

ARTICLE



The double burden of 'malnutrition': under-nutrition & obesity

Turkish version of the Preschool Children's Nutrition Screening Tool (NutriSTEP®): a validity and reliability study

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OBJECTIVE: In this study, it was aimed to evaluate the Turkish validity and reliability of the Preschool Children's Nutrition Screening Tool (NutriSTEP®), which is used to determine the nutritional status of children in the preschool period.

SUBJECT/METHODS: The sample of the study consists of 333 parents with children aged 3–5 years old living in Turkey, who voluntarily agreed to participate in the study and answered the Turkish NutriSTEP® form online. The forward and backward translation method was applied for the language validity of the Turkish form. Expert opinion was sought for content validity. Factor analyzes were applied to determine the construct validity of the Turkish form. Original NutriSTEP® and Iran NutriSTEP® were evaluated to assess cut-points. To evaluate the reliability of the Turkish version, the test–retest method was used.

RESULTS: As a result of expert opinion, the Content Validity Index was found to be 0.97. According to exploratory factor analysis, unlike the original NutriSTEP®, five sub-dimensions were obtained and the 13th question with a factor load of less than 0.30 was removed. According to the confirmatory factor analysis, it was shown that the scale was suitable for Turkish society. There were positive, high and statistically significant correlations between the NutriSTEP® scale test–retest scores ($p < 0.01$).

CONCLUSION: The Turkish NutriSTEP® questionnaire is both valid and reliable for the screening of nutrition risk in preschool children of the Turkish population.

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INTRODUCTION

The World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF) reported that in 2020, 47 million children under the age of 5 were stunted and 38.3 million were overweight [1]. It was found that 6% of children under the age of 5 in Turkey are stunted and 8% are obese. Stunting is more common in rural areas (8%), in the east of the country (8%), and among children from low-income (12%) and uneducated families (9%) [2]. It has been shown that 26–41% of children who were obese before school continue to be overweight in adulthood [3]. It is emphasized that eating habits develop in the preschool period and the importance of early intervention if there is a risk in terms of nutritional deficiency. It is recommended that preschool children aged 3–5 are at risk of malnutrition and their nutritional status should be evaluated regularly [4].

Nutrition screening tools are used to determine the risk factors of individuals in terms of nutrition and to plan nutritional intervention [5]. The Nutritional Screening Tool for Preschool Children (NutriSTEP®) has been developed and validated by J. Randal Simpson and friends of Canada, whose aim is to screen nutrition risks for children aged 3–5 years [4]. The NutriSTEP® was created to evaluate children's food and nutrient intake, physical growth and development, physical activity and sedentary behavior, food safety and nutrition environment. Studies on

NutriSTEP have been carried out in different societies and it has been concluded that it is an easy and practical scale that can be easily applied by parents without the need for healthcare professionals [6–9].

In Turkey, there is no short, fast and reliable nutrition screening tool that can be easily filled by the parent or the person who takes care of the child. This study was conducted based on the thought that it would be useful to evaluate the nutritional status of children in the preschool period. Therefore, this study aimed to adapt NutriSTEP to the Turkish language and culture, so that it can be used to assess the nutritional status of 3–5-year-old preschool children.

SUBJECTS AND METHODS

A written authorization was obtained from J. Randall Simpson and Steve De Brabandere by email for the validation and reliability study on the Children's Nutrition Screening Tool for Preschool Periods (NutriSTEP®). Approval was obtained from the Ethics Committee of Istanbul Bilgi University for the research. A voluntary consent form has been obtained from parents electronically for participation in the surveys.

This study was carried out online with parents with children aged 3–5 years living in Turkey between January 2021 and February 2021 within the scope of Coronavirus measures. In the literature, it is suggested that the sample size should be 5–10 times larger than each scale item in scale

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studies [10]. Based on this information, the sample size was determined as at least 170 people and 363 people who met the study criteria were reached. Persons who did not have children between the ages of 3 and 5 and did not agree to participate in the study were excluded from the study.

Data collection tools

The questionnaire form used as a data collection tool; anthropometric measurements consist of the Turkish form of the Nutritional Screening Tool (NutriSTEP®) for preschool children aged 3–5 years with the date of birth.

