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A COMPARISON OF THREE NUTRITIONAL ASSESSMENT TOOLS IN PREDICTING NUTRITIONAL-RELATED CLINICAL OUTCOMES AMONG RENAL PATIENTS AT THE KOMFO ANOKYE TEACHING HOSPITAL, GHANA

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ABSTRACT

Renal impairment (RI) is a prevalent condition characterised by suboptimal kidney function, often leading to undernutrition and significant metabolic disturbances. The global rise in RI, especially in developing countries, highlights the need for effective nutritional assessment tools. A cross-sectional descriptive study was conducted at the Nephrology Unit of Komfo Anokye Teaching Hospital (KATH) in Ghana to compare the effectiveness of three nutritional assessment tools – the Mini Nutritional Assessment (MNA), Subjective Global Assessment (SGA), and Malnutrition Universal Screening Tool (MUST) – in predicting nutritional-related clinical outcomes among 110 renal patients. Nutritional status was assessed using the MNA, SGA, and MUST tools. Data were analysed using SPSS version 23. The study found that 49.1% of patients were malnourished according to the MNA, compared to 16.4% by MUST and 12.7% by SGA. Significant associations were observed between the MNA scores and clinical outcomes such as declined food intake, weight- change, and BMI. The MNA showed superior predictive capability for these outcomes compared to the SGA and MUST. There was a significant gender and age difference in nutritional status, with female patients and those aged 51-60 years being at higher risk of malnutrition. The MNA was found to be the most effective tool in predicting nutritional-related clinical outcomes in renal patients, supporting its use in clinical settings for early identification and intervention. Regular training of healthcare professionals in using the MNA is recommended to enhance early detection and management of malnutrition, ultimately improving patient outcomes.

Keywords: Malnutrition, Renal impairment, Nutritional assessment, Ghana

INTRODUCTION

Renal Impairment (RI), defined as the suboptimal performance of the kidneys' glomerular filtration rate, is commonly associated with undernutrition, fat deficiency, and significant changes in serum phosphate levels (Günalay *et al.*, 2018). The global prevalence of renal impairment has surged, especially in developing countries where contributing factors such as diabetes and hypertension are also on the rise. In the USA, approximately 14.5% of adults are affected by some degree of kidney impairment (Coresh *et al.*, 2017), with similar rates observed in Europe, Australia, and Asia (Stevens *et al.*, 2016). In Ghana, the incidence of renal impairment is increasing, leading to a higher demand for hemodialysis (Mate-Kole, 2017). However, many Ghanaian renal patients face financial barriers that prevent them from accessing hemodialysis (Tannor *et al.*, 2019).

Protein-energy malnutrition, arising from insufficient nutrient intake, is a common problem among kidney patients and a leading cause of death (Dai *et al.*, 2017). For example, research conducted at the Komfo Anokye Teaching Hospital (KATH) in Ghana revealed an 86.8% prevalence of anaemia among 203 chronic kidney patients (Amoako *et al.*, 2014). Proper nutritional assessment is crucial for managing these patients. Tools like the Mini Nutritional Assessment (MNA), Subjective Global Assessment (SGA), and Malnutrition Universal Screening Tool (MUST) have been validated for assessing the nutritional status of patients with kidney disease (Paslan *et al.*, 2010; Vischer *et al.*, 2012; Dai *et al.*, 2019). However, these tools are not widely used in many healthcare settings in Ghana, including KATH.

This study aimed to evaluate and compare the effectiveness of the MNA, SGA and MUST tool in predicting nutrition-related clinical outcomes in renal patients at KATH in Ghana. The goal was to identify the most suitable nutrition screening tool for this population to reduce malnutrition and ensure timely nutritional interventions.

This study provides a comprehensive comparison of three widely recognised nutritional assessment tools, evaluating their predictive capabilities regarding clinical outcomes in renal patients. By identifying the most effective tool, this research aims to enhance the nutritional assessment practices within Ghana's healthcare system, ultimately improving patient outcomes and reducing the prevalence of malnutrition among renal patients.

