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Hemodialysis Specific Nutrition Screening Tool (HD-NUT): validity and reliability assesment for Turkey

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Herramienta de detección nutricional específica para hemodiálisis (HD-NUT): evaluación de la validez y la fiabilidad para Turquía

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Ethical approval: The study was conducted in accordance with the Declaration of Helsinki and was approved by the Fırat University Non-Interventional Research Ethics Committee with the decision numbered 2022/14-06 to be in compliance with ethical rules. Informed consent was obtained from all subjects involved in the study.

Conflict of interest: The authors declare no conflict of interest.

Artificial intelligence: The authors declare not to have used artificial intelligence (AI) or any AI-assisted technologies in the elaboration of the article.

ABSTRACT

Background and aims: this study aimed to evaluate the validity and reliability of the Hemodialysis Specific Nutrition Screening Tool (HD-NUT), a new hemodialysis-specific nutrition screening tool for Turkey.

Methods: HD-NUT was compared for assessing malnutrition with the Malnutrition Universal Screening Tool (MUST) and Subjective Global Assessment (SGA) in 165 adult patients across two dialysis units. Nutritional status was evaluated using anthropometric measurements and the nurse's opinion was assessed via a survey.

Results: HD-NUT was found to be more sensitive than MUST in identifying increased risks of malnutrition and providing dietary guidance. The Cramer V coefficient was 0.445 between MUST and HD-NUT, and 0.487 between SGA and HD-NUT, and indicating compatibility with variables in other screening tools. Significant agreements were found between MUST and HD-NUT (Kappa = 0.409, p = 0.000) and between SGA and HD-NUT (Kappa = 0.290, p = 0.000).

Conclusions: HD-NUT is a valid and reliable nutritional screening tool when used by specialist nurses experienced in dialysis units for hemodialysis patients in Turkey.

Keywords: Hemodialysis. Malnutrition. MUST. SGA. HD-NUT.

RESUMEN

Antecedentes y objetivos: este estudio tuvo como objetivo evaluar la validez y la fiabilidad de la herramienta de cribado nutricional específica para hemodiálisis (HD-NUT), una nueva herramienta de cribado nutricional específica para hemodiálisis para Turquía.

Métodos: se comparó la HD-NUT para evaluar la desnutrición con la

herramienta de cribado universal de la desnutrición (MUST) y la evaluación global subjetiva (SGA) en 165 pacientes adultos de dos unidades de diálisis. El estado nutricional se evaluó mediante mediciones antropométricas y la opinión de la enfermera se evaluó mediante una encuesta.

Resultados: se encontró que la HD-NUT era más sensible que la MUST para identificar mayores riesgos de desnutrición y proporcionar orientación dietética. El coeficiente V de Cramer fue de 0,445 entre MUST y HD-NUT, y de 0,487 entre SGA y HD-NUT, lo que indica compatibilidad con las variables de otras herramientas de cribado. Se encontraron concordancias significativas entre MUST y HD-NUT (Kappa = 0,409, p = 0,000) y entre SGA y HD-NUT (Kappa = 0,290, p = 0,000).

Conclusiones: la HD-NUT es una herramienta de detección nutricional válida y confiable cuando la utilizan enfermeras especializadas con experiencia en unidades de diálisis para pacientes de hemodiálisis en Turquía.

Palabras clave: Hemodiálisis. Desnutrición. MUST. SGA. HD-NUT.

INTRODUCTION

Hemodialysis is the most commonly preferred method (89 %) worldwide for patients with stage 5 chronic renal failure (1). One of the most important problems faced by this patient group is that malnutrition may occur at a rate of 28-54 % (2). Malnutrition is significantly associated with adverse patient outcomes, including increased morbidity and mortality, with significant additional economic costs (3). Nutritional assessment is a basic and introductory clinical procedure in nutritional management, and the Dialysis Outcome Quality Initiative guideline recommends regular nutritional assessment for all dialysis patients (4).

In terms of nutrition status, there are validated and recommended nutritional assessment methods such as subjective global assessment (SGA) (5). However, completing an individualized renal dietetic assessment, or SGA, for each admission requires a certain level of training, staffing, and resources that may be inefficient and impractical for many hemodialysis patients (6). A nutritional screening tool needs to be evaluated for validity and reliability, especially to ensure that it is compatible with a comprehensive nutritional assessment and to achieve the same result when used by different individuals (7).

