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Validity and Reliability of the Persian Version of Nutrition Screening Tool for Every Preschooler (NutriSTEP®) in Iranian Preschool Children

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ABSTRACT

Backgrounds: To assess the validity and reliability of the Persian version of Nutrition Screening Tool for Every Preschooler (NutriSTEP®), a community-based nutrition screening tool in preschool children.
Design and methods: A cross-cultural validation study was conducted on 192 Iranian preschool children in Mashhad, Iran. Forward and backward translation and face validity was assessed. Criterion validity was confirmed by nutritionist risk score which was determined by an expert physician. Content validity, construct validity and reliability of the Persian version was assessed as well. Receiver operating characteristic (ROC) curve was used to detect the reasonable cut-points for the Persian version.
Findings: Content validity index and ratio ranged between 0.9 and 1 and 0.63–1, which both were acceptable. NutriSTEP® scores were significantly different in the three categories of nutritionist risk scores ($p = .007$). Item-to-scale correlation analysis shows significant correlation between each item and the total score. A significant correlation was seen between test-retest scores of NutriSTEP® ($r = 0.68$, $p < .001$). In Persian NutriSTEP®, scores 27 and 31 seems to better reflect the nutrition risk in Iranian preschool children population and are suggested as cut-points; Therefore, scores lower or equal to 27 are determined as mild risk and 28–31 as moderate risk, while scores higher than 31 are categorized as high risk.
Conclusion: The Persian NutriSTEP® questionnaire is both valid and reliable for the screening of nutrition risk in preschool children of the Iranian population.
Practice implications: Health care professionals may use the NutriSTSP® tool to find nutritionally high risk children as an important step to prevent childhood obesity.

Introduction

According to recent reports of world health organization (WHO), non-communicable diseases (NCDs) including insulin resistance, coronary artery diseases (CADs), type-2 diabetes mellitus (T2DM), nonalcoholic fatty liver disease (NAFLD), the metabolic syndrome, and some kinds of cancers, are identified as a major challenge in the 21st century and are definitely considered as a core priority in both developed and developing countries ((WHO), 2017). Childhood obesity is shown to be associated with a higher risk of developing NCDs at a younger age, as well as premature death in adulthood (Li, Chen, Srinivasan, Xu, & Berenson, 2012; Park, Falconer, Viner, & Kinra, 2012). In 2016, an estimated number of 42 million children under five years old around the world, were overweight or obese, while >70% of them belong to countries with lower socioeconomic status ("UNICEF, WHO, World Bank Group: Levels and trends in child malnutrition,", 2017). Keeping these facts in mind that childhood obesity persists into adulthood and healthy eating habits which are established during childhood will be likely maintained to adulthood, urgent action is required to stop childhood obesity.

An important action toward prevention of childhood obesity is the early recognition of children at nutrition risk. Nutrition risk is defined as the presence of habitual characteristic or risk factors that can

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potentially lead to impaired nutritional status, which is a spectrum from under- to over-nutrition ("American Dietetic Association: Identifying patients at risk: ADA's definitions for nutrition screening and nutrition assessment,", 1994). Especially in developing countries where nutrition transition is occurring, children are the most vulnerable population in dietary transition. Early identification of children at risk of nutrition, even before anthropometric changes, can result in early intervention and effective prevention of moving the child toward childhood obesity. Therefore, screening systems for all children at a widespread level that identifies children at nutrition risk as early as possible are definitely cost-effective and can prevent many future expenses.

In Iran, a valid and reliable nutrition screening tool for younger children of the general population is not currently available. The Nutrition Screening Tool for Every Preschooler (NutriSTEP®) is a community-based nutrition screening tool for children that has been developed in four phases during eight years (1998–2006) and then validated in two versions for preschoolers and toddlers (Randall Simpson et al., 2015; Simpson et al., 2013; Simpson, Keller, Rysdale, & Beyers, 2007; Simpson, Keller, Rysdale, & Beyers, 2008; Whyte, 2012). It was first developed in two languages, English and French and is now translated into more than five other languages and is being used around the world ("NutriSTEP®, Nutrition Screening for Toddlers and Preschoolers,"). The main advantages of this tool are the following: 1) very simple and rapidly answered by parent/caregiver (Watson-Jarvis, McNeil, Fenton, & Campbell, 2011) (around five minutes), 2) providing an early identification of potential nutrition issues, 3) supporting in evaluating toddler and preschool nutrition interventions and 4) a means of monitoring community child nutrition programs. In October 2013, an internet adapted version of toddler and preschool NutriSTEP® (Nutri-eSTEP) was launched as part of a web tool, which is considered as another advantage of this tool (Simpson, Diedericks, & Haresign, 2018).

