ISSN Print: 2664-6064
ISSN Online: 2664-6072
IJAN 2024; 6(1): 129-135
www.agriculturejournal.net
Received: 13-02-2024
Accepted: 21-03-2024

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Investigating nutritional status and body composition in geriatric outpatient clinics in Baghdad Teaching Hospital: Unveiling the importance of muscle screening

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DOI: https://doi.org/10.33545/26646064.2024.v6.i1b.152

Abstract
Background: Malnutrition is a significant concern for elderly adults due to its impact on physical and cognitive function. This study investigates the prevalence and contributing factors of malnutrition in elderly outpatients in Baghdad, Iraq. The study aims to determine the prevalence of malnutrition, identify associated factors, and highlight the importance of combining BMI with muscle screening tools for a more comprehensive assessment.
Methods: A cross-sectional study design was used with 190 elderly outpatients recruited from Baghdad Teaching Hospital. Data collection included demographics, anthropometric measurements {body mass index (BMI), Mid-Upper Arm Circumference (MUAC), calf circumference (CC)}, and body composition analysis.
Results: The study found a high prevalence of overweight and obesity (76.3%) with a concerning rise in obesity among the 60-69 age group. Females exhibited a higher obesity rate, and a history of chronic diseases was linked to a greater risk of overweight or obesity. Body composition analysis revealed concerning trends: over 88% had excess body fat mass, while over 35% suffered from low Skeletal Muscle Mass (SMM) Low MUAC and CC were significantly associated with lean arms and legs, respectively, indicating potential malnutrition.
Conclusions: This study highlights a critical public health concern of high overweight/obesity prevalence and low muscle mass in elderly outpatients. BMI limitations as a sole indicator and the importance of incorporating muscle screening tools are emphasized. The study recommends weight management programs, interventions promoting physical activity and healthy eating, and exploring alternative body composition assessment methods alongside BMI for elderly patient evaluation.

Keywords: Malnutrition, elderly, BMI, SMM, body composition

Introduction
The global demographic landscape is experiencing a dramatic shift, characterized by a burgeoning elderly population. This phenomenon presents a double-edged sword for healthcare systems worldwide, offering opportunities for improved senior care while simultaneously introducing significant challenges. Among these challenges, malnutrition occurs in people who are either undernourished or over nourished – emerges as a pressing concern for older adults. In this population group, malnutrition carries profound consequences, impacting both physical and cognitive function. It weakens the immune system, increasing susceptibility to infections, and ultimately translates into higher morbidity and mortality rates [1].
Elderly individuals face a unique set of nutritional challenges. Age-related physiological changes, such as diminished appetite and weakened digestive function, can present hurdles to adequate food intake [2]. Social factors also play a significant role, with isolation and limited financial resources restricting access to healthy and diverse food options. Furthermore, the presence of underlying medical conditions can further complicate the situation by increasing energy demands and hindering nutrient absorption [3]. Additionally, mental health issues like

depression can further diminish interest in eating, creating a complex web of factors that contribute to malnutrition in this vulnerable population [2, 3].

Iraq's recent social and economic struggles have particularly impacted vulnerable populations like the elderly, leading to concerns about malnutrition. Existing studies suggest a high prevalence of malnutrition risk among older adults in Iraq. A Baghdad study found that over two-thirds of elderly nursing home residents were malnourished or at risk [4]. This highlights the need to investigate the prevalence and causes of malnutrition in elderly populations and the importance of using a more comprehensive assessment of elderly nutritional status.

Investigating this issue is crucial for several reasons. Early identification allows for interventions to improve health, manage chronic diseases, and potentially reduce hospital admissions. Understanding the specific factors contributing to malnutrition in this population can lead to targeted solutions like nutritional counseling, dietary education, and social support programs. Additionally, this research can inform healthcare resource allocation by guiding training for providers and potentially leading to dedicated support programs for elderly patients. Ultimately, this research can improve the nutritional status and overall health of Iraq's aging population [5].

This research primarily focuses on the prevalence and contributing factors of malnutrition in elderly outpatients, it also indirectly highlights the importance of BMI (Body Mass Index) and muscle screening tools in the context of this issue. BMI is a commonly used anthropometric tool that provides a preliminary assessment of weight status (underweight, normal weight, overweight, obese). However, it has limitations, particularly in older adults, as it doesn't distinguish between muscles mass and fat mass [6].

