Acta Biomed 2025; Vol. 96, N. 5: 16627 DOI: 10.23750/abm.v96i5.16627

Original article

Impact of renal function decline on nutritional status in older adults: A cross-sectional analysis

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Abstract. *Introduction:* Nutrition is a key factor in maintaining health and overall well-being, particularly in older adults. One of the critical areas affected by insufficient nutrition is the decline in renal function, which can exacerbate other health issues. Decreased renal function in the elderly is due to physiological processes accompanied by changes in the anatomical structure of the kidney, such as progressive nephrosclerosis (glomerulosclerosis, tubular atrophy, and atherosclerosis). Malnutrition correlates with decreased renal function due to inadequate nutritional needs such as vitamins, proteins, and minerals that can exacerbate impaired renal function. *Methods:* This study was conducted from February 2024, to September 2024, with two primary locations: Panti Werdha Makassar, a care home for the elderly, and Posyandu Lansia, a health service center for older adults. The sampling type is using consecutive sampling. *Results:* This study was conducted on 100 elderly subjects. Subjects with abnormal UAC were found more in the CKD group (50%) than the non-CKD group (35%) (p: 0.005; OR; 5,714). Subjects with abnormal WC were found more in the non-CKD group (36%) than the CKD group (34%) (p: 0.175; OR: 0.547). Subjects at risk of malnutrition were more prevalent in the CKD group (33%) than the non-CKD group (23%) (p: 0.028). *Conclusion:* The elderly patients in this study had a complex profile with a high incidence of malnutrition and decreased renal function. This indicates the need for a multidisciplinary approach in the care of elderly patients, focusing on nutritional assessment, chronic condition control, and comprehensive management to improve quality of life and prevent further complications. (www.actabiomedica.it)

Key words: aged, geriatric assessment, malnutrition, nutritional status, renal function

Introduction

Elderly patients have special characteristics that distinguish them from elderly patients in general. A special characteristic of geriatric patients that is often found in Indonesia is malnutrition. *Setiati et al* reported that malnutrition was the most common geriatric syndrome in elderly patients treated (42.6%) in 14 hospitals. The elderly are at risk of chronic kidney disorder because of changes within the anatomical structure of the kidneys, consisting of revolutionary nephrosclerosis (glomerulosclerosis, tubular atrophy, and atherosclerosis) examinations such as creatinine can help verify the diagnosis of CKD within the elderly (1). Studies from the *American Society of Nephrology*, glomerular filtration rate indicators by age between 40-65 years with LFG 60 ml/min per 1.73 m^2 and at age >65 estimated GFR >45 ml/min per 1.73 m^2.

Interventions that can be made to prevent the development of CKD are fulfilling nutritional needs (2). Nutrition plays a crucial role in modulating overall health and well-being, particularly as individuals age. In old age, the body's physiological needs change, making adequate nutrition even more essential for maintaining physical and cognitive function. A lack of proper nutrients not only weakens the immune system but also increases vulnerability to various chronic diseases, including cardiovascular disorders, diabetes, osteoporosis, and cognitive decline. Therefore, inadequate nutrient intake can significantly contribute to the onset and progression of a wide range of health conditions, further highlighting the importance of balanced and sufficient nutrition for the elderly population. Ensuring an optimal intake of essential nutrients is critical to promoting healthy aging and preventing illness. The risk of malnutrition increases in elderly patients due to decreased body mass and many other factors that may interfere with nutrient and fluid intake (3). The recommended *nutritional* scoring in the elderly is the *Mini nutritional assessment-short form* (MNA-SF) which is used to identify malnutrition in the elderly. This tool has a sensitivity of 96% and a specificity of 98% (4). Nutrition plays a crucial role as a modulator of health and well-being, particularly in relation to the pathophysiological mechanisms that arise from a decline in nephron numbers. In a healthy individual aged 18 to 29 years, approximately 1,000,000 nephrons are present in the kidneys. However, as one ages beyond 65 years, the nephron count reduces significantly, often reaching around 500,000. This decline in nephron quantity is directly linked to aging, highlighting the importance of kidney health as people grow older. Research conducted by Through et al. supports this observation, revealing that patients with an average age of 68 years generally maintain normal Glomerular Filtration Rates (GFR). However, in patients with an average age of 73 years, the GFR value drops below 60 ml/min/1.73 m^2. This decrease in GFR underscores the significant reduction in kidney function in older individuals, indicating the need for early preventive and therapeutic interventions. The findings from this study emphasize the importance of early detection and management strategies to mitigate the impact of kidney function decline in the elderly population, ultimately promoting better health outcomes through tailored nutritional and medical approaches (2,5). There have been many research studies reported on the association between kidney function and nutritional status in the elderly, currently in Makassar there is no research that reports this, so researchers are interested in conducting this research and assessing the picture of the relationship from different populations both in demographics, subject characteristics, and markers used.

