56.2%)		
HLOS (days)					
<7	151 (51.5%)	0 (0.0%)	151 (23.6%)	3.451 (95% CI; 3.004-3.964)	0.000
≥7	142 (48.5%)	348 (100.0%)	490 (76.4%)		
BMI (Kg/m2)					
<30	172 (58.7%)	219 (62.9%)	391 (61.0%)	0.837 (95% CI; 0.61-1.15)	0.274
≥30	121 (41.3%)	129 (37.1%)	250 (39.0%)		
ALB (g/dl)					
<2.85	2 (0.7%)	323 (92.8%)	325 (50.7%)	0.001 (95% CI; 0.000-0.002)	0.000
≥2.85	291 (99.3%)	25 (7.2%)	316 (49.3%)		
AACCI					
<7	158 (53.9%)	43 (12.4%)	201 (31.4%)	8.301 (95% CI; 5.6-12.3)	0.000
≥7	135 (46.1%)	305 (87.6%)	440 (68.6%)		

A chi-square test was performed to analyse the variability in distribution rates of various tested variables between two groups: patients exhibiting higher functionality, as indicated by a geriatric functional rating scale exceeding 30 (Group I), and geriatric patients demonstrating lower functionality, as indicated by a GFRS below 30 (Group II).

cOI: Composited outcomes of interests; F: Females; M: Males; OD: Odd ratio.

GNRI: Geriatric nutritional risk index.; AACCI" Age adjusted charlson comorbidity index; GFRS: Geriatric functional rating scale.

Table 2 Multiple logistical regressional analyses for the dual examined independent variables in relation to the patients' GFRS.

Model				**Sig.**	**95.% CI B**	
	B±SE	**Exp (B)**			**LL**	**UL**
BMI	0.064±0.031	1.066		0.039	1.003	1.133
GNRI	-0.282±0.036	0.754		0.000	0.702	0.810
Constant	23.490±3.185	1.6×10^{10}		0.000		
The multiple logistical regression model exhibited a variability range (VR) of 69.1% to 92.4% in predicting the assessed dependent variable, suggesting a higher probability of diminished functionality status and, therefore, greater reliance on institutional care, in contrast to enhanced functionality status and decreased dependence on institutional or specialised facility care. The statistical significance was denoted by $\chi 2$ (8) =35.359, p=0.000, with the resultant specificity (true negative rate or TNR), sensitivity (true positive rate or TPR), and accuracy indices evaluated at 98.6%, 94%, and 96.1%, respectively.						
GFRS: Geriatric functional rating scale; B: Regressional coefficient; SE: Standard of error; CI: Confidence intervals			GNRI: Geriatric nutritional risk index; LL: Lower interval limit; UL: Upper interval limit.			

4. Discussion

The study investigates the correlation between a geriatric patient's functionality rating and their anthropometric indices, particularly among independently living geriatric patients. Lower anthropometric indices accompanying decreased functionality are encountered, especially among the independently living geriatric population. Elderly patients with frailty frequently experience difficulties in chewing and swallowing, diminished appetite, and inadequate food consumption, resulting in malnutrition. Therefore, the assessment and management of nutritional status should be integrated into the standard care for frail older adults [23-26].

Low anthropometrics indicate low muscle mass. Many studies have researched the relation between frailty, malnutrition, and sarcopenia, but these entities are not interchangeable. Validated instruments for screening frailty were used to evaluate frailty status, including patient fatigue, weight loss, ambulation capabilities, and the presence of acute and chronic inflammatory conditions. However, these encountered criteria pertain to the quantification of patients meeting the specified criteria [27-30].

The study population includes aspects of patient care such as functionality, mental status, and social status, which is important for generalizability. Functionality can be studied by objective measurements or asking a patient about their limitations in activities of daily living. To enhance the physical and psychological quality of life for geriatric patients, the integrated approach of multi-disciplinary geriatric nutrition assessment should be reinforced to ascertain the specific nutritional requirements of each individual and formulate geriatric care plans [31-33].

Decreased functionality ratings have been linked to decreased body indices, such as grip strength and gait speed. Decreased functionality is associated with multiple adverse health outcomes, such as higher usage rates of medication, higher readmission rates, and higher mortality rates in geriatric medical patients. There is limited published research to demonstrate the relation between decreased admission functionality rating and low indices in relation to a general medical population [34-37].

The study analyzed 983 outpatient clinic admissions, with a mean age of 81 years and 53% being female. 22% of patients had a decreased informed consent functionality rating on their first visit to the outpatient clinic, with a mean difference of -0.3. 44% of patients died during hospital admission. Patients with decreased functionality were admitted with lower anthropometrical indices, and after adjustment for BMI, a lower functionality rating was independently associated with lower total body mass (TC), but no longer present for UCE and CRP. Both lower TC, TO, and Albumin were linked with increased mortality [38-42].

The results support the idea that screening for undernutrition with practical tools such as the MNA-SF and assessment of muscle mass and strength will identify patients with a higher risk of developing postoperative complications in a geriatric surgical population. Further research is needed to determine the cause and effect of decreased muscle mass and strength in this population [43-46].

This study aimed to assess the prognosis of geriatric patients in dichotomised outcome groups: superior and inferior, and extract pertinent regression associations in relation to the prognostic dependent variables of both patients' ages and genders. The Geriatric Nutritional Risk Index (GNRI) is a tool used to assess the nutritional risk of individuals aged 65 and older who may be at risk of malnutrition. The GNRI has been demonstrated to be a reliable predictor of malnutrition in various clinical settings, including hospitalized elderly patients and individuals undergoing treatment for various conditions, including cardiovascular disease [47-49].