Parents who volunteered to answer the questions online. The data were recorded electronically. It was re-sent to 62 parents two weeks later and recorded for test–retest analysis.

Anthropometric measurements

In the study, anthropometric measurements could not be taken by the researcher due to the coronavirus epidemic. Parents were informed about height and weight measurement procedures. Height and weight measurements were recorded based on the statements of the families. Body mass index (BMI) is calculated as kg/m² divided by the length (m²) of body weight (kg). BMI assessment The Growth Standards used by WHO in the 0–5 age group were used [10]. Children's BMI, percentile values and Z-scores were evaluated using WHO ANTROPLUS [11, 12]. Unlike adults, BMI is grouped according to age and gender in children. The BMI classification is according to WHO data [13].

Nutritional Screening Tool for Children before School (NutriSTEP®)

Developed by J. Randal Simpson et al. to assess children's nutritional risk [4]. There are two versions for toddlers (18–35 months) and preschoolers (3–5 years) [9, 14]. NutriSTEP® consists of 17 questions assessing children's food intake, physical growth and development, physical activity and sedentary behavior, food safety and nutrition environment. The original scale consists of four sub-dimensions: food and fluid intake, physical growth and development, physical activity and sedentary behavior and factors influencing food intake and nutritional behavior. Each question has between two and five choices. Each option has a score from 0 (no risk) to 4 (high risk). Total points are determined by collecting question points. A high score means a high nutrition risk for children. Total scores range from 0 to 68. The breakpoints of the scale mean ≤20 low risk, 21–25 medium risk, ≥26 high risk [15]. Prevalence rates expected in the original study have been determined. The breakpoints according to the Iranian NutriSTEP® study that meets the expected prevalence mean ≤27 low risk, 27–31 medium risk, >31 high risk [7].

Validity and reliability study

With the increase in the number of multicultural and multinational studies in the world, the need for quantification tools, many of which are developed in English, has also increased. For the intercultural adaptation of scale in a new country, culture and language, it must use a method that is appropriate to the source and objectives. Intercultural adaptation needs to be adapted linguistically and culturally [16]. The paths to be followed in the adaptation are detailed in line with WHO and the International Test Commission. The language and culture between the country where the scale is developed and the country that adopts it, as well as the level of development, family order, economy and social life, affect the validity and reliability of the study [17].

Validity

Validity refers to how accurately a measurement tool measures the intended characteristic. The degree to which a scale can measure accurately without mixing any properties other than the measured property [18]. Only the validity of the scale cannot be determined with the scale itself. It also depends on the purpose, application, scoring format and group to which the scale is applied. Overall, the validity is higher for direct measurements and lower for indirect measurements. The validity level of the scale is determined by the result of the validity coefficient. The validity coefficient is the correlation coefficient between the values obtained from the scale and the set of criteria or criteria determined by the intended use of the scale, and it takes values between –1.00 and +1.00 [19, 20]. Validity; the structure is assessed in four ways as appearance,

scope and criteria validity. Language, scope and structure validity were studied in this study.

Language and content validity of the scale

According to the recommendations of scale adaptation studies, language and content were initially validated. After the translation of the scale to Turkish was carried out by the researcher, it was reviewed by two independent experts who are fluent in both languages and drafted upon the necessary changes. The draft form was translated back into English and evaluated by another expert, independent of the experts who provided the first translation [21].

The items of the original scale form which were rejected were compared and the non-conforming articles were reviewed again. The obtained NutriSTEP® Turkish form and original English form were submitted for the opinion of seven experts, including a doctor, dietitian, and nurse, who work in the field of child health, to ensure both language validity and content validity. A Content Validity Index (CGI) was used to assess expert opinions accurately [22]. Using the expert's DAVIS technique They are classified as "not suitable (1)", "slightly suitable correction is required (2)", "reasonably suitable (3)" and "very suitable (4)." Experts were asked to write down recommendations for the items that needed corrections or changes, only if the goods coverage rates are higher than 0.70. A CGI value higher than 0.80 is sufficient for scope validity [23]. As a result of expert opinions, necessary changes have been made.