The Malnutrition Universal Screening Tool (MUST) is a widely used and validated nutritional screening tool (6). MUST screening recognizes acute starvation but ignores renal-related risk factors such as anorexia and malnutrition (8). In the absence of a specific nutritional screening tool validated for the hemodialysis patient group and to increase the number of malnourished patients accurately identified for nursing intervention and dietetic referral, the Hemodialysis Specific Nutrition Screening Tool (HD-NUT) was developed, which was adapted from the Renal Inpatient Nutrition Screening Tool (iNUT). As with MUST, HD-NUT divides patients into high (score ≥ 2), intermediate (score = 1), and low-risk (score = 0) malnutrition categories with appropriate action plans (9).

This study aimed to evaluate the validity and reliability of HD-NUT and its applicability as a practical tool to determine the risk of malnutrition in patients in the hemodialysis unit. The aim is to ensure the timely application of nutritional support through monthly follow-up of inpatients.

MATERIALS AND METHODS

Study population

This cross-sectional study was conducted with 165 adults older than 18 and undergoing hemodialysis between December 2022 and September 2023 along with the related ethics committee approval.

The study was carried out following the Declaration of Helsinki in the Training Hospital within the Faculty of Medicine at Firat University in Elazig, Turkey. Informed consent was obtained from each participant included in the study. The study included patients who had been receiving hemodialysis treatment three times a week for at least one year. Patients with hepatitis, cancer, thyroid or liver disease, psychological disorders, or those who could not be evaluated by a dietitian within the first 48 hours were excluded from the study.

This study aimed to determine the usability of HD-NUT by nurses working in dialysis units as well as dietitians. HD-NUT was evaluated independently by both the dietitian and the nurse in charge of the dialysis units. Additionally, after the evaluation of HD-NUT, SGA and MUST assessments were conducted for the patients by the dietitian. At this stage, the patients' body weight (dry and wet), height, triceps skinfold thickness, and mid-upper arm circumference were measured. Then, the dietitian compared all the scores and recorded the net results.

Demography and biochemistry

Demographic characteristics of the patients, such as age, ethnicity, gender, and education level, along with biochemical parameters including BUN, albumin, prealbumin, fasting blood sugar, transferrin, CRP, and urea values, were recorded.

Construct validity

For the validation of HD-NUT, the SGA based on the method of Detsky et al., and conducted by an experienced renal dietitian, was chosen as the reference standard (5). SGA is recommended in conjunction with a clinical dietary interview and examination, and it is a validated method for classifying malnutrition in kidney patients (10). Nutritional status was classified as well-nourished, moderately malnourished, or malnourished based on the SGA results.

Another reference used for the validation of HD-NUT is the MUST score, recommended by ESPEN and widely used in hospitals to detect malnutrition (11). For this score, patients' BMI values, body weight changes over the last 3-6 months, and the risk of acute illness or not being able to eat for more than 5 days were considered (12). Patients were classified as low, medium, or high risk of malnutrition based on their MUST scores.

Predictive validity

The wet and dry body weights of the patients were measured and recorded.

Interrater reliability

For the interrater reliability assessment of HD-NUT, a second dietitian or nurse evaluated the form in the same patient group, blinded to the patients' initial assessments conducted by the first rater. Then, the results were compared (13,14).

Face validity

A feedback survey was administered to nurses who used HD-NUT to gather information about the form, its ease of use, and the time required to complete the scale.

Statistical evaluation of data

The data obtained in the study were analyzed using the Statistical Package for Social Sciences (SPSS) for Windows 25.0 software. Descriptive statistical methods (number, percentage, mean, and standard deviation) were used while evaluating the data. The continuous data used was tested for suitability for normal distribution. The determination of whether the variables were normally distributed was based on skewness and kurtosis values, and it was concluded that they were not normally distributed. The relationship between continuous variables was calculated using Spearman correlation

analysis, and the concordances were assessed using the Intraclass Correlation Coefficient (ICC) coefficient. The evaluation of measurement tools was conducted categorically, and the relationship between categorical variables was examined using chi-square analysis. In addition, the concordance coefficient was calculated to determine the compatibility between the measurement tools. Various forms of the Kappa statistic, including Fleiss' Kappa and Weighted Kappa, were employed for this purpose.

RESULTS

The results of 165 individuals were evaluated; 53.9 % of the patients included in the study were males while 46.1 % were females. When the age ranges of the participants were examined, it was seen that 20.6 % were under 45 years old, 24.3 % were between 46 and 55 years old, 26.1 % were 56-65 years old, and 29.1 % were over 66 years old. The average age of the participants was determined to be 56.04 ± 14.42. When the distribution of the participants' chronic diseases was examined, it was determined that 86.1 % had chronic renal failure, 18.2 % had diabetes, and 15.2 % had hypertension. It was also observed that 7.9 % of the participants received nutritional support one year ago.

