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Original Article

Neonatal Nutritional Risk Screening Tool: Turkish Validity and Reliability Study

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Abstract

Background: It is extremely important and necessary to make nutrition screening to determine the risk of nutrition in the newborn and the problems that may develop. Nutrition screening can be screened by determining the nutritional needs of the patient and timely and effective nutritional support can be provided by early intervention. The study was conducted to evaluate the Turkish validity and reliability of the Neonatal Nutritional Risk Screening Tool.
Methods: The study, which had a methodological design, was conducted in the newborn clinic of a university hospital. A total of 402 infants who had the inclusion criteria constituted the sampling of the study.
Results: In this Turkish adaptation study, NNRST was calculated to have 43.31% sensitivity, 99.45% specificity, 98.94% positive predictive value, and 59.80% negative predictive value. The results of the NNRST evaluation and the reference test indicate a significant correlation [r = 0.501, p = 0.000]. The validity of the content was examined by calculating the Spearman Correlation Coefficient between each item score and the total score and the correlations between the total score and each item were found positive. The Spearman Correlation Coefficients received a value within the range of 0.245-0.767.
Conclusion: It can be argued that NNRST, which is adapted to Turkish, has a high power to effectively screen/distinguish healthy newborns in terms of nutritional risk.This tool can be used by healthcare professionals to screen a nutritional risk in hospitalized newborns.

1. Introduction

Nutrition is important for the preservation of the health of the child and the maintenance of normal growth and development [1]. Nutritional problems occurring since the early stages of life affect the child's health and development negatively, causing a series of problems that can continue at later ages [2]. Nutritional failure is not yet known or not emphasized in hospital children [3]. Severe nutritional insufficiency can be identified in children and mild or moderate nutritional failures can be overlooked. Nutritional failures that occur or are unidentified in the newborn period, which is a more special and sensitive period, adversely affect the health and development of the newborn. In previous studies, it was reported that nutritional difficulties and malnutrition cause serious problems in the short and long term in hospital newborns, especially in premature and low birth weighted infants [2, 4, 5]. It was reported that nutritional problems lead to an increase in hospital stay in the short term, an increase in morbidity, mortality, and maintenance costs, growth developmental retardation in the long term, neurotic

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problems, and learning difficulties. For this reason, it is extremely important and necessary to make nutrition screening to determine the risk of nutrition in the newborn and the problems that may develop. Nutrition screening can be screened by determining the nutritional needs of the patient and timely and effective nutritional support can be provided by early intervention [3]. European Pediatric Gastroenterology, Hepatology and Nutrition Association recommend that nutrition screening be performed as a way to identify patients with a high risk of nutrition [4]. Nutritional screening tools to determine the risk of nutrition can be applied simply and easily by all healthcare professionals. Especially nurses have significant responsibilities in the stages of patients to make comprehensive nutritional assessments and apply for nutritional support during the hospitalization of patients [6]. Although there are screening tools to determine the risk of pediatric nutrition, the diet screening tools that can be applied to newborns are limited in number. Development or validity reliability of the newborn-specific nutritional tools is very important in terms of allowing nutritional problems to allow early diagnosis, treatment, and care [3]. The present study was conducted to evaluate the Turkish validity and reliability of the screening tool Neonatal Nutritional Risk Screening Tool that was developed by [2] to identify the risk of neonatal nutrition.

2. Methods

Study design and population

The study had a methodological research design and the data were collected between November 2021-April 2022.

Population and Sampling

The population of the study consisted of infants who were hospitalized in the neonatal unit of a university hospital in a province of Turkey and the sample consisted of 402 infants in the first 28 days after birth and accepted to the newborn unit at least 24 hours ago. There is no consensus in the literature to determine the sample size in scale development, validity, and reliability studies. However, in the methodological studies conducted to test the validity and reliability of the measurement tools, it is recommended to obtain at least 5-10 times the number of items on the scale for the sample size. It is also emphasized that the number of samples less than 200 may be insufficient in revealing the psychometric structure, 300 may be suitable for revealing the factor structure of the test, and the ideal number is over 500 [7, 8]. In this study, it was deemed sufficient for the number of samples to be 310 since the measurement tool to be adapted consists of a total of 31 items. Since the loss rate was accepted as 25%, the sample size was expanded and the final sample size was determined as 402.