The purpose of the current study was a translation into Persian, cross-cultural adaptation and assessment of validity and reliability of the Persian version of NutriSTEP® in Iranian preschool children.

Methods and materials

In preparation for customized Healthy Start/Depart Santé initiative in Iran (Iran Healthy Start), we needed to validate and use all relevant tools including NutriSTEP®. Therefore, a cross-cultural validation study of the Persian version of NutriSTEP® questionnaire was conducted on 192 Iranian preschool children in Mashhad, Iran.

The Original NutriSTEP®

The original scale contains 17 questions in four categories: 1) food and fluid intake (items 1,2,3,4,5,6,9,10,13), 2) physical growth and development (items 8,16,17), 3) physical activity and sedentary behavior (items 14,15), 4) factors affecting food intake and feeding behavior, e.g. food security, feeding environment (items 7,11,12). Each question has two to five options, and each option has a score, ranging from 0 (no risk) to 4 (high risk). The scores of each choice are then summed to find the total score. A higher score indicates higher nutrition risk. Total scores can range from zero to 68. According to the cut-points, which was suggested by developers, a total score of ≤20 is categorized as low risk, while 21–25 and ≥ 26 are categorized as moderate and high risk, respectively ("NutriSTEP® Implementation Toolkit,", 2015).

Establishing the Persian version of NutriSTEP®

After obtaining the required license from developers through our lab, translation and cross-cultural adaptation of the original scale initiated in six stages, based on the guideline suggested by Beaton, Bombardier, Guillemin, and Ferraz (2000). Forward and backward translation and synthesis of the Persian version of NutriSTEP® were performed in the first three stages. For this purpose, two Ph.D. candidates, one informed and the other uninformed from the nature of the study independently translated the English version into Persian. After consensus and merging the translated versions, backward translation from the Persian version into English was done by two bilingual translators who had never seen the original NutriSTEP®. Conflicts or ambiguities were discussed, and two versions of the questionnaire (original NutriSTEP® and the back-translated one) did not have remarkable differences and were recognized to be equal. The pre-final Persian version was synthesized through the mentioned process.

Content validity

In the next stage, an expert committee was organized comprising of two physicians, four nutritionists, one physical activity expert, one psychologist, one epidemiologist, and two PhD candidates. They were asked to rate each item of the questionnaire for relevancy (1-not relevant, 2-item needs some revisions, 3-relevant but needs minor revisions, and 4-very relevant); clarity (1-not clear, 2-item needs some revisions, 3-clear but needs minor revisions, 4-very clear); and simplicity (1-not simple, 2-item needs some revisions, 3-simple but needs minor revisions, 4-very simple). The content validity index (CVI) was computed using the proportion of experts who rated the item as relevant, clear and simple (a rating of 3 or 4). A CVI of at least 0.79 was considered acceptable. If 0.70–0.78, it was revised and if CVI was ≤0.69, the item was eliminated (Abdollahpour, Nedjat, Noroozian, & Majdzadeh, 2011; Lynn, 1986). Content validity ratio (CVR) was also calculated for each item following Lawshe's procedure (Lawshe, 1975), after evaluation of expert committee and classifying each item as "essential", "useful, but non-essential" or "not essential". Regarding the number of reviewers, a CVR of at least 0.59 was considered acceptable. Moreover, to reduce the probability of agreement by chance, modified kappa statistic was calculated. This measure is interpreted as excellent for scores above 0.74, good for scores between 0.60 and 0.74, and fair for scores between 0.40 and 0.59 (Polit, Beck, & Owen, 2007). CVI, CVR and kappa statistic for each item based on four dimensions of the questionnaire are shown in Table 2.

Face validity

The next stage was pretesting the preliminary adapted Persian version. Thirty parents were asked to complete the questionnaire, and then they were interviewed by the researcher to comment on the questionnaire regarding understandability and fluency of items, phrases misinterpretations or ambiguity based on their perception to ensure that the adapted version still maintains its equivalences and adheres to the main idea in other situations.