The average wet weight of the participants was calculated as 70.22 ± 15.16 while the average dry weight was calculated as 67.63 ± 15.08. The average BMI obtained from the participants' wet weight was calculated as 25.51 ± 5.05 while the average BMI obtained from the dry weight was calculated as 24.57 ± 5.01. The average mid-arm muscle circumference value of the patients included in the study was calculated as 26.99 ± 4.24. While the average triceps skinfold thickness value was calculated as 12.90 ± 17.91. A significant difference was observed between the upper middle arm circumference measurements (low nutritional risk: 28.38 ± 3.84; monitor the patient at risk: 26.34 ± 4.15; consult a dietitian: 23.46 ±

3.32) between the groups and the patient at risk of malnutrition and the other groups ($p < 0.005$).

When the general evaluation of MUST, SGA, and HD-NUT of the patients was examined (Table I), it was seen that 72.7 % were at low risk, 10.9 % were at medium risk, and 16.4 % were at high risk. According to the SGA measurement tool evaluation, it was determined that 72.7 % of the patients were well-nourished, 23.6 % had mild-moderate malnutrition, and 3.6 % had severe malnutrition. When the scores obtained by the patients from the HD-NUT evaluation tool were categorized, it was determined that 55.8 % were at low risk, 26.7 % were at moderate risk, and 17.6 % were at high risk.

A Chi-square test was conducted to analyze the relationship between patients' MUST and HD-NUT evaluations, as well as between SGA and HD-NUT evaluations (Table II). The results indicated a significant relationship between the HD-NUT evaluations of MUST and SGA. Cramer's V coefficient was 0.455 for the HD-NUT and MUST evaluation tools and 0.487 for the HD-NUT and SGA evaluation tools.

The Kappa coefficient was calculated to assess the agreement between MUST and HD-NUT evaluations (Table III). The results revealed a statistically significant agreement between MUST and HD-NUT (Kappa = 0.409, $p = 0.000$). Similarly, a significant agreement was observed between SGA and HD-NUT evaluations (Kappa = 0.290, $p = 0.000$). In addition, the evaluation results in the first and third categories were found to be significant ($p < 0.05$).

The ICC and Spearman correlation analysis results between HD-NUT and MUST are given in table IV. It was observed that there was a statistically significant positive moderate relationship between the HD-NUT red box total number and the MUST total score ($p < 0.05$; $r = 0.584$). Additionally, the calculated ICC indicated an absolute agreement coefficient of 0.594 and a consistency of 0.745 between the two measurement tools.

Face validity

Feedback was received from 32 nurses in the survey. Their experience in dialysis nursing was 0-18 years, with an average of 4.5 years. 92 % of nurses reported that HD-NUT was 'easy' or 'very easy' to use, and 92 % completed HD-NUT in ≤ 8 minutes. Overall, 94 % of nurses reported that they felt confident in determining the correct course of action, and 90 % reported that it was an appropriate tool for dialysis patients.

DISCUSSION

HD-NUT may be more sensitive than MUST in the hemodialysis patient population due to the inclusion of questions regarding recent appetite and food intake as indicators of malnutrition rather than the MUST criterion of acute fasting. This is supported by study showing the role of appetite and other nutrition-related symptoms in screening for malnutrition risk in hemodialysis patients (15). HD-NUT found that 26.7 % of all patients were at risk for malnutrition and 17.6 % were at high risk. These figures surpass the intermediate and high-risk categories determined by MUST. Consequently, it was observed that HD-NUT exhibited greater sensitivity in monitoring and dietetic evaluation of malnourished patients compared to MUST. Additionally, HD-NUT demonstrated superior reliability compared to previously reported findings for MUST in hemodialysis units (16).

Overhydration is common in hemodialysis and may mask muscle or fat depletion in individual patients (17). In the current study, the mean (min-max) BMI calculated from clinical estimation of dry weight was found to be 24.57 (14.58 to 40.88) kg/m^2, well above the MUST and HD-NUT limit of 20 kg/m^2. Assessing body weight alone may mask the true weight in the presence of edema. Therefore, it seems more logical to use HD-NUT, which evaluates dry weight. Additionally, a decrease in upper mid-arm circumference, which indicates muscle mass, is associated with increased mortality (18). In this study, classification according to HD-NUT revealed a significantly lower

upper middle arm circumference in the risk group. The compatibility of the HD-NUT screening tool with upper middle arm circumference in determining the risk of malnutrition further enhances the reliability of this tool.

