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Herramienta de detección nutricional para pacientes hospitalizados con insuficiencia renal (Renal iNUT): evaluación de la validez y fiabilidad en Turquía

Renal Inpatient Nutrition Screening Tool (Renal iNUT) - A validity and reliability assesment for Turkey

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Herramienta de detección nutricional para pacientes hospitalizados con insuficiencia renal (Renal iNUT): evaluación de la validez y fiabilidad en 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 2022/14-07 to be in compliance with ethical rules. Informed consent was obtained from all subjects involved in the study.

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ABSTRACT

Background and aims: there is a need for a kidney-specific nutritional screening tool for patients with renal failure. It was planned to perform the validity and reliability of the Renal Inpatient Nutrition Screening Tool screening tool developed for renal patients in Turkey.

Methods: the validity and reliability of the Renal Inpatient Nutrition Screening Tool were investigated by comparing it with the Malnutrition Universal Screening Tool and the Subjective Global Assessment for assessing malnutrition in 153 adult patients newly admitted to the nephrology unit. Nutritional status was assessed using anthropometric measurements and nurse opinion was assessed using a questionnaire.

Results: the Renal Inpatient Nutrition Screening Tool was found to be more sensitive than the Malnutrition Universal Screening Tool in identifying increased malnutrition risks and providing dietary guidance. Cramer V coefficient was 0.238 between the Malnutrition Universal Screening Tool and the Renal Inpatient Nutrition Screening Tool, and 0.137 between the Subjective Global Assessment and the Renal Inpatient Nutrition Screening Tool, indicating the compatibility of the Renal Inpatient Nutrition Screening Tool with the variables in the Malnutrition Universal Screening Tool screening tool. A significant positive moderate correlation was observed between the total number of red boxes in the Renal Inpatient Nutrition Screening Tool and the total score of Malnutrition Universal Screening Tool ($p < 0.05$; $r = 0.404$).

Conclusions: the Renal Inpatient Nutrition Screening Tool is a valid and reliable tool for assessing malnutrition risks in renal patients in Turkey, particularly when used by experienced specialist nurses in nephrology units.

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Keywords: Malnutrition. Malnutrition Universal Screening Tool. Nephrology. Renal Inpatient Nutrition Screening Tool. Subjective Global Assessment.

RESUMEN

Antecedentes y objetivos: existe la necesidad de una herramienta de detección nutricional específica para el riñón en pacientes con insuficiencia renal. Se planeó evaluar la validez y confiabilidad de la herramienta de detección de nutrición en pacientes hospitalizados renales desarrollada para pacientes renales en Turquía.

Métodos: se investigaron la validez y la confiabilidad de la Herramienta de Detección Nutricional en Pacientes Hospitalarios Renales comparándola con la Herramienta de Detección Universal de Malnutrición y la Evaluación Global Subjetiva para evaluar la malnutrición en 153 pacientes adultos recién ingresados en la unidad de nefrología. El estado nutricional se evaluó mediante mediciones antropométricas y la opinión de la enfermera se evaluó mediante un cuestionario.

Resultados: se encontró que la herramienta de detección nutricional para pacientes hospitalizados con enfermedad renal era más sensible que la herramienta de detección universal de desnutrición para identificar mayores riesgos de desnutrición y brindar orientación dietética. El coeficiente V de Cramer fue de 0,238 entre la Herramienta de Detección Universal de Malnutrición y la Herramienta de Detección de Nutrición en Pacientes Hospitalarios Renales, y de 0,137 entre la Evaluación Global Subjetiva y la Herramienta de Detección de Nutrición en Pacientes Hospitalarios Renales, lo que indica la compatibilidad de la Herramienta de Detección de Nutrición en Pacientes Hospitalarios Renales con las variables de la herramienta de detección de Malnutrición Universal. Se observó una correlación moderada positiva significativa entre el número total de casillas rojas en la Herramienta de Detección Nutricional para pacientes hospitalizados con enfermedad renal y la puntuación total de la Herramienta de Detección Universal de Desnutrición ($p < 0,05$; $r = 0,404$).

Conclusiones: la herramienta de detección nutricional para pacientes hospitalizados con insuficiencia renal es una herramienta de detección nutricional válida y confiable cuando la utilizan enfermeras especializadas experimentadas en unidades de nefrología para pacientes diagnosticados de insuficiencia renal en Turquía.