Characteristics of participants

Preschoolers aged 4–6 years who came to two randomly selected preschools during summer time (June to September 2017) asking for registration for the education year (which starts from September 20th and ends at June 20th, in Iran) were included in the study. Preschools were located in low and high socioeconomic regions of Mashhad city, North-Eastern Iran, according to the data provided from the Provincial Education Department. Inclusion criteria were Iranian nationality and lived in Iran for the last five years and having enough reading and writing literacy for parent/caregiver. Parents were asked to fill two questionnaires, containing sociodemographic data and the Persian NutriSTEP®. The study protocol was approved by the Ethics Committee of Mashhad University of Medical Sciences (IR.MUMS.fm.REC.1395.208).

Procedure

Parents filled the sociodemographic and NutriSTEP® questionnaires and were also asked for 24-h recall for the child's dietary intake and

eating habits. Recall data was obtained from parents for three days with at least 14 days in between, at two weekdays and one weekend day. Anthropometric measurements were done as well for each child according to the standard protocol (CDC, 2007). Weight was measured by Beurer BG13 Digital Scale, Germany with a measuring rod of 0.1 kg and height by SECA 206 stadiometer, Germany with a measuring rod of 0.1 cm. Body mass index (BMI), BMI percentile and BMI z-score were calculated by AnthroPlus software, version 1.0.4, Geneva, WHO, 2009 ("WHO AnthroPlus for personal computers Manual: Software for assessing growth of the world's children and adolescents,", 2009). Children were also evaluated by a nutritionist. Then the nutritionist filled a standardized risk-rating guide according to the data from clinical history, physical examination, healthy eating index (extracted from three 24-h recalls) and anthropometry of each participant. This guide was introduced by the NutriSTEP® team and rates the nutrition status of the child based on a 10-point scale (1–4: low, 5–7: moderate and 8–10: high risks). The Persian version of this guide was also approved by the expert committee. This nutritionist risk rating score was used for the purpose of criterion validity of the Persian version.

Reliability

A number of 98 parents cooperated to fill out the questionnaire again after eight weeks for test-retest reliability assessment.

Data analysis

Data analysis will be done by IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp and MedCalc for Windows, version 18.9 (MedCalc Software, Ostend, Belgium). Descriptive analysis (frequency, percentage, mean, standard deviation) was used to characterize basic characteristics of participants. Analysis of correlation was used for assessment of criterion validity. Internal consistency was assessed by item-to-scale correlation. Exploratory factor analysis was used to obtain factor loadings by Varimax Rotation method. Reliability of the Persian version was evaluated by test-retest analysis. For developing appropriate risk determining cut-points for the Persian version, receiver operating characteristic (ROC) curve was created after comparing Persian NutriSTEP® and nutritionist risk rating scores to see which cut-point best matches the Iranian population by maintaining accepted sensitivity and specificity by use of Youden index. The comparison of ROC curves was performed using DeLong test. All tests were two-tailed and *P*-value <.05 was considered as significant.

Results

A total of 192 preschool children was recruited in the validation study, and 98 participants did the retest for reliability assessment. Demographic and anthropometric characteristics of participants are presented in Table 1.

Quantitative content validity

Accepted measures of both CVI and CVR were considered for approving the content validity of the Persian NutriSTEP® in the present study. Based on the results obtained from 11 members of the expert committee, the scores were 0.63 and higher for CVR, meaning that experts have approved the essentiality of all 17 items of the questionnaire. CVI scores were all above 0.80 which confirms relevancy, clarity, and simplicity of all items. Scale content validity index which was measured by the mean approach was calculated as 0.98. (Table 2).

Criterion validity

Risk rating scores which were identified by the nutritionist was considered as the standard criterion. NutriSTEP® scores ranged between 13 and 49. The scores were significantly different in three categories of nutritionist risk scores ($p = .007$). For low, moderate and high-risk groups based on nutritionist categorization, the mean NutriSTEP® score was 22.90 ± 6.60, 25.28 ± 6.03 and 28 ± 8.19, respectively. Analysis of correlation was also significant between the NutriSTEP® score and nutritionist risk score, ($r = 0.23$, $p = .003$). Significant reverse correlation also existed between the total score of NutriSTEP® and the healthy eating index of children ($r = -0.16$, $p = .03$).

Table 1
Demographic and anthropometric characteristics of the study population.