Preliminary application of the research

In the preliminary application of the research, to determine the intelligibility of the finalized scale with expert opinions, five parents with children between the ages of 3 and 5 were asked to read the scale and to indicate any questions or words that could not be understood. The questions were edited according to the opinions and suggestions.

Construct validity

Construct validity can be defined as the degree of measurement of a test that measures a feature that cannot be measured directly. If the scale explains the structure well, it means that the items are consistent with each other. The subdimension is valid within the sub-scale. Each subdimension must be homogeneous and consistent within itself [23, 24].

Factor analysis aims to discover a small number of significant new dimensions-factors by combining interrelated variables. It was arranged to examine the structure of the variables and to explain the relationships between the variables in terms of a much smaller number of unobserved variables [25]. Factor analysis defines it as an analytical technique with a computational logic based on the relationships between observed variables, aiming to reach a small number of exploratory factors (concept) that explain the maximum variance. Factor analysis was developed by Spearman in the early twentieth century [26]. The purpose of factor analysis is divided into two basic methods: exploratory and confirmatory.

Exploratory factor analysis (EFA)

EFA aims to discover fewer and conceptually meaningful new variables (factors/dimensions) by bringing together interrelated variables [22]. Load values of 0.60 and higher are high and load values between 0.30 and 0.59 are defined as intermediate values and these ranges are taken into account when evaluating the variables [27].

In this study, EFA was applied to determine NutriSTEP® sub-dimensions. After the EFA, items with a factor load less than 0.3 were removed to reduce the variances between dimensions that would occur in the analysis and to increase the total variance explanation rate. As a result of the analysis, a five-factor structure different from the original scale was formed. Before applying the factor analysis, Kaiser–Meyer–Olkin (KMO) and Bartlett's test of sphericity were applied for the suitability of the data. KMO predicts that the sample should be greater than 0.5 for appropriate factor analysis [28].

Confirmatory factor analysis (CFA)

According to the EFA result, whether the structures whose final state was determined were confirmed or not was examined by first-level CFA. CFA aims to evaluate how well the model fits with the real data. Many fit indices are used to evaluate the validity of the model in CFA [29].

Reliability

Reliability determines how consistently a measurement tool measures a value it wants to measure. It shows the determination of results arising using the same methods under the same conditions. Reliability is not only a property of the measuring tool but also a property of the measuring tool and its results [30]. A high-validity scale is more reliable than a high-reliability scale. Reliability analysis is divided into four parts: reliability between observers, test–retest reliability, reliability of parallel forms and reliability of internal consistency [31]. Reliability analyses in this study, internal consistency and test–retest reliability, were performed.

It is the re-application of the measuring tool to the same individuals within a certain period under the same conditions. When re-applying the measuring tool, it is important to follow the application period. In the early application, the measuring tool can be remembered, but in practice, after a long time, it can cause states to change [32]. The time between two applications can be between two and four weeks. In this study, a repeat test was performed at two-week intervals by the literature.

Internal consistency is an assessment of how reliably survey or test items designed to measure a particular purpose do so. A high degree of internal consistency indicates that items aiming to evaluate the same goal give similar scores [33]. There is the halving method, Kuder Richardson reliability coefficient, item-total correlation, Cronbach alpha reliability coefficient, Tetra and Omega confidence coefficients. In this study, the Cronbach alpha coefficient was calculated.

Statistical evaluation of data

“Statistical Package for the Social Sciences (SPSS) 25.0” program was used to evaluate the data obtained from the study. KMO test was performed to determine whether the sample volume used in the study was sufficient.

The compatibility of the data obtained from the sample with the original factor structure of the questionnaire, root mean square errors of approximate, χ^2 fit test (χ^2 goodness), comparative fit index, good fit index, unnamed fit index were evaluated with the normalized fit index [29].

The methods used in the evaluation of validity and reliability can be summarized as follows:

Reliability: test–retest, internal consistency (Cronbach alpha coefficient).

Validity: language validity, content validity (expert opinion-CGI), construct validity (EFA, CFA, KMO coefficient and Bartlett’s test of sphericity analysis).