Data Collection Tools

The data were collected with the Descriptive Characteristics Form and the Neonatal Nutritional Risk Screening Tool.

Descriptive Characteristics Form

In this form that was prepared by researchers, there were 7 questions on the gender of the infant, age of gestation, date of birth, type of birth, physical measurements [birth and body weight], and medical diagnosis.

Neonatal Nutritional Risk Screening Tool [NNRST]

Zhou et al. [2] developed this tool to evaluate the risk of nutrition in newborns. NNRST can be used weekly in all newborns in the hospital with four items [Item I; Birth Status; Item II; Body Weight Change; Item III; Nutrients Route; Item IV; Diagnosis of Disease] and 31 indicators. For each indicator, the score varies between 1-4. Neonatal nutritional risk status is determined by total points obtained from four items of NNRST. Items I, II, III, and IV have the highest scores as 4, 4, 3, and 4, respectively. The lowest scores are 1, 2, 1, and 1, respectively and 0 points must be given if there is no relevant indicator for the newborn. The lowest score from NNRST is 0 and the highest score is 15. Nutritional risk is classified in three ways according to the total score: $\geq$ 8 points high risk, $\geq$ 4 and $\leq$8 points moderate risk, and $\leq$4 points low risk.

There are two basic scoring principles on the scale

Yılmaz et al. [1] the scoring process is never repeated. The highest score between the indicators in the same item is used in scoring. Even if more than one indicator is scored, only the highest score indicator is considered [2]. In scale, in items I-III, when there is no relevant indicator for the newborn, a “0” point is given. Based on the diagnosis of the doctor, the indicators not found in item IV are accepted in relation to the corresponding ones. NNTRA is recommended to be used with the revised Fenton Growth Table, which provides the determination of two indicators [An infant born small by gestational age: SGA; an infant born bigger by gestational age: LGA] and the evaluation of growth (length, head circumference, and weight).

The language and content validity of NNRST

There must be compliance between the original measurement tool and its translation and the items must be equivalent to each other in validity and reliability studies [9]. For this reason, the measurement tool was first translated from English to Turkish by three experts to ensure the validity of language and content. Translations were examined by the researchers and the Turkish text that best represents each item was prepared. Later, the scale, which was translated from the original language to the target language, was re-translated into the original language. With the new text obtained, the Turkish text was re-evaluated in terms of the meaning and understandability of the expressions by experts and the measurement tool has been given its final form.

Data Collection

Nutritional risk screening to ensure the standardization of the screening was performed by the newborn clinical responsible nurse at the time of application and until the infant was discharged. The anthropometric measurement data of newborns were evaluated by two trained nurses and recorded by the responsible nurse. Patients were weighed every morning using a precision electronic infant scale, and the head circumference area was measured weekly by using a sensitive standard taping. Weighing, height, and head circumference measurements were evaluated with reference to the Fenton Growth Curve [10]. Other information about newborns (gender, birth age, age of pregnancy, birth weight, any underlying disease, etc). was obtained from medical records.

Ethical considerations

Before the validity and reliability study of the scale into Turkish, permission was obtained by e-mail from Huaying Yin, one of the authors who developed the scale. Then, ethics committee [Date: 14.09.2021, No: 2021-09/10] and institutional permission [92047] was obtained. Additionally, verbal and written permission was obtained from the mothers of infants who meet the sampling criteria.

3. Results

Screening Accuracy

Using statistical cases of faltering growth and high-risk infants, the screening accuracy of the measurement tool was calculated. Faltering growth and high-risk infants were determined as positive, while medium risk and low risk infants and neonatals without faltering growth were determined as negative. As a result of the analysis, the sensitivity, specificity, positive predictive value and negative predictive value of the screening tool for all infants were calculated as 43.31%, 99.45%, 98.94% and 59.80%, respectively Table 1.

Table 1: Findings Regarding the Screening Accuracy of the Screening Tool.