Materials and Methods

An observational study with a cross-sectional design among 100 elderly patients at Panti Werdha Makassar and Posyandu (community health post) dedicated to the elderly during the period December 2023–May 2024. The inclusion criteria in this study were subjects over the age of 60 years and willing to participate in the study by stating their willingness to participate by signing a consent form. The MNA-SF test is a simple measurement consisting of five questions and anthropometric measurements. Questions include food intake, weight loss, mobility, psychological distress and neuropsychological disorders felt during the last 3 months. The MNA-SF instrument classifies subjects into three groups, normal nutritional status (score 12-14), at risk of malnutrition (8-11) and malnutrition (0-7). The interview took no more than 10 minutes and was followed by anthropometric measurements and blood sampling. Weight and height were measured using a device provided by the researcher, participants wore light clothing and no shoes. Waist circumference (WC) was measured around the abdomen using a tape measure positioned parallel to the floor, midway between the lower ribs and the iliac crest. Upper arm circumference (UAC) was measured on the less dominant arm, where the tape measure was positioned at the midpoint between the shoulder bone and the elbow.

All laboratory tests, using blood samples collected after the interview session, were performed by laboratory staff and examined at the Hasanuddin University teaching hospital laboratory. Estimation of glomerular filtration rate was measured using creatinine values through patient blood samples and calculated

using the CKD-EPI formula. The results of weight and height measurements were calculated to assess body mass index which was then classified into Underweight (BMI < 19 Kg/M^2), Normal (BMI 19 - < 21 Kg/M^2), Overweight (BMI 21 to < 23 Kg/M^2) and Obesity (BMI ≥ 23 Kg/M^2). The normal value of waist circumference (WC) for males is 90 cm and 80 cm for females. Normal values for upper arm circumference (UAC) for males were 23 cm and 22 cm for females. eGFR was calculated using CKD-EPI with eGFR considered impaired if eGFR was <60 mL/min/1.73. This research protocol was approved by the Ethics Committee for Biomedical Research on Humans, Faculty of Medicine, Hasanuddin University, Makassar, South Sulawesi. Based on the recommendation letter Number: 50/UN4.6.4.5.31/PP36/2024, with No. UH23110877: UH23110877.

Data were analyzed using Statistical Product and Service Solution (SPSS) version 29 IBM. Subject characteristics presented in frequencies and percentages were used for descriptive statistics. Statistical analysis used chi square test and Cochran-Mantel-Haenszel test. Statistical test results were considered significant if the p value was <0.05.

Results

This study was conducted on 100 elderly subjects of which 85% were subjects with abnormal UAC, 75% were in the Elderly category, 24% were in the *Old* category, and 1% were in the *Very Old* category. Most participants were female subjects 65%, indicating the predominance of female patients in this population. Anthropometric examination to determine the nutritional status of patients found 85% of subjects with abnormal upper arm circumference, and abnormal waist circumference in 30% of subjects, determination of nutritional status with MNA-SF found 9% of subjects were malnourished, 56% were at risk of malnutrition and 9% of subjects were malnourished. On assessment of renal function using CKD-EPI, almost half of the patients (53%) showed decreased renal function with a CKD-EPI score < 60, while 47% had a CKD-EPI score ≥ 60. This suggests that decreased renal function is quite common among elderly patients, emphasizing the need for close monitoring on renal function as part of their holistic health management (Table 1).