Limitations of the research

Since the study was conducted online because of the COVID-19 pandemic, the height and body weight measurements of the children could not be measured precisely and are limited to parental measurements. Three-day food consumption records of the children could not be taken and nutritional status assessment could not be evaluated by the dietitian. Data are limited to parents’ measurements and responses to survey questions.

RESULTS

A total of 44.1% of the children participating in the study were boys and 55.9% were girls. Considering the BMI percentile classification, 3% ($n = 10$) of the children were underweight, 6.6% ($n = 22$) were at risk of weakness, 52.2% ($n = 174$) were normal, 19.5% ($n = 65$) were overweight and 18.6% ($n = 62$) were in the obese group. The frequency and distribution table of categorical variables is given in Table 1.

The average height of the children is 103.36 cm, the average body weight is 17.76 kg, the average BMI is 16.75, and the average BMI (z) values are 0.80. Descriptive statistics for numerical variables are given in Table 2.

Validity analysis

Content validity. The NutriSTEP® language adaptation validity study was conducted using the CGI. It was submitted to expert opinion for content validity evaluation. The expert opinion form was evaluated by the DAVIS technique. The total CGI value was found to be 0.97 (Table 3).

Construct validity. The validity of the scale was evaluated using factor construct validity. The scale was first examined with EFA.

Table 1. Frequency and distribution for categorical variables.

		n	%
Gender	Boy	147	44.1
	Girl	186	55.9
BMI (percentile group)	Underweight	10	3.0
	Underweight risk	22	6.6
	Normal	174	52.2
	Overweight	65	19.5
	Obese	62	18.6

Table 2. Descriptive statistics for numerical variables.

	n	Mean	ss.	Min	Max
Age	333	4.39	0.80	3.00	5.00
Height (cm)	333	103.25	9.47	53.00	135.00
Weight (kg)	333	17.76	3.38	12.00	32.00
BMI (kg/m ²)	333	16.75	3.74	9.90	36.40
BMI (Z)	333	.80	2.33	−5.05	11.31
BMI (percentile)	333	64.6	30.47	0.10	99.90

KMO value and Bartlett’s test were applied to test the suitability of the data for factor analysis. According to the results of the KMO test, it was determined that the sample volume was sufficient (KMO = 0.689; $p < 0.01$).

Exploratory factor analysis (EFA). EFA was applied to find the sub-dimensions that are thought to affect children’s eating behaviors. EFA of 17 items was performed and five sub-dimensions were reached (Fig. 1). To reduce the variances between the sub-dimensions that may occur and to increase the total variance explanation rate, the 13th question with a factor load less than 0.3 was removed after the EFA was completed.

As a result of factor analysis, five sub-dimensions were formed. Questions 12, 15, and 16 are under the first subdimension. Under the second subdimension, there are questions 1, 2, 3, 4, and 5. Under the third subdimension, there are questions 6, 9, 10. Questions 7 and 14 are under the fourth subdimension and questions 8, 11, and 17 are under the fifth subdimension.

The structure resulting from AFA was evaluated with DFA. As a result of DFA, the compatibility indices of the model are sufficient. Criteria for compliance indices and results obtained from the model are presented in Table 4.

CFA was applied to assess whether the five-factor structure of the scale was verified. Figure 1 shows the path diagram of factor loads between the factors (sub-dimensions) obtained after the CFA and related substances.

Reliability analysis

Internal consistency. Cronbach’s alpha coefficient was calculated to test the reliability of the Turkish version of NutriSTEP®. Cronbach’s alpha coefficient was not calculated in the original NutriSTEP®.

The analysis was evaluated using data obtained from 333 parents. To determine to what extent the items affect the alpha coefficient, “Alpha If Item Deleted” values of the items were calculated.

Cronbach’s alpha values calculated for subdimension 4 and subdimension 5 are below the desired limits. However, Cronbach’s alpha value for the scale total shows that the scale is reliable. When the indicators calculated after CFA and Cronbach’s alpha were evaluated together, the reliability of the scale was confirmed (Table 5).

Table 3. NutriSTEP® expert opinion and content validity rates of Items ($n = 7$).