Cramer's V coefficient, unlike the contingency coefficient, measures the strength of the relationship between two IxJ-dimensional variables, independent of the number of rows and columns (19). In this study, consistency between risk groups was observed in the measurement tools. For ratings based on a nominal or ordinal scale, the kappa coefficient was found to be an appropriate measure of reliability (20). In this study, an examination of the kappa coefficient revealed that HD-NUT was compatible with MUST and SGA. This indicates that HD-NUT for hemodialysis patients can effectively identify patients at risk and is consistent with other assessment scales.

A strength of this study is the inclusion of nurses as important stakeholders in malnutrition screening. Nurses completed HD-NUT after receiving standardized, resource-free training. This demonstrates that the achieved levels of specificity, sensitivity, and reliability are realistic and attainable in other hemodialysis services facing similar staffing, time, and financial constraints.

In conclusion, HD-NUT proves to be a reliable, valid, and practical nutritional screening method in hemodialysis units across Turkey. This screening tool aligns well with both MUST and SGA, offering distinct advantages over other screening tests by its independence from edema influence thanks to its focus on dry weight calculation and the ability to detect malnutrition through regular monthly screenings. Additionally, HD-NUT is likely to be well-received by nurses for routine implementation in hemodialysis units. Its utilization can significantly enhance the detection of malnourished patients, which can ensure timely nutritional intervention. Future studies may delve into longer-term planning, incorporate patient feedback, and assess the impact of

nutritional support initiated post-screening on malnutrition and biochemical parameters.

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Table I. Evaluation results of the MUST, SGA and HD-NUT measurement tools

	Classification of Measurement Tools	**Number**	**Percentage**
General MUST Score	Score 0 = Low risk	120	72.7
	Score 1 = Medium risk	18	10.9
	Score ≥ 2 = High risk	27	16.4
SGA Score	A = Well fed	120	72.7
	B = Mild to moderate malnutrition	39	23.6
	C = Severe malnutrition	6	3.6
HD-NUT Score	Low risk	92	55.8
	At risk	44	26.7
	High risk	29	17.6

Table II. Relationship between MUST and HD-NUT with the SGA and HD-NUT measurement tools

		HD-NUT risk status		
		Low nutritional risk	**Monitor the patient at risk**	**Consult a dietitian**
		***n* (%)**	***n* (%)**	***n* (%)**
MUST risk status	*Low risk*	87 (94.6)*	23 (51.1)	10 (35.7)
	Medium risk	3 (3.3)	12 (26.7)*	3 (10.7)
	High risk	2 (2.2)	10 (22.2)	15 (53.6)*
		Chi-square test: 65.328; Cramer V: 0.445. *$p = 0.000$		
SGA risk status	*Well fed*	85 (92.4)*	31 (68.9)	4 (14.3)
	Mild to moderate malnutrition	7 (7.6)	14 (31.1)*	18 (64.3)
	Severe malnutrition	0	0	6 (21.4)*

Chi-square test: 68.607; Cramer V: 0.487. *$p = 0.000$.

Table III. Kappa coefficient for MUST and HD-NUT and SGA and HD-NUT measurements

MUST and HD-NUT Measurements						
					95 % CI	
	Kappa	**Standard error**	***z***	***p* value**	**Min.**	**Max.**
All	0.409	0.058	7.074	0.000	0.296	0.522
categories harmony						
1	0.499	0.078	6.406	0.000	0.346	0.651
2	0.235	0.078	3.017	0.003	0.082	0.387
3	0.455	0.078	5.839	0.000	0.302	0.607
Weighted Kappa	0.492	0.060	7.885	0.000	0.375	0.609
SGA and HD-NUT Measurements						
					95 % CI	
	Kappa	**Standard error**	***z***	***p* value**	**Min.**	**Max.**
All	0.290	0.061	4.747	0.000	0.170	0.409
categories harmony						
1	0.446	0.078	5.728	0.000	0.293	0.599
2	0.106	0.078	1.358	0.175	-0.047	0.258
3	0.279	0.078	3.579	0.000	0.126	0.431
Weighted Kappa	0.419	0.055	7.403	0.000	0.312	0.526

Table IV. ICC and Spearman's correlation analysis between HD-NUT and MUST

		95 % CI		
	ICC	**Lower limit**	**Upper limit**	***r***
Single measurements (absolute fit)	0.594	0.485	0.684	0.584
Average measurements (consistency)	0.745	0.653	0.812	