MATERIALS AND METHODS

Study Area

The study was conducted in the Nephrology Unit of Komfo Anokye Teaching Hospital (KATH) in the Ashanti Region of Ghana. KATH, the country's second-largest hospital, serves as a major tertiary healthcare provider. Established in 1954 and affiliated with Kwame Nkrumah University of Science and Technology since 1975, KATH offers postgraduate training in various medical fields and houses the National Accident and Emergency Center (KATH report, 2019).

Study design

The study utilised a cross-sectional descriptive design to assess the nutritional status of renal patients at Komfo Anokye Teaching Hospital (KATH) in Ghana. The research involved patients aged 18 and above who had been diagnosed with renal impairment and were receiving treatment for at least three months in the hospital's Nephrology Unit. Participation required written and signed consent from all patients. The study's design aimed to provide a snapshot of the nutritional status of these patients, employing established nutritional assessment tools to gather data. Ethical approval for the study was obtained from the KATH Institutional Review Board, ensuring adherence to ethical standards in research. The study period spanned from October 1, 2019, to June 30, 2020, and employed a convenient sampling method due to the limited number of eligible patients. A total of 110 patients were recruited during their scheduled visits to the Nephrology Unit.

Study Population

The study population comprised patients aged 18 years and older who had been diagnosed with renal impairment and were undergoing treatment for at least three months at the Nephrology Unit of Komfo Anokye Teaching Hospital (KATH). All participants provided written informed consent before their inclusion in the study.

Ethics

The study received ethical approval from the Institutional Review Board of Komfo Anokye Teaching Hospital (KATH), with the reference number KATH-IRB/AP/016/20. All participants provided written informed consent before inclusion in the study, ensuring that ethical guidelines were followed in the conduct of the research.

Sample Size Determination and Sampling Technique

The study population comprised adults (≥18 years) diagnosed with renal impairment who had been undergoing treatment at the Nephrology Unit of Komfo Anokye Teaching Hospital (KATH) for a minimum duration of three months between October 1, 2019, and June 30, 2020. Only patients who provided written informed consent were included in the study.

Given the limited number of eligible patients during the study period, a convenient sampling approach was adopted. This method enabled the recruitment of 110 patients who were present during their scheduled clinic visits to the Nephrology Unit and met the inclusion criteria.

The minimum required sample size was determined using Cochran's formula for categorical data (Cochran, 1977):

$$n = Z^2 P (1 - P) / d^2$$

Where:

$Z = 1.96$ (Z-score corresponding to 95% confidence level)

P = anticipated population proportion (0.11 or 11%)

d = margin of error (0.05 or 5%)

$$n = (1.96)^2 \times (0.11)(1 - 0.11) / (0.05)^2$$

$$n = 150$$

This represents the minimum sample size required without applying a finite population correction. Ultimately, 110 patients were included due to constraints in the number of available eligible participants during the study time frame.

Data Collection

To evaluate the nutritional status of the patients, full versions of the Mini Nutritional Assessment (MNA), Subjective Global Assessment (SGA), and Malnutrition Universal Screening Tool (MUST) were utilised. These tools are well-established and effective for identifying potential malnutrition in adult patients. The MNA, SGA, and MUST have been validated in numerous studies and are widely employed in clinical settings for malnutrition screening (Boléo-Tomé *et al.*, 2011). MNA is endorsed by the European Society for Clinical Nutrition and Metabolism (ESPEN) for routine geriatric nutritional assessments. SGA is recognised by the American Society for Parenteral and Enteral Nutrition and the European Society for Clinical Nutrition and Metabolism. MUST was developed by the Malnutrition Advisory Group of the British Association for Parental and Enteral Nutrition (BAPEN) and has been found to be reproducible across studies.

The MNA, initially created to assess the dietary status of older adults, is also suitable for patients with renal health concerns. It consists of 18 questions grouped into four categories: anthropometric measurements (including weight, height, BMI, weight loss, and the circumferences of the arm and calf), general examination (covering symptoms of illness or cognitive issues), and a brief nutritional assessment (self-perception of nutrition and health). The tool generates a score out of 30, with scores above 24 indicating good nutritional status, scores between 17 and 23.5 suggesting a risk of malnutrition, and scores below 17 indicating malnutrition.