The results of this study showed that in the group with kidney function <60, there were 50 subjects with abnormal UAC and 3 subjects with normal UAC. In the renal function group ≥60, there were 35 subjects with abnormal UAC and 12 subjects with normal UAC. Subjects who had abnormal UAC were found more in the CKD group (50%) than the non-CKD group (35%), with a p-value of 0.005. The odds ratio (OR) analysis indicated that individuals exhibiting abnormal UAC levels were 5,714 times more likely to experience a decline in kidney function compared to those in the normal UAC group. This finding highlights a significant association between abnormal UAC and impaired renal performance, suggesting that monitoring UAC levels may be critical for identifying individuals at increased risk for deteriorating kidney function (Table 2).

Table 1. Characteristics of study participants

Variables	Results	
	n	**%**
Age		
• Elderly	75	75.00
• Old	24	24.00
• Very Old	1	1.00
Gender		
• Women	65	65.00
• Male	35	35.00
Upper Arm Circumference		
• Normal	15	15.00
• Abnormal	85	85.00
Waist Circumference		
• Normal	70	70.00
• Abnormal	30	30.00
Nutrition Status		
• MNA-SF Normal	9	9.00
• MNA-SF Malnutrition Risk	56	56.00
• MNA-SF Malnutrition	9	9.00
CKD-EPI		
• <60 mL/min/1.73	53	53.00
• >60 mL/min/1.73	47	47.00

Table 2. Association between upper arm circumference and renal function

Variables	Category	CKD-EPI (mL/min/1.73)				Total		OR (95%CI)**	p-value*
		<60 (n=53)		>60 (n=47)					
		n	%	n	%	n	%		
UAC	Not Normal	50	50.00	35	35.00	85	85.00	5.714 (1.501-21.755)	0.005
	Normal	3	3.00	12	12.00	15	15.00		

*chi square test, ** Cochran-Mantel-Haenszel test.

Table 3. Association between waist circumference and renal function

Variables	Category	CKD-EPI (mL/min/1.73)				Total		OR (95%CI)	p-value
		<60 (n=53)		>60 (n=47)					
		n	%	n	%	n	%		
WC	Not Normal	34	34.00	36	36.00	70	70.00	0.547 (0.887-5.070)	0.175
	Normal	19	19.00	11	11.00	30	30.00		

*chi square test, **Cochran-Mantel-Haenszel test.

Table 4. Association between MNA-SF and renal function

Variables	Category	CKD-EPI (mL/min/1.73)				Total		p-value
		<60 (n=53)		>60 (n=47)				
		n	%	n	%	n	%	
MNA	Normal	1	1.00	8	8.00	9	9.00	0.028
	At Risk	33	33.00	23	23.00	56	56.00	
	Malnutrition	19	19.00	16	16.00	35	35.00	

*chi square test, ** Cochran-Mantel-Haenszel test.

Based on the study's findings, in the group with kidney function <60, the abnormal WC was 34 subjects while normal WC was 19 subjects. In the renal function group ≥60, 36 subjects had abnormal WC and 11 subjects had normal WC. Subjects who had abnormal WC were found more in the non-CKD group (36%) than the CKD group (34%), with a p-value of 0.175. OR analysis obtained 0.547, which showed no significant correlation between WC and the incidence of CKD (Table 3).

The group with kidney function <60 obtained normal MNA in as much as 1 subject, at risk of malnutrition in as many as 33 subjects, and malnutrition in as many as 19 subjects. In the renal function group ≥60, 8 subjects had normal MNA, 23 subjects were at risk of malnutrition and 16 subjects were malnourished. Subjects at risk of malnutrition were more prevalent in the CKD group (33%) than the non-CKD group (23%), with a p-value of 0.028 (Table 4).