Palabras clave: Desnutrición. *Malnutrition Universal Screening Tool.* Nefrología. Herramienta de detección nutricional para pacientes hospitalizados con insuficiencia renal. Evaluación global subjetiva.

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INTRODUCTION

Renal failure is the irreversible decrease in kidney function. In this case, biochemical homeostasis cannot be maintained, waste products and body fluids begin to accumulate (1). Renal failure is a disease with a prevalence of 9.1 % worldwide, increasing psychosocial problems and reducing quality of life (2,3). Patients with end-stage renal failure often experience a gradual decrease in nutritional status (4). The energy reserves and protein levels in the body are also depleted simultaneously. Later, muscle and fat loss and a decrease in the visceral protein pool occur (5,6). This condition, called protein-energy wasting, is reported to be 11-54 % worldwide in end-stage renal disease patients with stage 3-5 renal disease and 28-54 % in end-stage renal disease requiring dialysis (7).

The clinical use of Subjective Global Assessment (SGA) is increasing in patients with chronic renal failure. It has been confirmed that SGA can be used for nutritional status and protein-energy wasting, especially in dialysis patients (8,9). SGA requires regular and careful training of healthcare professionals to assess (10). However, SGA is not used as the gold standard for nutritional assessment in patients with renal failure (11).

Malnutrition Universal Screening Tool (MUST) is a screening tool used worldwide that includes Body Mass Index (BMI), decreased food intake in acute illness, and weight loss (12). However, the presence of malnutrition cannot be detected with MUST in most patients with chronic renal failure (13). In studies conducted with kidney patients, MUST has been found to have low sensitivity in detecting malnutrition (14,15).

It is important that the nutritional screening application yields the same results when applied by different individuals, identifies the risk of malnutrition with high sensitivity and can predict intervention when necessary (16). Nutrition guidelines recommend the use of combinations such as anthropometry, serum albumin, bioelectrical impedance, food intake and others to minimize errors in nutritional diagnosis (17,18).

In the absence of a validated kidney-specific nutritional screening test for kidney patients and to accurately identify the number of malnourished patients, the Renal Inpatient Nutrition Screening Tool (Renal iNUT) was developed. As in MUST, iNUT patients are divided into high (score 2), moderate (score 1), and low-risk (score 0) malnutrition categories with an appropriate action plan. In addition to body weight, height, BMI, and estimated weight loss found in other screening tools, iNUT includes questions on appetite, supplement use, intake, and kidney-specific weight details (19). This study was planned to establish the validity and reliability of the Renal iNUT screening tool specific to kidney patients in Turkey, as SGA requires clinical experience and MUST has low malnutrition sensitivity.

MATERIALS AND METHODS

Study population

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This cross-sectional study was conducted in the Department of Nephrology at Fırat University Medical Faculty Hospital in Elazığ, Turkey, with 153 individuals aged 18 and over between January 2023 and June 2024. Using these data, a power analysis was conducted to determine the required sample size for our study, targeting a similar effect size (Cohen's f ≈ 0.25) at an alpha level of 0.05 and a power of 0.95. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Patients with acute renal failure and chronic renal failure who were admitted to Fırat University Faculty of Medicine, either planned or unplanned, were included in the study within the first 48 hours after admission. Those who were admitted for less than 24 hours, those with communication barriers, those who could not be evaluated by the dietician within the first 48 hours, and those who could not be given an SGA grade were excluded from the study. Informed consent was obtained from all individual participants included in the study. The study was conducted through face-to-face interviews using a questionnaire. The iNUT form was applied by the nurse as part of the routine admission procedure. iNUT scores were checked and recorded by the dietician.

Validity of renal-iNUT

A cross-sectional study was designed to evaluate the predictive validity and face validity of Renal iNUT with MUST. Height and weight were measured using the standard MUST protocol (20). The patients' body weights were measured without shoes and wearing light clothing using a Tanita BC 601. Their heights were measured using a wall-type Leicester brand stadiometer. The patients' triceps skinfold thickness was measured with an Onbody brand plastic device and their upper mid-arm circumference was measured with a tape measure and recorded. Handgrip measurements were recorded by selecting the maximum value from the dominant arm or the arm without cannula/fistula, if any, up to three trials (patient-led).

Demographic information and biochemistry

The patients' application date, gender and age were questioned. Serum albumin, transferrin, fasting blood sugar and C-reactive protein (CRP) values were recorded from routine blood samples, and BUN and creatinine values were recorded from urine samples. Additionally, diastolic and systolic blood pressure values were recorded.