The SGA is used by healthcare professionals to assess nutritional status based on a combination of medical history and physical examination, incorporating both subjective and objective elements. It evaluates four key areas: weight, dietary intake, gastrointestinal symptoms, and functional capacity.

The MUST, developed by the British Association for Parenteral and Enteral Nutrition (BAPEN), is designed to screen for malnutrition across all patient groups. It includes a flowchart that helps healthcare providers identify patients at risk of malnutrition during assessments.

Data on declined food intake were collected through patient reports of reduced consumption over the previous three months, caused by factors such as loss of appetite, digestive issues, or problems with chewing or swallowing. Weight changes were determined by comparing patients' current weight with their weight three months prior. For those undergoing dialysis, BMI was calculated using their post-dialysis weight.

Data Analysis

Statistical analyses were performed using IBM's Statistical Package for Social Sciences version 23 (SPSS, IBM Inc., Chicago, USA) along with Microsoft Excel. Both absolute and relative frequencies were calculated for sociodemographic variables and the malnutrition risk was determined by the MNA, MUST, and SGA tools. For continuous variables, means and standard deviations (SD) were calculated. Cohen's Kappa analysis was utilised to identify independent predictors of malnutrition according to the three nutritional assessment methods: Mini Nutritional Assessment (MNA), Subjective Global Assessment (SGA), and Malnutrition Universal Screening Tool (MUST). A p-value of less than 0.05 was considered statistically significant.

RESULTS

The sociodemographic characteristics of the study participants are summarised in Table 1. There were more females (60.0%) recruited for this study than male patients (40.0%). The Chi-square test revealed a significant association between the gender of the renal impairment patients and their classification according to nutritional status ($p = 0.020$). Concerning the age group of the patients, a majority (34.5%) of them were between ages 51-60 years old, and the mean age of the population was 41 ± 21 years. Additionally, there was a significant association between the age group of the patients and the nutritional status classification of the patients ($p=0.007$). A number of the patients were married 53 (48.2%), whereas 26 (23.6%) were single. In addition, 23 (20.9%) of the patients were divorced and the remaining 8 (7.3%) were widowed. The Chi-square test showed no significant association between the patient's marital status and their classification according to nutritional status (p = 0.115). However, a majority of the patients had tertiary –level education 53 (48.2%). There was no statistically significant association between the patients' educational level and their classification according to nutritional status (p = 0.249). On the other hand, the average weight of the participants included in the study was 63.65 ±12.3 kg. In addition, the average BMI of the patients was greater than 20kg/m^2 (Table 1).

Table 1: Socio-Demographic Characteristics of Participants (N=110)

Categories	Responses	Frequency(N)	Percentage(%)	P-value
Gender	Male	44	40.0	0.020*
	Female	66	60.0	
Age group	Below 21years	1	0.9	
	21-30years	11	10.0	
	31-40years	21	19.1	
	41-50years	15	13.6	0.007**
	51-60years	38	34.5	
	Above 60years	24	21.8	
Marital status	Single	26	23.6	
	Married	53	48.2	
	Widowed	8	7.3	0.115
	Divorced	23	20.9	
Educational level	No formal education	11	10.0	
	Basic level	27	24.5	
	Secondary level	19	17.3	0.249
	Tertiary level	53	48.2	
Weight	63.65 ±12.295			
BMI	>20kg/m^2			

***. p is significant at the 0.01 level; *p is significant at the 0.05 level (2-tailed).*

Table 2 indicates the risk of malnutrition based on the three nutritional screening tools. The study found that 54 (49.1%) of the patients included in the study were malnourished and 56 (50.9%) of them were not malnourished using the MNA tool. The patient's classification according to the MNA tool was significant (p<0.0001). According to the MUST tool, 18 (16.4%) patients were malnourished whiles 92 (83.6%) were not malnourished. The difference among the patient's classification according to the MUST tool was statistically significant (p<0.0001). On the other hand, 14 (12.7%) of the renal patients were malnourished, while 96 (87.3%) were not malnourished using the SGA tool. There was a statistically significant association between patients' nutritional classification according to the SGA tool and the overall distribution of patients across nutritional status categories (p = 0.023; Table 2).