Discussion

Upper arm circumference, commonly called UAC, is a comprehensive measure of both muscle tissue mass and the subcutaneous fat layer. This anthropometric parameter is widely utilized as an indicator of malnutrition. In the context of the present study,

it was observed that a higher prevalence of abnormal UAC measurements was found among subjects diagnosed with chronic kidney disease (CKD), with 50% of individuals in this group exhibiting abnormal results compared to 35% in the non-CKD cohort. The statistical significance of this finding was confirmed with a p-value of 0.005 Furthermore, odds ratio (OR) analysis revealed that individuals with abnormal UAC measurements were 5.714 times more likely to experience a decline in kidney function when compared to their counterparts with normal UAC readings. This highlights the potential role of upper arm circumference as a crucial biomarker in assessing the risk of renal impairment, particularly in populations at risk for malnutrition and CKD. These results are in line with research conducted at the Wredha Wana Sraya Panti in Denpasar, which has an upper arm circumference that indicates malnutrition due to lack of energy and protein (6). Waist circumference measurement (WC) is a simple anthropometric index to assess health risks, detect central obesity, and assess changes in body composition such as decreased muscle mass and increased central fat (7,8). In this study, subjects who had abnormal WC were found to be more in the non-CKD group (36%) than the CKD group (34%), with a p-value of 0.175. OR analysis obtained 0.547, which showed no significant correlation between WC and the incidence of CKD. This is different from the research of *Anggraini et al* in assessing the association between anthropometric measurements using WC, the ratio of WC to height (WHtR), WC, and body mass index to the decline in kidney function, the test results showed moderate correlation with decreased LFG in the elderly population (9). This is not under the research we got, where patients with abnormal WC showed insignificant results in increasing the risk of CKD.

The mini nutritional assessment short form (MNA-SF) is used to identify malnutrition in the elderly. This tool has a sensitivity of 96% and a specificity of 98%. *Nurizky K et al*'s research study describes old age as having a higher risk of malnutrition, especially in women. (4) In this study, subjects at risk of malnutrition were found more in the CKD group (33%) than the non-CKD group (23%) with a p-value of 0.028. This study was in line with findings by *Guligowska et al*, where they observed a positive correlation of statistically lower MNA results in the LFG 15-30 ml/min/1.73 group indicating an increased risk of malnutrition in CKD subjects. This is due to changes in the body composition of the elderly which affect nutritional status (10). It is reported that in the elderly there is a decrease in food intake and motivation to eat which causes problems related to impaired energy balance and control of food intake which will have an impact on the nutritional status of the elderly. Interventions can be carried out by providing information about the impact of malnutrition (10,11). This is in accordance with our research where patients with malnutrition have an increased risk of CKD.

Conclusion

The elderly patients in this study had a complex profile with a high incidence of malnutrition and decreased renal function. This indicates the need for a multidisciplinary approach in the care of elderly patients, focusing on nutritional assessment, chronic condition control, and comprehensive management to improve quality of life and prevent further complications.

Ethic Approval: This research was approved by the Ethics Committee for Biomedical Research on Humans, Faculty of Medicine, Hasanuddin University, Makassar, South Sulawesi, Indonesia. Based on recommendation letter Number: 50/UN4.6.4.5.31/PP36/2024, with protocol number: UH23110877.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Authors Contribution: H.R conceptualized and designed the study, drafted the manuscript, and reviewed it; A.A.Z. led data analysis and interpretation, and reviewed the manuscript; S.R.Z.R., R.J., and A.S. reviewed the manuscript; A.F.F. assisted in drafting and reviewing the manuscript; R.S. led data collection at Panti Werdha and contributed to the manuscript drafting.

Acknowledgments: This research was funded by a grant from Hasanuddin University (Ref No: 01181/UN4.1/KEP/2024).

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Received: 4 November 2024
Accepted: 4 December 2024
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