	All Infants [n=402]	**High Risk [n=95]**	**Medium Risk [n=242]**	**Low Risk [n=64]**
True Positives	94	94	0	0
False Positives	1	1	0	0
True Negatives	183	0	119	64
False Negatives	123	0	123	0
Sensitivity [%]	43.31	100	0	-
Specificity [%]	99.45	0	100	100
Positive Predictive Value [%]	98.94	98.94	-	-
Negative Predictive Value [%]	59.80	-	49.17	100

Validity and Reliability

The validity of this study was demonstrated by criterion validity and content validity. Infants with faltering growth were accepted as the standart for criterion validity. Spearman correlation analysis and non-parametric Mann-Whitney U test were used to test criterion validity. A positive, moderate and significant correlation was found between the scores of high-risk infants and the number of infants with faltering growth [r=0.501, p=0.000]. The difference in scores between infants with faltering growth (7 (6, 8)) and infants without faltering growth (4 (3, 5)) was significant [Z=-16,319, p=0.000].
Content validity was examined by calculating the Spearman correlation coefficient between each item score and the total score of the screening tool. As shown in Table 2, the correlations between the total score and each item were found to be positive, and Spearman correlation coefficients ranged from 0.245 to 0.767.

Table 2: Spearman Correlation Results.

		Item 1	Item 2	Item 3	Item 4	Total Score
Item 1: Birth Situation	r	1				
	p	-				
Item 2: Weight Change	r	-0.003	1			
	p	0.946	-			
Item 3: Nutrient İntake Method	r	0.294*	0.106*	1		
	p	0.000	0.035	-		
Item 4: Disease Diagnosis	r	-0.028	-0.086	0.050	1	
	p	0.571	0.084	0.314	-	
Total Score	r	0.767*	0.245*	0.704*	0.274*	1
	p	0.000	0.000	0.000	0.000	-

* $p<0.05$

Comparison of General Data of Newborns in Three Risk Groups

General data of newborns in three risk groups are given in Table 3. There was no significant difference in the distribution of newborns in the three risk groups by gender [p>0.05]. As the nutritional risk level increased, it was determined that the gestational age and birth weight decreased significantly [p=0.000, p=0.000]. The difference between cesarean delivery rates in the three risk groups was statistically significant [p=0.002] and as the nutritional risk level increased, the rate of cesarean delivery increased. The differences between the length on admission and head circumference on admission measurements of the three risk groups were found to be statistically significant [p=0.000, p=0.000], and these values decreased as the nutritional risk level increased.

Table 3: The General Data of the Newborns at Different Risk Levels.

Characteristic	Low Risk	Medium Risk	High Risk	Statistical Value	P Value
Male Female [n]	40/24	136/106	48/47	2.252	0.324
Gestational Age [median [P_{25}, P_{75}], hafta]	38.0 [38.0, 39.0]	38.0 [35.0, 39.0]*	31.0 [28.0, 35.0]*+	132.213	0.000
Birth Weight [mean [SD], g]	3245.5 [397.4]	2918.4 [744.7]*	1770.2 [844.3]*+	106.510[a]	0.000
Cesarean Delivery [n [%]	32 [50.0]	166 [68.6]	73 [76.8]*	12.862	0.002
Length on Admission [median [P_{25}, P_{75}], cm]	50.0 [49.0, 52.0]	49.0 [46.0, 51.0]*	43.0 [35.0, 47.0]*+	91.858	0.000
Head Circumference on Admission [median [P_{25}, P_{75}], cm]	34.0 [34.0, 36.0]	34.0 [32.0, 35.0]*	30.0 [26.0, 32.0]*+	106.193	0.000

* Compared with the low-risk group, the difference was statistically significant
+ Compared with the medium-risk group, the difference was statistically significant
[a] F test [variance analysis]

4. Discussion

It is important for scientific impartiality that the correct measurements of observers who make measurements in the correct diagnosis in research and/or routine health services make the correct measurements of observers who make measurements with these methods. The studies conducted to determine the methods used in the diagnosis and how much they apply to the person in the diagnosis and what is the size of observation-school errors caused by participants who use these methods, in other words, the studies conducted to determine the quality of observations and measurements are called methodological studies [11–13]. Another diagnostic test method, which can make a definite patient and health diagnosis for a disease, that has been previously determined and has a high diagnosis rate, is called the reference test [gold standard]. The validity of the new test/method is determined according to a reference test [13]. Neonatal Nutritional Risk Screening is an important part of nutritional management. However, there is no reference test to evaluate newborns in terms of nutritional risk. To measure the degree of newborn nutrition risk, anthropometric measurements were evaluated as a reference test to evaluate the validity of NNRST developed in China and the Newborn Percentile curve was used. The Newborn Percentile Curve was used as a reference test to verify the measurement tool made in Turkish.