As depicted in Table 3, a significant correlation between MNA and declined food intake among patients with renal impairment (k=0.972, *p*=0.015) was found. The medium-risk malnutrition of patients with renal impairment had the highest declined food intake (M= 3.52, SD=1.31, CI: 1.12–1.93), followed by high-risk malnutrition (M= 2.51, SD=1.523; CI: 1.12–1.93). In addition, the low-risk malnutrition had the lowest declined food intake (M= 2.01, SD=1.37; CI: 1.12–1.93). From Table 3, the low-risk malnutrition of patients with renal impairment had the lowest weight change (M= 0.68, SD= 0.152; CI: 0.61–1.93). Also, the trend for medium-risk malnutrition patients' groups had the highest weight change (M=4.18, SD=1.513; CI: 2.13 – 5.39), followed by high-risk malnutrition (M= 1.09, SD=1.105; CI: 0.59 – 0.81). This reached statistical significance between MNA and weight change among patients with renal impairment (k =.827, *p*=0.024). The group at low-risk malnutrition (M=1.52, SD= 0.151; CI: 0.41 – 191), medium-risk malnutrition (M=1.37, SD=1.018; CI: 0.82 – 1.92), and the group classified as high-risk malnutrition (M=1.14, SD=1.124; CI: 0.07 – 2.36), were analysed together and compared with Body Mass Index (BMI) of patients with renal impairment by using MNA. There was a significant correlation (k=1.00, *p*=0.048) between the MNA and BMI of patients with renal impairment (Table 3).

Table 2: Patient classification according to the various assessment tool

SD variable	MNA		P- value	MUST		P- value	SGA		P-value
	Malnourished	Not malnourished		Malnourished	Not malnourished		Malnourished	Not malnourished	
	54 (49.1%)	56 (50.9%)	<0.0001**	18 (16.4%)	92 (83.6%)	<0.0001**	14 (12.7%)	96 (87.3%)	0.023*

Key: MNA=Mini Nutritional Assessment, SGA= Subjective Global Assessment tool, MUST=Malnutrition Universal Screening Tool

****. p is significant at the 0.01 level; *p is significant at the 0.05 level (2-tailed).**

Table 3*: Clinical outcome results for the MNA nutritional risk categories*

Clinical Outcome		Parameter for assessment			P. Value	Cohen's Kappa
		Low risk of malnutrition *(n=35)*	**Medium risk malnutrition *(n=21)***	**High risk of malnutrition *(n=54)***		
Declined food intake	M ()	2.01	3.52	2.51	0.015*	0.972
	SD	1.37	1.331	1.523		
	CI	1.12– 1.93	2.81 – 4.73	1.27 – 1.92		
Weight change	M ()	0.68	4.18	1.09	0.024*	0.827
	SD	0.152	1.513	1.105		
	CI	0.61– 0.93	2.13 – 5.39	0.59 – 0.81		
Body mass index (BMI)	M ()	1.52	1.37	1.14	0.048*	1.00
	SD	0.151	1.018	1.124		
	CI	0.41 – 191	0.82 – 1.92	0.07 – 2.36		

***Note:** Kappa <0.20: poor, 0.41–0.60: moderate, 0.61–0.80: good, and 0.81–1: very good. **. p is significant at the 0.01 level; *p is significant at the 0.05 level (2-tailed).*
***M:** Mean Value; **SD:** Standard deviation Value; **CI:** Confidence Interval*