Muscle loss, a condition termed sarcopenia, is a significant concern in the elderly population and is often associated with malnutrition. Screening tools that assess muscle mass, such as Mid-Upper Arm Circumference (MUAC) and calf circumference (CC) can be used in conjunction with BMI to provide a more comprehensive picture of nutritional status [7]. In malnourished individuals, muscle wasting is a common consequence, and these tools can help identify this at an earlier stage. By incorporating both BMI and muscle screening tools into routine assessments, healthcare providers can gain valuable insights into the body composition of elderly patients, aiding in the diagnosis and management of malnutrition [8].

Objectives of the study

The study investigates the following objectives

1. To determine the proportion of malnutrition among elderly people attending the geriatric outpatient clinic at Baghdad Teaching Hospital.
2. To identify the factors associated with malnutrition in this population.
3. To highlight the importance of using a combination of BMI and muscle screening tools for a more comprehensive assessment of elderly nutritional status.

Subjects and methods

Study Design: A cross-sectional study with an analytic component design was used to investigate the prevalence and risk factors associated with malnutrition in elderly people attending geriatric outpatient clinics in Baghdad Teaching Hospital. This design allowed for the collection of data at a single point in time, providing a snapshot of the population being studied.

Study setting and timing: The study was conducted from October 2023 to February 2024 at geriatric outpatient clinics in a Baghdad Teaching Hospital, Iraq. This setting was chosen due to the high concentration of elderly patients seeking routine healthcare services. This setting allowed for the recruitment of a representative sample of the target population.

Study population: The study population included all elderly people attending geriatric Outpatient Clinics within Baghdad Teaching Hospital during the study period and meeting the eligibility criteria. Inclusion criteria included people aged 60 years or older and able to provide informed consent**.** Exclusion criteria included the presence of any acute or terminal illness as determined by the treating physician

Sample size and technique: A total of 190 elderly patients attending the geriatric outpatient clinics were recruited for the study. It adopted a convenience sampling approach to recruit participants. Due to limitations on time and resources, a fully randomized sampling strategy was not feasible. Participants were recruited from the elderly population attending the geriatric outpatient clinic of Baghdad Teaching Hospital during the designated study timeframe. The study included only participants who met eligibility criteria and provided written informed consent.

Data collection tools: Data for this study was collected from elderly people attending geriatric outpatient clinics in a Baghdad Teaching Hospital, Iraq. A standardized questionnaire was used to gather demographic information including age, gender, education level, income, marital status, and any co-morbid conditions. Nutritional status was then assessed using a multi-faceted approach, employing validated malnutrition screening tools such as MAUC, CC, and bioelectrical impedance analysis via the in body 270 Scale.

Data management and analysis: The data was coded and entered into SPSS version 26. Descriptive statistics (frequencies and percentages) were generated to summarize socio-demographics. Statistical analyses were performed to determine the prevalence of malnutrition and identify factors associated with malnutrition among the study participants. Chi-square tests were used to examine associations between independent variables (socio-demographic characteristics, body composition variable) and the dependent variable (presence of malnutrition). The level of statistical significance was established at $p< 0.05$.

Ethical considerations: The Research Ethics Committee of the Directorate of Public Health of the Ministry of Health of Iraq approved the protocol of this study. All participants gave their informed consent in writing before starting the study. The anonymity and confidentiality of the data was maintained throughout the study.

Data availability: Due to ethical considerations and privacy concerns, the data of individual participants cannot be publicly shared.

Results

This study focuses on malnutrition in elderly patients visiting a geriatric clinic. It aims to determine how widespread it is, pinpoint factors influencing it like social background, health issues, and social support, and emphasize the value of combining BMI with muscle assessments for a more thorough evaluation of elderly nutrition.

Table 1 presents the socio-demographic characteristics of the 190 participants included in the study and investigates their association with malnutrition. The weight distribution of the study sample shows a mean of 76.92 ± 15.47 kg, and the height distribution has a mean of 162.38 ± 12.11 cm. In terms of BMI, 44.2% of the participants were classified as obese, while 32.1% were overweight and 23.7% were normal weight. The age distribution reveals a concentration in the 60-69 years old category (60.5%), followed by 70-79 years old (33.2%) and those above 80 (6.3%). The sample comprised slightly more males (58.9%) than females (41.1%). Marital status indicated a majority of married participants (73.7%), with singles (14.2%) and separated/divorced individuals (12.1%) following. Educational attainment showed nearly half (47.4%) having an illiterate or primary education level, while 21.6% had intermediate or secondary education, and 31.1% reached graduate or postgraduate levels. Regarding income, a larger portion (73.7%) reported having income, while 26.3% did not. Finally, a significant proportion (79.5%) of participants acknowledged having a chronic disease, with the remaining 20.5% reporting no chronic conditions.