	Not suitable	Slightly suitable correction is required	Reasonably suitable	Very suitable	CGR
NutriSTEP1	0	0	2	5	1.00
NutriSTEP2	0	0	2	5	1.00
NutriSTEP3	0	0	1	6	1.00
NutriSTEP4	0	0	1	6	1.00
NutriSTEP5	0	1	1	5	0.85
NutriSTEP6	0	1	1	5	0.85
NutriSTEP7	0	0	1	6	1.00
NutriSTEP8	0	0	1	6	1.00
NutriSTEP9	0	0	1	6	1.00
NutriSTEP10	0	0	3	4	1.00
NutriSTEP11	0	0	1	6	1.00
NutriSTEP12	0	1	0	6	0.85
NutriSTEP13	0	0	2	5	1.00
NutriSTEP14	0	0	1	6	1.00
NutriSTEP15	0	0	1	6	1.00
NutriSTEP16	0	0	1	6	1.00
NutriSTEP17	0	0	2	5	1.00
CGI					0.97

Test–retest. For the NutriSTEP® reliability analysis, the test–retest method was used in the original study. For the time constancy and internal consistency calculations, 62 parents were retested with an interval of 2 weeks. As a result of the retest, a positive, high and statistically significant correlation was found between test–retest scores of the NutriSTEP® scale ($p < 0.01$).

DISCUSSION

In this study, the Turkish validity and reliability study of the Children’s Nutrition Screening Tool (NutriSTEP®) for preschool periods was conducted. NutriSTEP is an easy measurement tool that can be used to detect nutritional problems in preschool children, which parents can answer in a short time. Therefore, it is important to adapt it to different languages [15]. NutriSTEP® was previously translated into French, Farsi, Traditional Chinese, Chinese, Spanish and Vietnamese. However, there is no report of other than the published Iranian and New Zealand paper addressing the validity and reliability of translated versions of NutriSTEP® [6, 7].

After obtaining the necessary permissions, a draft form was created by using the translation and back translation methods of the scale into Turkish and presented to the expert opinion. As a result of expert opinions, the Content Validity Index (CGI) was calculated and the CGI value was found to be 0.97. Considering the obtained value as 0.80, a consensus among experts was achieved [22, 28]. Similar to our study, the CGI value was found to be high in the Iranian study [8]. These results confirm the relationship level of the expressions and their simplicity and clarity.

According to the results of KMO and Bartlett’s tests, after it was seen that the data were suitable for factor analysis, EFA was applied to reach the factors (sub-dimensions) that are thought to affect the nutritional status of children. According to this, after the EFA on the 17-item draft scale, the factor load was found to be less than 0.3, and NutriSTEP® with 16 items was obtained by removing the 13th question. The factor load of the 6th question was found to be less than 0.3 and it was excluded from the Iran NutriSTEP® study, and this item was interpreted as not being able to determine the frequency of fast-food eating exactly [8]. In different cultures, such differences may arise in adapting to different languages. In our study, it is thought that asking the 6th question related to the child’s physical activity adequacy

differently or presenting it with five options, as in most questions, may be useful in Turkish adaptation.

The original NutriSTEP® consists of four sub-dimensions, but in the Turkish NutriSTEP® study, five sub-dimensions were found, different from the original scale. Since the explained variance between 40% and 60% was acceptable, the value of 49.940% was found to be sufficient. According to the results of NutriSTEP® Turkish factor analysis and literature review, sub-dimensions were sedentary behaviors and nutritional behaviors (questions 12, 15, 16), consumption of food groups (questions 1, 2, 3, 4, 5), food and fluid consumption (questions 6, 9, 10), physical activity (questions 7, 14) and physical growth and development (questions 8, 11, 17). CFA was applied to evaluate the accuracy of NutriSTEP®’s 16-item structure with five sub-dimensions. Fit indices were examined. Considering the fit statistics calculated by CFA, it was decided that the previously determined structure of the scale was in good agreement with the collected data.

When the test–retest results were evaluated according to the sub-dimensions and the total of the scale, it was observed that there was a positive, high-level, statistically significant relationship between the original scale, the same as in the Iran NutriSTEP® and New Zealand NutriSTEP® studies ($p < 0.001$) [6]. These results were interpreted as the scale questions were clear, simple and reliable.