		Validity study ($n = 192$)	Reliability study ($n = 98$)
Child-related characteristics			
Age (month)		64.1 ± 6.0	62.5 ± 6.9
Sex (Female)		91 (47.9%)	47 (48.5%)
BMI z-score		0.3 ± 1.4	0.5 ± 1.3
Age of starting kindergarten (year)		4.7 ± 1.2	4.7 ± 1.1
Duration of exclusive breastfeeding (month)		4.8 ± 1.9	4.4 ± 2.0
Duration of breastfeeding (month)		18.5 ± 8.1	18.8 ± 8.0
Age of starting supplementary feeding (month)		5.5 ± 1.2	5.2 ± 1.0
Parent-related characteristics			
Mother age (year)		33.8 ± 4.7	33.5 ± 4.5
Father age (year)		38.1 ± 5.3	37.7 ± 5.4
Mother BMI (kg/m^2)		25.2 ± 3.9	25.5 ± 4.1
Father BMI (kg/m^2)		26.8 ± 3.8	26.3 ± 3.3
Mother education	Diploma or lower	84 (44.9%)	38 (39.2%)
	Higher than diploma	103 (55.1%)	59 (60.8%)
Father education	Diploma or lower	95 (51.3%)	48 (50.6%)
	Higher than diploma	90 (48.7%)	50 (49.4%)
Monthly Income (US Dollars)		1114.8 ± 939.1	1218.9 ± 1078.3

Data represents mean ± SD or frequency (percentage) as appropriate.

Construct (factor) validity

Internal consistency of the Persian version of NutriSTEP® questionnaire was assessed by item-to-scale correlation and factor analysis. Item-to-scale correlation analysis showed a significant correlation between each item and the total score. In this analysis "r" statistic ranged between 0.18 (question 7) and 0.62 (question 17). Factor analysis resulted in a four-factor solution, which was different from the original attribution for items 12, 13. Factor loading ranged between 0.33 (item 1) to 0.79 (item 12), and all the items had factor loadings higher than 0.30 except for item 6 (Table 3).

Table 2
Content validity index (CVI), content validity ratio (CVR), kappa statistic and Item-to-scale correlation for each item of the Persian NutriSTEP®.

Item number	CVI	CVR	Kappa	Item- to-scale correlation (r)
1	1	1	1	0.30
2	1	1	1	0.31
3	1	1	1	0.41
4	1	1	1	0.39
5	1	0.81	1	0.32
6	1	1	1	0.22
7	0.9	0.63	0.89	0.39
8	1	0.63	1	0.31
9	1	0.63	1	0.25
10	1	0.81	1	0.39
11	0.9	0.63	0.89	0.55
12	1	1	1	0.62
13	1	1	1	0.18
14	1	1	1	0.20
15	1	0.81	1	0.36
16	1	1	1	0.39
17	1	0.63	1	0.36

Test-retest reliability

Aiming at assessing the reliability of the Persian version, 98 parents accepted to re-fill the questionnaire after eight weeks. A significant and almost strong correlation exists between NutriSTEP® scores at baseline and after eight weeks ($r = 0.68$, $p < .001$).

Receiver Operating Characteristic (ROC) curve

The ROC curve for Persian version of the questionnaire, after comparison to the nutritionist risk scores indicates that the area under the curve (AUC) for the high (score 8+ was considered as high risk) and moderate (score 5+ was considered as high risk) risk rating was 62% and 65.5%, respectively. The second ROC was accepted (Fig. 1), although there was not a remarkable difference between the two AUCs ($p = .63$). The sensitivity and specificity for both moderate and high nutritionist rating scores are provided in Table 4. We suggest two cut-points to classify preschoolers into one of three following risk categories: ≤27 as low risk; >27 and ≤31 as moderate risk; >31 as high risk. The frequency of children in the low-risk category increased to 59.4%, while the rest of children were in moderate and high-risk categories.