The analysis of overweight and obesity reveals significant trends. Age emerges as a crucial factor (P=0.001) with a dramatic rise in obesity prevalence within the 60-69 age group (55.7%) compared to older participants. Gender also bears influence, with females exhibiting a higher obesity rate, while males have a larger overweight percentage. Interestingly, marital status, educational level, and income level did not display statistically significant associations with Body Mass Index (BMI). However, a noteworthy finding is the strong link between a history of chronic diseases and a higher risk of overweight or obesity (79.5%) (P=0.004).

Table 1: Association of BMI with the socio-demographic distribution of the study sample

Variable	Normal 45 (23.7)	Over wt. 61 (32.1)	Obese 84 (44.2)	Total 190 (100.0)	P-value
Age (in years)					
60-69	26 (22.6)	25 (21.7)	64 (55.7)	115 (60.5)	0.001
70-79	17 (27.0)	29 (46.0)	17 (27.0)	63 (33.2)	
80 +	2 (16.7)	7 (58.3)	3 (25.0)	12 (6.3)	
Sex					
Male	33 (29.5)	39 (34.8)	40 (35.7)	112 (58.9)	0.011
Female	12 (15.4)	22 (28.2)	44 (56.4)	78 (41.1)	
Marital status					
Married	36 (25.7)	44 (31.4)	60 (42.9)	140 (73.7)	0.782
Single	5 (18.5)	8 (29.6)	14 (51.9)	27 (14.2)	
Separated, divorced	4 (17.4)	9 (39.1)	10 (43.5)	23 (12.1)	
Education level					
Illiterate & Primary	21 (23.3)	33 (36.7)	36 (40.0)	90 (47.4)	0.679
Intermediate & Secondary	11 (26.8)	12 (29.3)	18 (43.9)	41 (21.6)	
Graduate and Postgraduate	13 (22.0)	16 (27.1)	30 (50.8)	59 (31.1)	
Income state					
Has income	35 (25.0)	44 (31.4)	61 (43.6)	140 (73.7)	0.794
Not has	10 (20.0)	17 (34.0)	23 (46.0)	50 (26.3)	
History of chronic diseases					
Yes	28 (18.5)	51 (33.8)	72 (47.7)	151 (79.5)	0.004
No	17 (43.6)	10 (25.6)	12 (30.8)	39 (20.5)	

In Table 2 the analysis of body composition in the participant group identified a concerning trend. Over 88% of participants exhibited body fat mass exceeding the healthy range, with nearly two-thirds demonstrating excess visceral fat, a particularly dangerous type accumulating around organs. In contrast, skeletal muscle mass (SMM) showed worrying deficiencies. Over a third (more than 35%) of participants had levels below the normal range. This imbalance between fat and muscle content suggests a potential lack of physical activity or unhealthy dietary patterns within the study population. While CC and MAUC remained mostly within the normal range, waist-hip ratio (WHR) distribution presented a contrasting picture. Only one-third (33.7%) were classified with a normal WHR, while the majority (66.3%) exhibited a high ratio.

Further analysis revealed a statistically significant link (p-value < 0.001) between BMI and the composition of water, protein, and minerals. Individuals with a normal BMI possessed the highest proportion of these components within the "normal" category, whereas those classified as obese displayed the highest proportion in the "over" category. This suggests a potential decline in water, protein, and mineral content as BMI increases.

A strong association (p-value < 0.001) was also evident between BMI and body fat. The vast majority (88.4%) of overweight or obese participants had high body fat mass, indicating a positive correlation between BMI and fat content. Similarly, BMI demonstrated a significant connection (p-value < 0.001) with SMM. Individuals with a normal BMI had the highest proportion in the "normal" category for SMM, while those with obesity were most prevalent in the "under" category. This suggests a decrease in muscle mass with increasing BMI. This relationship between BMI and muscle mass extended to MAUC, and CC with a significant association observed (p-value < 0.001). Normal-weight individuals had the highest percentage in the

"normal" category for MAUC, while overweight/obese individuals were more likely to fall under the "under" category. This suggests a potential decrease in lean arm muscle with increasing BMI. Additionally, a significant association existed (p-value < 0.001) between BMI and WHR. Normal-weight individuals had the highest percentage in the "normal" category, while overweight/obese individuals were more prevalent in the "high" category. This indicates a trend towards a more central fat distribution with increasing BMI.