Cronbach’s alpha is one of the most commonly used analyzes to evaluate reliability. According to the articles published in the original NutriSTEP® and other studies, Cronbach’s alpha value was not calculated [6, 7, 9]. In the 16-question Turkish NutriSTEP® study, Cronbach’s alpha value was found to be 0.617. According to the evaluation criterion of Cronbach’s alpha coefficient, the interpretation of “The scale is quite reliable” was made. Since the values of the questions were not significantly higher than the Cronbach’s alpha value of the scale total, it was concluded that no question disrupted the structure formed after the factor analysis.

Considering the expected prevalences in risk determination proposed by the original NutriSTEP®, 55–75% low risk, 11–30% medium risk, 10–17% high risk are expected. When we evaluate the Turkish NutriSTEP® results, 33.6% are low risk, 21.1% medium risk and 45.3% high nutritional risk. According to our application to a large population in Turkey, such a high medium and high nutritional risk is not expected. This difference may be due to the cultural and sociodemographic differences of the Canadian and Turkish

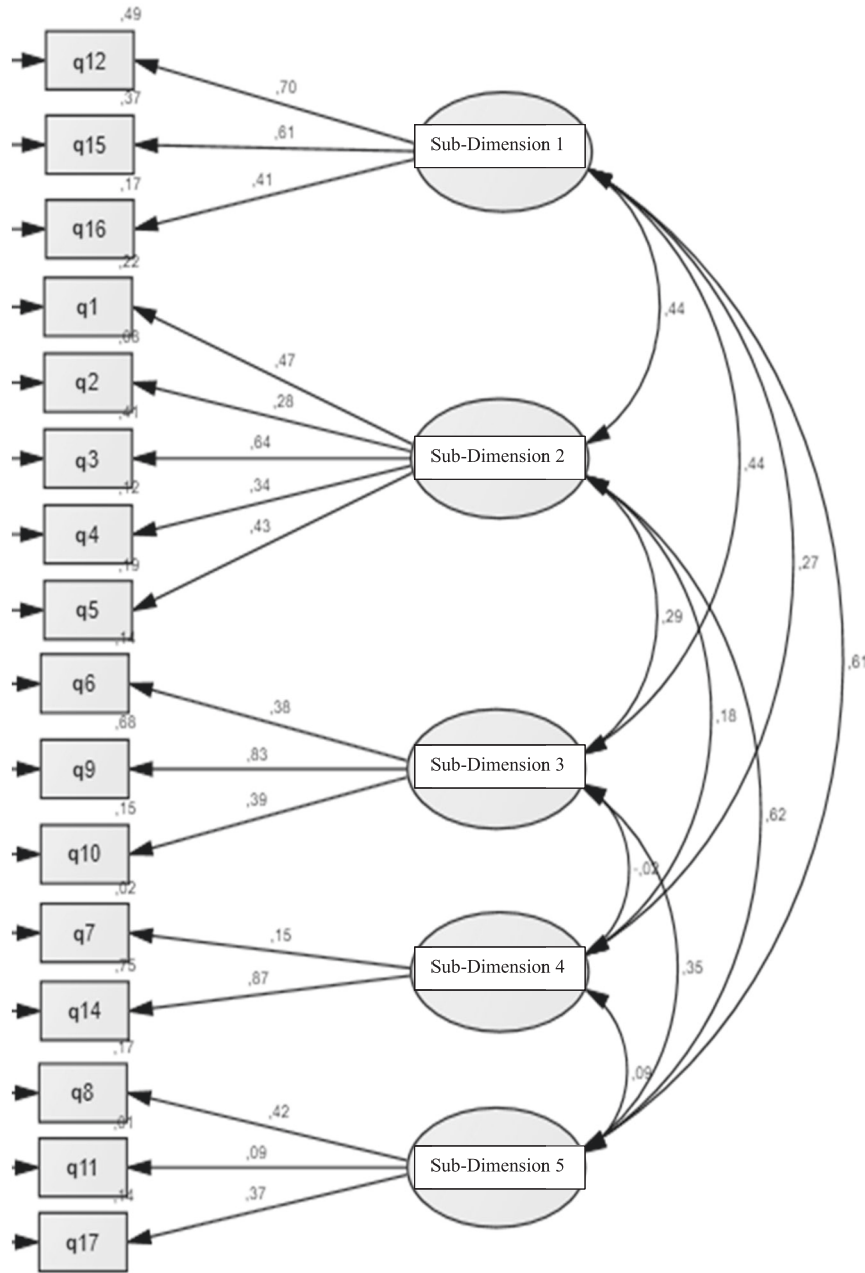


Fig. 1 NutriSTEP Path diagram and sub-dimensions (q = question).