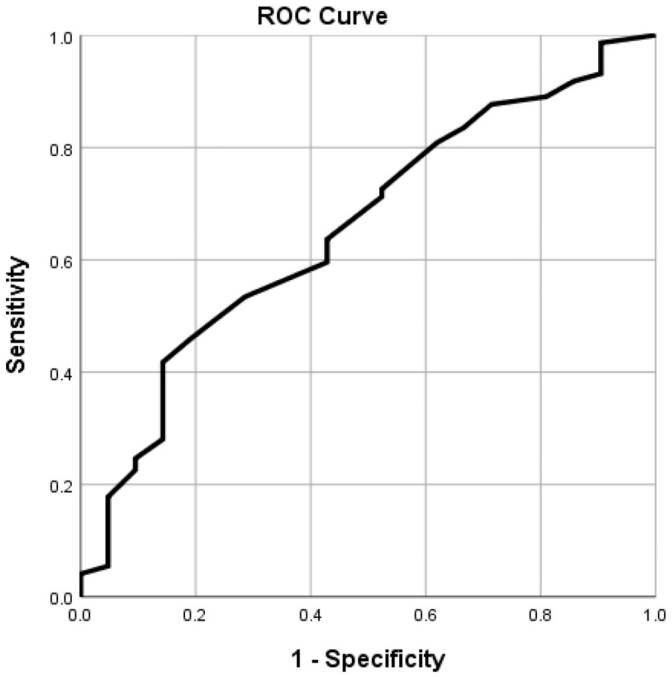

Fig. 1. Receiver operator characteristic (ROC) curve for NutriSTEP® score compared to nutritionist rating score (risk ≥5).

Discussion

Current findings indicated that the Persian Nutrition Screening Tool for Every Preschooler (NutriSTEP®) had accepted validity and reliability indices among the Iranian preschool children; however, cut-points needed to be revised to better interpret the nutrition risk among the Iranian population. This is the first validated screening tool for identification of nutrition risk among preschool children for population studies in Iran. This tool has been translated into other languages. However, there is no published report addressing the validity and reliability of translated versions of NutriSTEP®.

Considering the cut-points for risk determination that has been suggested by NutriSTEP® developers (≤20: low risk; >20 and ≤ 25: moderate risk; >25: high risk), the prevalence of children with low, moderate and high risk for nutrition status in current study was 19.8%, 28.1% and 52.1%, respectively. This frequency did not seem to be logical, because we had randomly recruited the preschools from both high and low socioeconomic levels and did not expect to have such a large number of nutritionally high-risk children. Moreover, this prevalence did not match the expected prevalence of risk, which was introduced by developers, based on the data from about 4000 preschoolers and toddlers ("NutriSTEP® Implementation Toolkit,", 2015), and was not congruent with the clinical experiences of our expert panel as well. This remarkable difference could be related to different cultures and beliefs among Canadian and Iranian parents. Most of the Iranian parents are not satisfied with their child's weight, and usually underestimate their child's healthy behaviors or habits and overestimate the child's malnutrition or unhealthy habits. This approach seems to be related to culture and perhaps results in higher average scores among Iranian children. As we found in this study, about half of parents believed that their child needs to gain or lose weight. Therefore, we decided to suggest new cut-points for the Iranian population, based on the NutriSTEP® scores and nutritionist rating scores. Based on the ROC curve for NutriSTEP® score in the studied sample, cut-points of 27 and 31 seemed more sensible and better-categorized children into different risk groups. Considering the new cut-point for interpreting the Persian NutriSTEP® (≤27:

Table 3
Factor loading and attribution of each item based on factor analysis.

Item	Factor loading	Original attribute	Current attribute
1) My child usually eats grain products	0.33	Food and fluid intake	Food and fluid intake
2) My child usually has milk products	0.57	Food and fluid intake	Food and fluid intake
3) My child usually eats fruit	0.42	Food and fluid intake	Food and fluid intake
4) My child usually eats vegetables	0.49	Food and fluid intake	Food and fluid intake
5) My child usually eats meat, fish, poultry or alternatives	0.53	Food and fluid intake	Food and fluid intake
6) My child usually eats "fast food."	<0.3	Food and fluid intake	–
7) I have difficulty buying food to feed my child because food is expensive	−0.56	Factors affecting food intake and eating behavior	Factors affecting food intake and eating behavior
8) My child has problems chewing, swallowing, gagging or choking when eating	0.58	Physical growth and development	Physical growth and development
9) My child is *not* hungry at mealtimes *because* he/she drinks all day	0.41	Food and fluid intake	Food and fluid intake
10) My child usually eats [number] times a day	0.52	Food and fluid intake	Food and fluid intake
11) I let my child decide how much to eat	0.65	Factors affecting food intake and eating behavior	Factors affecting food intake and eating behavior
12) My child eats meals while watching TV	0.79	Factors affecting food intake and eating behavior	Physical activity and sedentary behavior
13) My child usually takes supplements	0.65	Food and fluid intake	Factors affecting food intake and eating behavior
14) My child [gets enough/needs more] physical activity	0.36	Physical activity and sedentary behavior	Physical activity and sedentary behavior
15) My child usually watches TV, uses the computer, and plays video games	0.81	Physical activity and sedentary behavior	Physical activity and sedentary behavior
16) I am comfortable with how my child is growing	0.78	Physical growth and development	Physical growth and development
17) My child weighs [too little/much]	0.75	Physical growth and development	Physical growth and development