The GNRI score is calculated using various methodologies, such as standard assessments, which produce a wide range of scores that extend from 0 to 100. Malnutrition is not a concern when the score is near 100 (98 is the threshold). However, these categorised thresholds, which differentiate between low, moderate, and high nutritional risks, exhibited high sensitivity indices, albeit in a variable manner. It is noteworthy that the assessment of GNRI may be conducted by nurses, dietitians, nutritionists, geriatricians, or other physicians, provided that they are healthcare professionals who regularly supervise patients. Furthermore, the GNRI rating can be implemented in a variety of clinical settings, such as oncological or chronic patients, inpatients, and outpatients [50-54].

Five studies have been conducted on the GNRI in medically admitted patients, comprising a combination of postoperative and medical admissions, involving diverse patient groups with varying conditions and demographics. The evidence supporting the GNRI in medically admitted hospitalized patients was substantial; however, there were constraints in establishing an international benchmark and ambiguities regarding the presence of certain risk factors at baseline. Collectively, these five studies indicate that the GNRI possesses prognostic significance in medically admitted patients, potentially advantageous across diverse clinical practices [55-58].

This study highlights the importance of nutritional assessment in elderly patients due to the rapid physiological, pathological, social, and economic changes that have occurred in the last two decades. The study highlights the differences between older geriatric patients (≥75 years) and younger elderly geriatrics (65-75 years), including impaired digestive function, altered taste perception, slowed peristalsis, diminished thirst response, and heightened vulnerability to dehydration. The lack of dental reform leads to dysphagia and challenges in mastication, prompting the elderly to avoid viscous foods, resulting in nutritional deficiencies.

The calculated odds ratio in this study was 1.643 (95% CI; 1.201-2.247), indicating that the geriatric males tested exhibit a considerably greater propensity for decreased functioning and a higher likelihood of requiring institutional care compared to the geriatric females examined. This study demonstrated a positive risk ratio for elderly individuals over 75 years of age, indicating a tendency for diminished functionality, as seen by GFRS≤30, with an odds ratio of 1.527 (95% CI; 1.115-2.091). This study demonstrated a statistically significant link between lengthy hospitalisation exceeding 7 days and the functional state of geriatric individuals admitted for medical reasons, with a high odds ratio of 3.451 (95% CI; 3.004-3.964). This study did not demonstrate a statistically significant variation in distributional rates between the two compared groups, the greater functionality cohort (Group I) and the lower functionality cohort (Group II), with an abstracted p-value of 0.274. Upon conducting multiple logistic regression analyses to investigate the association between the body mass indexes of the tested geriatric patients and their assessed geriatric nutritional risk indexes, we found a statistically significant adjusted association (p-value=0.039) with a regression coefficient of 0.064±0.031 and a propensity risk of 1.066 (95% CI; 1.003-1.133) concerning the likelihood of lower functionality statuses compared to higher functionality statuses. This study demonstrated a positive directional regression association between the anthropometric measurements of the tested patients, indicated by the body mass indexes of geriatric patients, and the dependent variable of functionality status, which correlates with increased dependency on specialised care facilities. However, this positive regression association was negated by the significant impact of the patients' nutritional risk, as indicated by the geriatric nutritional risk index (GNRI), which exhibited a negative directional and statistically significant association of -0.282±0.036, with a propensity risk estimate of 0.754 (95% CI; 0.702-0.810). This study demonstrated a statistically significant unadjusted association of 8.301 (95% CI; 5.6-12.3) between a higher comorbidity burden, indicated by geriatric patients with an AACCI exceeding the threshold of 7, and a propensity for lower functionality statuses, as assessed by a GFRS below the threshold of 30.

Decreased functionality in daily life in older adults correlated with lower anthropometric measures associated with muscle quality. This study can be used by healthcare professionals, mainly geriatricians and physical therapists, in daily clinical practice. All older patients presenting at the hospital should be thoroughly screened for decreased muscle mass, which may benefit from specific outcomes after and during hospitalization. Interdisciplinary cooperation between physicians and physical therapists is essential for patients with decreased muscle mass, which will be even more important in hospitals due to a shortage of nurses and increasing demands [1-4]. In conclusion, a decreased preoperative functionality classification within a geriatric fracture population was found to be related to lower anthropological indices. Healthcare policymakers, education practitioners, and evidence-based practice implementers

should consider anthropometrical status in geriatric patients to pre-determine life-threatening postoperative health outcomes due to impaired competence. Future research should explore the effect of intervention in patients with many comorbidities and incorporate anthropometrical assessments in regular history taking [59-60].

5. Conclusion

This study demonstrated a positive regression association between the two primary geriatric assessment tools: the GNRI for malnutrition evaluation and the GFRS for functionality and dependency assessment. The ageing of patients and male gender adversely affected the functionality of geriatric patients. The regulation of nutritional supplements is a critical issue in clinical practice that necessitates recognition and intervention from both physicians and other collaborative medical personnel.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest in this manuscript.

Statement of ethical approval

This study received initial approval from the Jordanian Royal Medical Services (JRMS) Institutional Review Board (IRB) at 4 February 2025 under registration number 1_2/2025. This sanctioned study received formal approval for publishing following evaluation by our institutional Directorate of Professional Training and Planning at 26 February 2025.

Statement of informed consent

Owing to the retrospective design of this study, the informed consent form was waived.

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