The researchers measured height (cm) and body weight (kg) of the participants. BMI was then calculated using the formula: weight (kg) / height (m)^2, and classified according to the WHO criteria (21).

Construct validity

According to the method of Detsky and colleagues, SGA was used as the reference standard for the validity of iNUT (22-24). The measurements were made by a nurse and a dietician and their reliability was checked. For SGA, body weight and height values measured with service equipment were recorded. According to the SGA result, the nutritional status of the patients was classified as A-well nourished, B-moderately malnourished and C-severely malnourished (22). The standard MUST form was applied by the research dietician. With the MUST score, the patients were classified as 0-low risk, 1-moderate risk and ≥ 2-high risk (20).

Predictıve validity

Patients' body weights were used for prediction validity.

Inter-rater reliability

The inter-rater reliability of the iNUT was tested in a subsample of patients who consented to the completion of an additional iNUT by a second person (dietician or floor nurse) who was blinded to the initial iNUT form (14,25).

Face validity

All nephrology service nurses were asked to respond to a brief survey using a four-point Likert scale regarding ease of use, time taken to complete the scale, an anonymous return option to reduce bias against negative responses, barriers, nursing education, and appearance and understanding of the iNUT.

Statistical evaluation of data

The data obtained in the study were analyzed using the SPSS (Statistical Package for Social Sciences) for Windows 25.0 program. Descriptive statistics were reported as minimum, maximum, mean ± standard deviation, frequency (*n*), and percentage (%). The evaluation of measurement tools was considered categorically and the relationship between categorical variables was examined with chi-square analysis. In addition, the concordance coefficient was calculated to determine the compatibility between the measurement tools. Kappa value is considered as Fleis Kappa and Weighted Kappa (a score of 0.01-0.20: slight agreement, 0.21-0.40: fair agreement, 0.41-0.60: moderate agreement, 0.61-0.80: substantial agreement, and 0.81-1.00: almost perfect agreement). The relationship between continuous variables was calculated with Spearman correlation analysis, and the concordances were calculated with the Intraclass Correlation Coefficient (ICC) coefficient (ICC, $>$ 0.75: agreement, 0.40-0.75: fair to good, $<$ 0.40: poor agreement). The continuous data used was tested for suitability for normal distribution. Whether the variables were normally distributed or not was examined with kurtosis and skewness values, and it was determined that they were not normally distributed. A 95 % confidence interval (CI) was applied to the correlation coefficients to evaluate the accuracy of the estimate and to assess the statistical significance of the associations between

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the variables.

RESULTS

The patients who participated in this study were 153 individuals in total, 56.2 % male (86 people) and 43.8 % female (67 people). When the distribution of chronic diseases of the participants was examined, it was observed that 48.3 % had chronic renal failure, 50.3 % had acute renal failure, 8.4 % had diabetes, 9.8 % had hypertension, and 13.0 % had other diseases; 67.3 % of the patients were hospitalized planned and 32.7 % were hospitalized unplanned.

The anthropometric measurements and blood pressure findings of the participants are shown in table I. Mean wet weight was 74.62 ± 14.95, dry weight was 72.17 ± 15.00, height was 1.67 ± 0.93, BMI obtained from wet weight was 26.83 ± 5.69 and BMI obtained from dry weight was 26.61 ± 5.65. Mean handgrip max was 17.69 ± 8.19, mid-arm muscle circumference was 28.05 ± 5.44 and triceps skinfold thickness was 22.23 ± 12.06. Systolic blood pressure was 131.17 ± 16.88 and diastolic blood pressure was 75.23 ± 11.70.

Participants' blood measurement results are given in table II. The mean BUN value of the participants was found to be 47.86 ± 32.16, creatinine value was 6.63 ± 10.24, albumin was 3.46 ± 0.71, blood glucose was 113.95 ± 4.56, transferrin was 50.46 ± 24.31, CRP was 24.97 ± 29.75 and urea was 113.97 ± 70.08.

The results of the participants' malnutrition status assessment with the MUST, SGA and iNUT measurement tools are given in table III. According to the MUST score result, 58.2 % of the participants have low, 24.2 % moderate and 17.6 % high malnutrition risk. According to the SGA score result, 72.7 % of the participants have low, 23.6 % moderate and 3.6 % high malnutrition risk. According to the iNUT score result, 32.7 % of the participants have low, 24.2 % moderate and 43.1 % high malnutrition risk.