Table 4
Criterion values and coordinates of the ROC curve for both previously defined cut-points based on nutritionist score.

NutriSTEP® score	Moderate risk (5+)				High risk (8+)			
	SN (95%CI)	SP (95%CI)	PLR	NLR	SN (95%CI)	SP (95%CI)	PLR	NLR
≥13	100.0 (97.5–100.0)	0.0 (0.0–16.1)	1.0		100.0 (95.3–100.0)	0.0 (0.0–4.0)	1.0	
>13	98.6 (95.1–99.8)	9.5 (1.2–30.4)	1.0	0.1	97.4 (90.9–99.7)	2.2 (0.3–7.8)	1.0	1.1
>15	93.1 (87.8–96.7)	9.5 (1.2–30.4)	1.0	0.7	92.2 (83.8–97.1)	6.6 (2.5–13.9)	0.9	1.1
>16	91.7 (86.1–95.7)	14.2 (3.0–36.3)	1.0	0.5	90.9 (82.2–96.3)	8.8 (3.9–16.8)	1.0	1.0
>17	89.0 (82.8–93.6)	19.0 (5.4–41.9)	1.1	0.5	88.3 (79.0–94.5)	12.2 (6.3–20.8)	1.0	0.9
>18	87.6 (81.2–92.5)	28.5 (11.3–52.2)	1.2	0.4	85.7 (75.9–92.6)	14.4 (7.9–23.4)	1.0	0.9
>19	83.5 (76.5–89.2)	33.3 (14.6–57.0)	1.2	0.4	83.1 (72.9–90.7)	20.0 (12.3–29.8)	1.0	0.8
>20	80.8 (73.5–86.9)	38.1 (18.1–61.6)	1.3	0.5	79.2 (68.5–87.6)	22.2 (14.1–32.2)	1.0	0.9
>21	72.6 (64.6–79.7)	47.6 (25.7–70.2)	1.3	0.5	74.0 (62.8–83.4)	33.3 (23.7–44.1)	1.1	0.7
>22	71.2 (63.2–78.4)	47.6 (25.7–70.2)	1.3	0.6	72.7 (61.4–82.3)	34.4 (24.7–45.2)	1.1	0.7
>23	63.7 (55.3–71.5)	57.1 (34.0–78.2)	1.4	0.6	70.1 (58.6–80.0)	46.6 (36.1–57.5)	1.3	0.6
>24	59.5 (51.2–67.6)	57.1 (34.0–78.2)	1.3	0.7	67.5 (55.9–77.8)	51.1 (40.3–61.8)	1.3	0.6
>25	53.4 (45.0–61.7)	71.4 (47.8–88.7)	1.8	0.6	59.7 (47.9–70.8)	57.7 (46.9–68.1)	1.4	0.7
>26	45.8 (37.6–54.3)	80.9 (58.1–94.6)	2.4	0.6	51.9 (40.3–63.5)	65.5 (54.8–75.3)	1.5	0.7
>27	41.7 (33.7–50.2)	85.7 (63.7–97.0)	2.9	0.6	50.6 (39.0–62.2)	72.2 (61.8–81.1)	1.8	0.6
>31	28.0 (21.0–36.1)	85.7 (63.7–97.0)	1.9	0.8	38.9 (28.0–50.8)	84.4 (75.3–91.2)	2.5	0.7
>32	24.6 (17.9–32.5)	90.4 (69.6–98.8)	2.5	0.8	35.0 (24.5–46.8)	87.7 (79.2–93.7)	2.8	0.7
>33	22.6 (16.1–30.3)	90.4 (69.6–98.8)	2.3	0.8	32.4 (22.2–44.1)	88.8 (80.5–94.5)	2.9	0.7
>34	17.8 (12.0–25.0)	95.2 (76.2–99.9)	3.7	0.8	25.9 (16.6–37.2)	92.2 (84.6–96.8)	3.3	0.8
>38	5.4 (2.4–10.5)	95.2 (76.2–99.9)	1.1	0.9	9.0 (3.7–17.8)	97.7 (92.2–99.7)	4.0	0.9
>39	4.1 (1.5–8.7)	100.0 (83.9–100.0)	–	0.9	6.4 (2.1–14.5)	98.8 (94.0–100.0)	5.8	0.9
>49	0.0 (0.0–2.5)	100.0 (83.9–100.0)	–	1.0	0.0 (0.0–4.7)	100.0 (96.0–100.0)	–	1.0