Interestingly, BMI did not exhibit a strong association with leg lean mass (p-value = 0.21). This suggests that the leg's lean mass might be less influenced by overall weight status compared to other muscle compartments.

Table 2: Association of BMI with various body composition measurements of the study sample

Variable	Normal 45 (%)	Over wt. 61 (%)	Obese 84 (%)	Total 190 (%)	P-value
Total body water					
Under	5 (55.6)	4 (44.4)	0 (0.0)	9 (4.7)	0.001
Normal	40 (29.2)	53 (38.7)	44 (32.1)	137 (72.1)	
Over	0 (0.0)	4 (0.1)	40 (90.9)	44 (23.2)	
Protein					
Under	34 (54.0)	18 (28.6)	11 (17.5)	63 (33.2)	0.001
Normal	11 (10.2)	43 (39.8)	54 (50.0)	108 (56.8)	
Over	0 (0.0)	0 (0.0)	19 (100.0)	19 (10.0)	
Mineral					
Under	11 (64.7)	6 (35.3)	0 (0.0)	17 (8.9)	0.001
Normal	28 (22.0)	49 (38.6)	50 (39.4)	127 (66.8)	
Over	6 (13.0)	6 (13.0)	34 (73.9)	46 (24.2)	
Body fat mass					
Normal	21 (95.5)	1 (4.5)	0 (0.0)	22 (11.6)	0.001
Over	24 (14.3)	60 (35.7)	84 (50.0)	168 (88.4)	
SMM					
Under	34 (50.0)	24 (35.3)	10 (14.7)	68 (35.8)	0.001
Normal	11 (11.8)	36 (38.7)	45 (49.5)	93 (48.9)	
Over	0 (0.0)	1 (3.4)	28 (96.5)	29 (15.3)	
MAUC					
Under	14 (70.0)	4 (20.0)	2 (10.0)	20 (10.5)	0.001
Normal	31 (18.2)	57 (33.5)	82 (48.2)	170 (89.5)	
Arms lean					
Under	15 (50.0)	14 (46.7)	1 (3.3)	30 (15.8)	0.001
Normal	30 (18.8)	47 (29.4)	83 (51.9)	160 (84.2)	
Calf circumference					
Under	12 (75.0)	3 (18.8)	1 (6.3)	16 (8.4)	0.001
Normal	33 (19.0)	58 (33.3)	83 (47.7)	174 (91.6)	
Legs lean					
Under	29 (23.4)	45 (36.3)	50 (40.3)	124 (65.3)	0.21
Normal	16 (24.2)	16 (24.2)	34 (51.5)	66 (34.7)	
Waist-hip ratio					
Normal	33 (51.6)	21 (32.8)	10 (15.6)	64 (33.7)	0.001
High	12 (9.5)	40 (31.7)	74 (32.1)	126 (66.3)	

Data from Table 3 demonstrates a statistically significant association between low anthropometric measurements (MUAC and CC) and malnutrition. Among elderly subjects, a low MUAC (categorized as "Under" in the table) is strongly linked to lean arms, a potential indicator of malnutrition, with 40% (8 out of 20) of individuals in this category exhibiting this characteristic. This contrasts significantly (p-value = 0.005) with the prevalence of lean arms in the normal MUAC group (12.9%, 22 out of 170), highlighting MUAC as a valuable screening tool for malnutrition risk. Similarly, CC demonstrates a clear association. All elderly subjects (100%, 16 out of 16) with calves classified as "under" have lean legs, again suggestive of malnutrition. This is statistically significant (p-value = 0.001) compared to the normal CC group, where only 62.1% (108 out of 174) have lean legs. In conclusion, this data emphasizes the utility of both MUAC and CC as effective screening tools for identifying potential malnutrition, particularly among elderly populations where low measurements in either category are linked to a significantly increased prevalence of lean limbs.

Table 3: Association of MUAC & Calf circumference with arms lean and legs lean status

MUAC	Under Arms lean	Normal Arms lean	Total	P value
Under	8 (40.0)	12 (60.0)	20 (10.5)	0.005
normal	22 (12.9)	148 (87.1)	170 (89.5)	
Calf circumference	Under Legs lean	Normal Legs lean	Total	P value
under	16 (100.0)	0 (0.0)	16 (8.4)	0.001
normal	108 (62.1)	66 (34.7)	174 (91.6)	

Discussion

This study investigates the weight distribution, body composition, and malnutrition risk factors in a sample of elderly individuals (aged 60 and above). The findings offer valuable insights into the health status of this population group, particularly regarding the prevalence of low muscle mass and its association with BMI.