Table 4. Confirmatory factor analysis compliance indices.

Compliance indices	Perfect harmony	Good harmony	The results
RMSEA	0<RMSEA<0.05	0.05<RMSEA<0.10	0.041
GFI	0.95<GFI<1	0.90<GFI<0.95	0.948
AGFI	0.90<AGFI<1	0.85<AGFI<0.90	0.925
CFI	0.95<CFI<1	0.90<CFI<0.95	0.902
c ² /df	c ² /df<3	3<c ² /df<5	1.564

Table 5. Reliability analysis on sub-dimensions and total basis.

	Cronbach's alpha
Subdimension 1	0.583
Subdimension 2	0.53
Subdimension 3	0.506
Subdimension 4	0.191
Subdimension 5	0.183
Total	0.617

populations. In the Iranian NutriSTEP® study, similar to our study, the expected prevalence according to the Canadian NutriSTEP® cut-off points was not met and it was stated that it may be related to different cultures and beliefs. New cut-off points were determined in the Iranian NutriSTEP® study [8]. Taking the new cut-off points into

account, low risk rose to 64.8%, the medium risk dropped to 16.5% and high risk dropped to 18.6%. When we applied the Iranian cut-off points, they matched the expected prevalence in the original study in the population we applied. In the adapted New Zealand NutriSTEP® study, the high-risk rate resulted in 10% higher than

the expected prevalence, and they stated that they concluded that the study result was more sensitive than the original NutriSTEP® [34]. It was decided to use Iranian NutriSTEP® cut-off points because it was more suitable for the expected prevalence in our study.

NutriSTEP is a parent-administered online questionnaire adapted and reliable for use in New Zealand setting to determine nutritional risk in preschool children [35]. The other study examined the feasibility of implementing the NutriSTEP® screen. A 17-item nutritional risk screening tool approved for use with both toddler and preschool populations, integrated with the electronic medical record in primary care settings in Ontario, Canada, concluded that it can be applied in the step-by-step decision-making process [36].

The experts reviewed the items for content validity and agreed that the scale showed good content validity in its original form. The high degree of expert agreement is an important finding to confirm the content validity of the Turkish version of NutriSTEP. Each dimension was subjected to a CFA to evaluate the factor structure and construct validity of the Turkish version of NutriSTEP.

This study confirms the validity and reliability of the Turkish version of NutriSTEP. The validity and reliability of the Iranian version of this scale have also been verified.

The strengths of this study are that NutriSTEP provided test-retest, language validity, content validity and construct validity. However, some limitations should not be forgotten. Criterion validity has not been evaluated. In future studies, children's 3-day food consumption record, medical and nutritional history, anthropometric measurements can be evaluated by dietitians and criteria validity can be achieved with NutriSTEP® total score. In this study, Iranian NutriSTEP® breakpoints with cut-off points meeting the expected prevalence were evaluated. Cronbach's alpha is one of the most widely used analyzes to evaluate reliability. Cronbach's alpha value was not calculated in the original NutriSTEP® and other studies. Therefore, this result could not be compared with previous studies.

CONCLUSION

It was concluded that the Turkish version of NutriSTEP® is valid and reliable. It is thought that it can be an easy and practical measurement tool that can be used to evaluate the nutritional status of preschool children in Turkey. It may be useful to conduct studies in which the Turkish version of the NutriSTEP scale is evaluated in detail by the dietitians of the 3-day food consumption record, medical and nutritional history, and anthropometric measurements of the children.

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HPD: concept and design or analysis and interpretation of data, design the article and translate it into English, and final approval of the version to be published. ST: concept and design or analysis and interpretation of data, designing the article, and contributing to the preparation of Turkish articles.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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