SN: Sensitivity; SP: Specificity; NLR: Negative Likelihood Ratio; PLR: Positive Likelihood Ratio.

low risk, >27 and ≤31: moderate risk and >31: high risk), the prevalence of children in low-risk group increased to 59.4%, while those with moderate and high nutrition risk decreased to 12% and 28.6%, respectively. This prevalence was more consonant with the expected distribution among the studied population. Furthermore, according to a recent systematic review and meta-analysis, the prevalence of each type of malnutrition, in terms of wasting, stunting and underweight among under 5-year-old children were 7.8%, 12.4% and 10.5%, respectively, which is not high and it's even lower than the average of that in the world and the Eastern Mediterranean region (Mohseni, Aryankhesal, & Kalantari, 2018).

In item-to-scale correlation test which is a psychometric evaluation of a scale, "r" statistic ranged 0.18–0.62. Items with the "r" statistic below 0.2 could be removed (Field, 2005). In the current study, only item 7 had the "r" value below 0.2 (0.18). This item is in the "Factors affecting food intake, and eating behaviors" aspect and the question is: "I have difficulty buying food to feed my child because food is expensive (choices: most of the time, sometimes, rarely, never)"; However due to critical economic situations in developing countries including Iran, we decided to keep this question; Besides that Borkhoff et al. suggested that this single question may be an effective screening tool for food insecurity (Borkhoff et al., 2016). Other items had acceptable "r" which means that items are consistent with the whole construction of the scale. This is also interesting that items 16 and 17 had remarkably higher "r" than other items. These two items reflect the parent's opinion regarding their child's weight and growth. Item 16 is "I am comfortable with how my child is growing (choices: yes, no)", and item 17 is "My child (choices: should weigh more, is about the right weight, should weigh less)".

Factor analysis based on current data attributed item 12 (My child eats meals while watching TV) to "physical activity and sedentary behavior" category which was originally categorized as "factors affecting food intake and eating behavior". Moreover, item 13 (My child usually takes supplements) was attributed to "factors affecting food intake and eating behavior" category, while it was categorized as "food and fluid intake", based on the developer's analysis. Item 6 (my child usually eats "fast food") was not attributed to any of the aspects, since it had a factor loading below 0.3. The main explanation for this finding is that items 12 and 13 can reflect dual concepts, which one gets the higher factor loading. It seems that item 6 cannot truly detect the frequency of eating fast food in the child, perhaps due to the reason that this question induced an under-reporting in Iranian parents.

Some points can be considered as the strengths of this study; One is that we assessed the validity of the Persian NutriSTEP® from several

aspects such as content, criterion and construct validity. Another strength relates to the use of clinical criteria and an expert nutritionist's clinical judgment for assessment of criterion validity. Moreover, clinical assessment of children was done by one person, and preschools were randomly selected from both low and high socioeconomic levels, which both could reduce the selection and performance bias. However, some limitations should be remembered. Although the Cronbach's alpha is one of the well-known and commonly-used analysis for assessment of reliability, it was impossible to be used in the current study, due to non-uniformity in frequency and weights of choices among items. Also, the authors decided not to dichotomize the choices with the reason that this approach might diminish the data values. Therefore, only test-retest analysis was used for assessment of reliability.

Overall, the Persian version of NutriSTEP® is valid and reliable and can be used in Iranian preschool children population surveys. However, considering the cultural diversity in different provinces in Iran, additional assessment of validity and reliability of this nutritional tool in the various socio-cultural environment can be of great value.

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Declaration of competing interest

None.

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