The chi-square test was performed for the relationship between the MUST and iNUT evaluations of the patients and the SGA and iNUT

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evaluations (Table IV). According to the results, it was determined that there was a significant relationship between the MUST and iNUT evaluations. In other words, it was concluded that the evaluation tools reached similar results for the patients. According to the iNUT result, 62 % of the patients with low nutritional risk were evaluated as low risk according to the MUST result; 40.5 % of the patients at risk according to the iNUT result were evaluated as medium risk according to the MUST result; 3 % of the patients who needed to see a dietician according to the iNUT result were evaluated as high risk according to the MUST result. In addition, the Cramer V coefficient showing the relationship between the evaluation tools was calculated as 0.238. However, it was determined that there was no significant relationship between the SGA and iNUT evaluations ($p > 0.05$).

The results of the ICC and Spearman's correlation analysis between iNUT and MUST are given in table V. It was observed that there was a statistically significant positive moderate correlation between the total number of iNUT red boxes and the total MUST score ($p < 0.05$; $r = 0.404$). In addition, the absolute agreement coefficient between the two measurement tools with the calculated intraclass correlation coefficient was 0.318; consistency was calculated as 0.482.

Feedback was received from 40 nurses and nursing students who participated in the survey. Their experience in nephrology nursing was 0-15 years, with an average of 2.5 years. In all, 92 % of nurses reported that iNUT was 'easy' or 'very easy' to use, and 90 % completed iNUT in ≤ 10 minutes. Overall, 92 % of nurses reported that they felt confident in determining the correct course of action and 92 % reported that it was an appropriate tool for nephrology patients.

DISCUSSION

The application of combined methods is important in the assessment of nutritional status (10). It was observed that 53 % of kidney patients were malnourished (14,26). In this study, it was observed that 41.1 %

of patients were at nutritional risk. According to the SGA score, 3.6 % of patients and according to the MUST score, 17.6 % of patients were at nutritional risk. In this study, the sensitivity of iNUT to detect malnutrition was higher than MUST and SGA, and results were found closer to the literature.

Since MUST is based on BMI and body weight loss, it may not be able to detect malnutrition in many kidney patients (13). In the present study, the mean BMI calculated from clinical estimation of dry weight was found to be 26.61 ± 5.65 kg/m^2, which is well above the 20 kg/m^2 limit of iNUT. In case of edema, the real weight may be masked. Therefore, it seems more logical to use iNUT, which evaluates dry weight.

Cramer's V coefficient measures the strength of the relationship between two IxJ dimensional variables, independent of the number of rows and columns (27). In short, closely related nominal variables are relationship measures (28). When the strength of agreement between variables in this study was examined, agreement was observed between the “low risk” group in MUST and the “low nutritional risk” group according to iNUT. Agreement was observed between the “medium risk” group in MUST and the “monitor the patient at risk” group according to iNUT. Agreement was observed between the “high risk” group in MUST and the “consult a dietitian” group according to iNUT. ICC is used to represent the reliability and similarity between measurement tools (29). According to the ICC and Spearman correlation analysis results, a statistically significant, positive and moderate relationship was found between the iNUT red box count and the MUST total score. This shows that iNUT can also capture patients at risk for kidney patients and is similar to other scales.

In order to reduce inter- and intra-observer variability, subjective methods should be explained to practitioners early and carefully (10). One of the strengths of this study is that nurses are considered important stakeholders in nutritional screening. In the current study, iNUT was completed by nurses on the nephrology floor to target a

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realistic approach. Furthermore, iNUT was completed by nurses after an unsourced training. This suggests that it is a realistic and achievable application that can be performed by all nephrology nurses in routine screening in terms of sensitivity, specificity and reliability.

In addition, the response rates for the nurse opinion survey were good and a positive evaluation of iNUT was reported. Barriers to the completion of nutritional screening tests by nurses were listed as not being in line with the definition of the profession and inadequacy or lack of confidence (30). The positive responses given by nurses to iNUT may also be related to their experiences with nephrology patients. During the application, iNUT can be used by screening with nurses, who are important stakeholders, within the scope of professional clinical judgment.

The study has some limitations. Firstly, the sample size may not be sufficient to achieve statistical significance, and more generalizable results could be obtained with a larger sample. In addition, only short-term results were analyzed, and long-term effects were not evaluated, which is an important limitation. Lastly, dietary and lifestyle data based on subjective assessments may impact the accuracy of the results.