The test method to be used in the observation measurement must be able to distinguish who is sick and who is healthy. In this context, firstly, the answer to the question *"What is the validity and accuracy of the method used in the measurement?"* is sought. There are 2 components of validity; sensitivity and specificity. Sensitivity shows how many of the new diagnostic/measurement methods can correctly detect as "sick". The ratio of patients identified as patients with the new diagnostic test according to the reference diagnostic test gives the sensitivity of the new diagnostic test. Specificity indicates how much the new diagnostic measurement tool can correctly determine from the solid ones. According to the reference diagnostic test of those who are intact with the new diagnostic test (correct negatives), the ratio of the new diagnostic test gives the selection of the new diagnostic test [11–14]. A study conducted in China reported 85.11% sensitivity and 91.07% specificity in evaluating newborns in different risk groups. It was calculated that NNRST had 43.31% sensitivity and 99.45% specificity in the Turkish adaptation study. Compared to the original measurement tool, the sensitivity of the measurement tool adapted to Turkish was low but the specificity was high. An ideal diagnostic test is required to be 100% sensitive and 100% selective [13, 15]. However, this is difficult in practice because as the sensitivity of a test increases, its specificity decreases, and as its specificity increases, its sensitivity decreases. However, a test with very high specificity will give a relatively large probability rate even if its sensitivity is low [16]. The positive predictive value of the diagnostic test indicates how many of all participants gave positive results to the new diagnostic test applied. The negative predictive value of the diagnostic test shows how much of all participants who gave negative results to the new diagnostic test applied according to the reference test [11, 13, 14]. In a study that was conducted in China, it was found that NNRST had a 60.61% positive predictive value and 97.43% negative predictive value. In the Turkish adaptation study, it was calculated that NNRST had a 98.94% positive predictive value and a 59.80% negative predictive value. When compared to the original measurement tool, the positive predictive value of the measurement tool adapted to Turkish was found to be higher but the negative predictive value was lower. The negative predictive value of a test with high sensitivity is generally high. A test with high sensitivity has a negative disease. The positive predictive value of a test with high specificity is generally high. A highly-specific test provides the diagnosis of the disease/risk if it is positive [13, 14]. In this adaptation study, sensitivity and negative predictive values were lower when compared to the original measuring instrument, and the specificity and positive predictive values were found higher.

According to the results of the original evaluation of the original scale and the reference standard, the R-value was found to be 0.53 [p = 0.000]. R-value was 0.501 in the Turkish adaptation study, indicating a significant correlation [p = 0.000]. This means that NNRSA has a positive effect on predicting and detecting healthy infants. The scores of infants with a slowdown in growth were higher than those who did not decline in growth. These data can be interpreted as a tool that can effectively classify the nutritional status of infants. The R values of the four items that might represent the results of the scope validity were 0.767, 0.245, 0.704, and 0.274, respectively. These results show that content validity is positively associated between total points and each item. NNRSA was divided into three levels (low risk, moderate risk, and high risk), and comparative analyzes were performed in the present study. There were some differences between the three nutritional risk groups. It was found that infants of the high-risk group had a lower gestational age and birth weight, and nutritional risk was higher in the newborns born by cesarean section. It was determined that the measures of anthropometric (stature and head circumference) of newborns with high nutritional risk levels were also lagging.

5. Conclusion

In line with the data obtained in the study, NNRST, which is adapted into Turkish, has a high power to effectively screen distinguish healthy newborns in terms of nutritional risk. This tool can be used by healthcare professionals to screen a nutritional risk in hospitalized newborns. According to the data obtained from NNRST, interventions for protecting healthy low-risk infants can be developed. However, growth indicators must be traced routinely and dynamically screening the risk of nutrition in moderate high-risk infants.

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