Socio-demographic Associations with BMI: The study population exhibits a high prevalence of overweight and obesity (76.3%). This is consistent with global trends reported by the World Health Organization (WHO), where over 39% of adults aged 65 and over are overweight or obese [9]. Age is a significant factor, with a sharp rise in obesity prevalence in the 60-69 age group (55.7%). This finding is consistent with previous research suggesting an increased risk of weight gain with advancing age due to factors like decreased physical activity and metabolic changes [10]. Sex also plays a role, with females having a higher percentage of obesity than males, while males have a higher percentage of overweight. This is partially consistent with some studies showing a higher prevalence of obesity in women [11, 12], but may differ based on specific demographics.

Interestingly, the study found no statistically significant associations between marital status, education level, and income state with BMI. This contrasts with some studies suggesting associations between lower socioeconomic status and higher obesity risk [13-15]. Further research is needed to explore these discrepancies in the context of this specific population. A strong positive association exists between having a history of chronic diseases and being overweight or obese (79.5%). This aligns with established knowledge that obesity is a major risk factor for various chronic conditions, including heart disease, diabetes, and certain cancers [16].

Body Composition Analysis

A concerning trend emerges regarding body composition, with a high percentage of participants having elevated body fat mass and lower muscle mass. Over 88% have a body fat mass exceeding the normal range and over 35% show deficiencies in SMM. This imbalance suggests a potential lack of physical activity or an unhealthy diet in the study population. This finding is consistent with previous research demonstrating a decline in muscle mass and an increase in fat mass with aging, especially in the absence of regular exercise [17, 18].

Recent studies have emphasized the growing concern of sarcopenia, the age-related loss of SMM and function. The study reported prevalence of low muscle mass (over 35%) falls within the range observed in other studies on elderly populations [19, 20]. Additionally, this study found a significant decrease in SMM with increasing BMI, suggesting that obesity might not be protective against low muscle mass in older adults. This is consistent with some recent research challenging the "obesity paradox" theory, which previously suggested a survival benefit for overweight or obese elderly individuals [21, 22].

BMI as a Tool for Assessing Muscle Mass

The study highlights the limitations of BMI as a sole indicator of health in the elderly. While BMI identifies a high prevalence of overweight and obesity, it doesn't necessarily reflect muscle mass. This is crucial because low muscle mass, even in individuals with normal BMI, is associated with increased health risks [23-25].

Conclusions and recommendations

This study identified a critical public health concern: a high prevalence of overweight and obesity (76.3%) in elderly participants, with a concerning rise in obesity within the 60-69 age group. Gender disparity was evident; with females having a higher obesity rate and males having a larger overweight percentage. Furthermore, a strong link connected a history of chronic diseases with a greater likelihood of being overweight or obese. The analysis of body composition revealed a particularly concerning trend: over 88% of participants had excess body fat mass, while over 35% suffered from deficiencies in SMM. This highlights a potential limitation of BMI as a sole health indicator in the elderly, as it may not accurately reflect changes in muscle mass. Importantly, the study found that low muscle mass, even with a normal BMI, is associated with increased health risks. To address these findings, future efforts should focus on implementing weight management programs specifically designed for this elderly population. Additionally, interventions promoting physical activity and healthy dietary patterns are crucial to combat the observed issues of low muscle mass and excess body fat. Finally, the study underscores the need to explore alternative body composition assessment methods alongside BMI, particularly when evaluating the health of elderly individuals.

Author's contributions

Preparation of study, implementation, and collected the data by Dr. Zainab Ghassan Lutfi and Dr. Mohsin Ahmed Jasim. Data analysis and wrote the paper by Dr. Riyadh Shiltagh Al-Rudaini.

All authors subsequently undertook a critical review of the report and subsequently approved the final version.

Acknowledgments

The authors would like to thank the Research Ethics Committee of the Directorate of Public Health of the Ministry of Health of Iraq for approving this study. We are grateful to all the participants who gave their informed consent and time to participate in this research.

Conflict of interest

The authors declare that there is no conflict of interest in the publication of this article.

Financial support

The study was self-funded by the researcher and there is no funding from any institution or organization.

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