In conclusion, iNUT is a valid, reliable and practical nutritional screening method in nephrology services. The iNUT screening tool is particularly compatible with MUST. Since dry weight is calculated and malnutrition can be detected through weekly screening, it has advantages over other screening tests in that it is not affected by edema. iNUT is probably acceptable to nurses for routine use in nephrology services. The use of iNUT is necessary for timely nutritional intervention. In future studies, patient opinions can be evaluated, longer-term plans can be made, it can be compared with larger samples and different screening tests, and the effect of nutritional support initiated as a result of the screening test on biochemical parameters and malnutrition can be monitored.

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Table I. Descriptive statistics regarding anthropometric measurements and blood pressures of the participants

Variables	**Min**	**Max**	**Mean ± SD**
Wet weight (kg)	28.00	126.00	74.62 ± 14.95
Dry weight (kg)	27.00	124.00	72.17 ± 15.00
BMI obtained from wet weight (kg/m^2)	14.22	43.01	26.83 ± 5.69
BMI obtained from dry weight (kg/m^2)	13.33	42.17	26.61 ± 5.65
Height (m)	1.40	1.93	1.67 ± 0.93
Handgrip max	5.50	40.50	17.69 ± 8.19
MAMC (cm)	10.00	50.00	28.05 ± 5.44
Triceps skinfold thickness	7.00	120.00	22.23 ± 12.06
Systolic BP	90.00	200.00	131.17 ± 16.88
Diastolic BP	60.00	120.00	75.23 ± 11.70

BMI: body mass index; MAMC: mid-arm muscle circumference; BP: blood pressure.

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Table II. Descriptive statistics regarding the patients' blood measurement results

Blood measurement	**Min**	**Max**	**Mean ± SD**
BUN (mg/dL)	4.50	106.70	47.86 ± 32.16
Creatinine (mg/dL)	0.81	74.00	6.63 ± 10.24
Albumin (g/dL)	1.50	5.00	3.46 ± 0.71
Blood glucose (mg/dL)	6.00	243.00	113.95 ± 4.56
Transferrin (mg/dL)	24,00	119,00	50.46 ± 24.31
CRP (mg/L)	0.30	154.00	24.97 ± 29.75
Urea (mg/dL)	32.00	429.00	113.97 ± 70.08

BUN: blood urea nitrogen; CRP: C-reactive protein.

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Table III. Evaluation results of MUST, SGA and iNUT measurement tools

	Classification of measurement tools	**Number**	**Percentage**
MUST Score	Score 0 = Low risk	89	58.2
	Score 1 = Medium risk	37	24.2
	Score ≥ 2 = High risk	27	17.6
SGA Score	A = Well fed	80	72.7
	B = Mild moderate malnutrition	70	23.6
	C = Severe malnutrition	3	3.6
iNUT Score	Low risk	50	32.7
	At risk	37	24.2
	High risk	66	43.1

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Table IV. Relationship between MUST and HD-NUT with SGA and iNUT measurement tools

		iNUT risk status		
		Low nutritional risk	**Monitor the patient at risk**	**Consult a dietitian**
		***n* (%)**	***n* (%)**	***n* (%)**
MUST risk status	Low risk	31 (62.0)*	21 (56.8)	28 (42.4)
	Medium risk	19 (38.0)	15 (40.5)*	36 (54.5)
	High risk	0	1 (2.7)	2 (3.0)*
		Chi-square test: 17.395, Cramer V = 0.238, *p*: 0.002*		
		iNUT risk status		
		Low nutritional risk	**Monitor the patient at risk**	**Consult a dietitian**
		***n* (%)**	***n* (%)**	***n* (%)**
SGA risk status	Well fed	39 (78.0)	21 (56.8)	29 (43.9)
	Mild to moderate malnutrition	7 (14.0)	12 (32.4)	18 (27.3)
	Severe malnutrition	4 (8.0)	4 (10.8)	19 (28.8)
		Chi-square test: 5.732, Cramer V = 0.137, *p*: 0.220		

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Table V. ICC and Spearman correlation analysis between iNUT and MUST

	95 % CI			
	ICC	**Lower limit**	**Upper limit**	***r***
Single measurements (absolute fit)	0.318	0.168	0.453	0.404
Average measurements (consistency)	0.482	0.287	0.624	

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