Table 4*: Clinical outcome results for the SGA nutritional risk categories*

Clinical Outcome		Parameter for assessment			P. Value	Cohen's Kappa
		Low risk of malnutrition *(n=68)*	**Medium risk malnutrition *(n=28)***	**High risk of malnutrition *(n=14)***		
Declined food intake	M	1.5	1.6	1.4	0.611	0.322
	SD	1.2	1.2	1.2		
	CI	1.2 – 1.8	1.2 – 2.0	1.0 – 1.8		
Weight change	M	0.7	1.8	1.6	0.812	0.547
	SD	1.0	1.1	0.9		
	CI	0.57– 0.8	0.6– 1.0	0.4 – 0.8		
Body mass index (BMI)	M	0.5	0.5	0.4	0.091	0.710
	SD	0.9	0.8	0.8		
	CI	0.4 – 0.7	0.4 – 0.6	0.31 – 0.68		

***Note:** Kappa <0.20: poor, 0.41–0.60: moderate, 0.61–0.80: good, and 0.81–1: very good. **. p is significant at the 0.01 level; *p is significant at the 0.05 level (2-tailed).*
***M:** Mean Value; **SD:** Standard deviation Value; **CI:** Confidence Interval*

Table 5: Clinical outcome results for the MUST nutritional risk categories

Clinical Outcome		Parameter for assessment			P. Value	Cohen's Kappa
		Low risk of malnutrition *(n=35)*	**Moderate risk malnutrition *(n=21)***	**High risk of malnutrition *(n=54)***		
Declined food intake	M	2.93	2.41	3.46	0.085	0.391
	SD	1.523	1.103	1.402		
	CI	2.23-3.63	1.67-3.16	2.26-4.66		
Weight change	M	1.151	1.24	1.46	0.186	0.721
	SD	1.048	1.801	1.271		
	CI	1.23-1.79	1.18-1.77	1.24-207		
Body mass index (BMI)	M	2.13	2.21	3.13	0.011*	0.613
	SD	1.226	1.084	1.381		
	CI	1.23-1.81	1.28-1.72	0.84-1.81		

Note: *Kappa <0.20: poor, 0.41–0.60: moderate, 0.61–0.80: good, and 0.81–1: very good.*

**. p is significant at the 0.05 level (2-tailed).*

M: *Mean Value;* ***SD:*** *Standard deviation Value;* ***CI:*** *Confidence Interval*

Table 4 indicates clinical outcome results for the SGA nutritional risk categories. High-risk malnourished patients (1.4±1.2) had the lowest mean declined food intake (k=.322, *p*=0.611), when compared to patients at medium risk of malnutrition (1.5±1.2) and those at low risk of malnutrition (1.6±1.2). The mean weight change (K=0.547, *p* = 0.812) was higher among patients at moderate risk of malnutrition (1.8±1.1) compared to those at low (0.7±1.0) and high risk of malnutrition (1.6±0.9). The mean BMI change (K= 0.710, *p* = 0.091) was higher among patients at moderate risk of malnutrition (0.5±0.8) compared to those at low (0.5±0.9) and high risk of malnutrition (0.4±0.8).

Table 5 presents clinical outcome results for the MUST nutritional risk categories. High-risk malnourished patients (3.1±1.4) had a higher mean BMI change (K = 0.613, *p* = 0.011) compared to low (2.1±1.2) and moderate risk malnourished patients (2.2±1.1). Likewise, high-risk malnourished patients (3.5±1.4, 1.5±1.3) had a higher mean decline in food intake (K = 0.391, *p* = 0.085) and mean weight change (K = 0.721, *p* = 0.186) compared to low (2.1±1.5, 1.2±1.0) and moderate risk malnourished patients (2.4±1.1, 1.2±1.8).

DISCUSSION

This study aimed to evaluate and compare the predictive accuracy of three nutrition assessment tools in renal patients at Komfo Anokye Teaching Hospital (KATH) in Ghana. The tools examined were the Mini Nutritional Assessment (MNA), Subjective Global Assessment (SGA), and Malnutrition Universal Screening Tool (MUST). The primary focus was on their ability to forecast nutrition-related clinical outcomes in this patient population. The results demonstrated that the MNA was superior in predicting all the clinical outcomes, including decreased food intake, weight change, and BMI, in patients with renal impairment. This supports the findings of previous research indicating that

MNA is a reliable tool with good sensitivity and specificity for nutritional assessment (Kondrup *et al.*, 2003; Vischer *et al.*, 2012). MNA's comprehensive approach, which includes anthropometric measurements, general examination, and dietary self-assessment, enables it to capture a wide array of nutritional issues, making it particularly useful in clinical settings for renal patients.

Conversely, the SGA did not show a significant correlation with clinical outcomes in this study. This is in contrast with some previous studies that found SGA to be effective in predicting nutritional risk and related complications (Duerksen *et al.*, 2015; Wakahara *et al.*, 2017). However, the variability in its performance could be attributed to its reliance on subjective clinical judgment, which may not be as consistent across different settings and practitioners.

The MUST tool, while somewhat effective in predicting changes in BMI, did not perform well in predicting other clinical outcomes such as food intake and weight change. This finding aligns with the results of studies that have questioned the predictive validity of MUST in various patient populations (Paslan *et al.*, 2010). MUST's relatively simpler assessment criteria might miss the nuances of malnutrition in renal patients, who often present with complex and multifactorial nutritional issues.

The significant gender and age differences in nutritional status classifications suggest demographic factors play a role in the nutritional outcomes of renal patients. Specifically, female patients and those in certain age groups (particularly 51-60 years) showed different patterns of malnutrition risk, which could inform targeted nutritional interventions.

The study underscores the importance of regular training for health workers on nutritional assessments using these tools. Given the high prevalence of malnutrition among renal patients and its impact on morbidity and mortality, employing the most effective tool, such as the MNA, could enhance early identification and intervention, potentially improving clinical outcomes.

In conclusion, the MNA stands out as the most effective tool among the three assessed for predicting nutritional-related clinical outcomes in renal patients at KATH. This tool's comprehensive and systematic approach likely accounts for its superior performance. Future studies should consider larger sample sizes and diverse patient populations to further validate these findings and potentially refine these tools for even better clinical applicability.

CONCLUSION

This study identified a significant risk of malnutrition among renal patients at the Komfo Anokye Teaching Hospital using three nutritional assessment tools: the Mini Nutritional Assessment (MNA), Subjective Global Assessment (SGA), and Malnutrition Universal Screening Tool (MUST). The MNA showed the highest accuracy in predicting malnutrition-related clinical outcomes, such as changes in food intake, weight, and BMI, suggesting its superiority in identifying and addressing malnutrition in renal patients in Ghana. The MNA's comprehensive approach, including detailed anthropometric measurements, general health evaluations, and dietary assessments, makes it particularly valuable for clinical practice. Its reliability and predictive capability highlight its suitability for routine use, especially for populations with complex nutritional needs, such as those with renal impairments. Conversely, the SGA and MUST tools were less effective in predicting malnutrition-related outcomes. The SGA's reliance on subjective clinical judgment and the MUST tool's simpler criteria might limit their effectiveness in capturing the multifaceted nature of malnutrition in renal patients. The study emphasises the need for ongoing training of healthcare professionals in using these nutritional assessment tools, particularly the MNA, to enhance early detection and intervention for malnutrition. Such training could improve patient outcomes by ensuring appropriate management of at-risk individuals. In summary, the MNA is a superior nutritional assessment tool for renal patients at Komfo Anokye Teaching Hospital, demonstrating significant potential in predicting important clinical outcomes. Its comprehensive approach and strong predictive validity make it essential for improving nutritional care in Ghana. Future research should validate these findings in larger, more diverse populations and explore potential refinements to enhance their clinical utility.

Authors Contributions:

MAT: Development of the proposal concept, supervision of proposal creation, data collection, data entry and analysis, along with manuscript writing and review.

LM: Proposal development, data collection, study implementation, data entry and manuscript writing and review.

OAB: Statistical analysis and interpretation of the data and review of the draft manuscript.

SSA: Data collection, data analysis and interpretation of the data, and review of draft manuscript.

JO: Data analysis, interpretation and reviewing of draft manuscript.

Conflict of interest:

The authors do not have any conflict of interest. However, we would like to disclose that the abstract of this study was once published in the book of abstracts of the American Society of Tropical Medicine and Hygiene (ASTMH) during its annual conference in 2021, which we took part in (Tandoh *et al.,* 2021).

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