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Research Article

Assessment of Validity and Reliability of the NutriCHEQ Questionnaire for Identifying Children Aged 1 to 3 Years at Nutritional Risk

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Abstract

Background: Toddlers' life is an important period for growth and development. Nutritional deficiencies created during this period are almost hard to compensate. This implies the need for timely, accurate and cost-effective screening of toddlers. Traditional methods of checking food intake are time consuming and expensive.

Objectives: Validate the NutriCHEQ questionnaire in assessment of the relevance of model and dietary intake of toddlers in Iran.

Methods: 155 children aged 12 to 36 months were randomly selected from health centers in the northen Tehran province. Their parents were asked to register all of their foods and beverage intakes. Each day, a trained expert contacted them to get information on food recalls, which were reviewed by Nutritionist 4. The NutriCHEQ questionnaire contained three parts; Part 1, Part 2 and Part 3. Finally, using the above information and statistical methods including Pearson correlation coefficient, one-way ANOVA and Bonferroni's test, for analyzing the data.

Results: The reliability of the first section was 0.62 and for the second section was 0.6. The mean NutriCHEQ scores for the first, second sections and total, were 2.12 ± 1.23, 3.43 ± 1.98 and 5.55 ± 2. 51, respectively. According to the NutriCHEQ score, 14 children (13%) were in the high risk group. There was a significant difference ($p<0.5$) between the risk groups in terms of percentage of carbohydrate energy, protein energy, vitamin D, iron. In the second section, there was a significant difference ($p<0.5$) between the groups in terms of daily intake of fiber.

Conclusion: The NutriCHEQ questionnaire seems to be a reliable and convenient tool for professionals and parents to identify children aged 1 to 3 who are at nutritional risk. Keywords: Children, Malnutrition, Nutritional Screening, Outpatient, Validation

Keywords: NutriCHEQ; Questionnaire; Nutritional Risk

Introduction

The early years of life is an important period for growth, development and health in children [1-3]. The adequacy of nutrient intake in this sensitive period is a key determinant of health in the short and long term [3-7]. Early childhood is a period in which habits and dietary preferences may be formed and the dietary habits that are created in this period may track into adulthood [8-10].

Malnutrition in this age group has increased significantly, and nutritional deficiencies created during this period are hardly compensable in the future [11]. Cognitive functions are associated with malnutrition, in particular lack of intake of iodine, iron, zinc, folate and vitamin B12 [4]. The toddler period is a time of dramatic changes in the physical and emotional development and is a key phase in the transition from breastfeeding to family food. In the

second year of life, the growth rate is reduced compared with infancy, while the need for nutrients remains high. One to two year old children need more energy and nutrients per body weight, which indicates that the energy and nutrient density should be high in toddler's diet [12]. On the other hand, this age coincides with the formation of a sense of independence, over confidence, complaint of foods and fear of new food [6,13,14]. Studies show that the current diet of toddlers is related to social status, especially maternal education and in some cases inadequate [15,16] and therefore, many children are at nutritional risk.

Generally, nutrient-rich foods are consumed to a lesser extent than the recommended dietary guidelines suggest, and high-calorie foods with low nutrient density are prevalent. For example, the UK National Diet and Nutrition Survey of 2008/09 showed that 50% of children aged 1.5 to 3 years in four days of registered dietary intake, consumed high-calorie items with low nutrient content, such as meat products, fried potato, bakery products and sweetened drinks [13]. Foods rich in nutrients, such as fish, raw vegetables and eggs were consumed by less than half of the same sample population. Similar patterns were observed in other countries, such as the United States and Australia [13]. With a high risk of a combination of malnutrition and environmental stress in some social strata, the path to a healthy development may be challenged which can lead to a poor performance in school, reduced economic opportunities and chronic health problems in adult life. When malnutrition and its consequences persist through the reproductive period and adulthood, it can affect the next generation and results in a vicious cycle of economic and health deprivation [5].

This emphasizes the need for timely, accurate and cost-effective screening of toddlers in terms of nutritional risk. This is normally done by comparing the food intake in these children with the dietary guidelines. Traditional methods of checking food intake, such as recalling and recording food, is time consuming, expensive and difficult. It is also difficult to compare the data extracted from these two methods with dietary guidelines, which are based on food groups. Using a Food Frequency Questionnaire (FFQ) is a cheaper, faster, and more convenient method, and the results can be made comparable to food guidelines. However, a complicated questionnaire can reduce family co-operation. Therefore, an appropriate nutrition assessment questionnaire for toddler diet should be short and simple and provide results based on food groups. Current dietary questionnaires evaluate only a limited group of foods (such as oils or fruits and vegetables) and we have a limited set of

Materials and Methods

The original NutriCHEQ questionnaire was carefully checked by the program executives and colleagues and translated without any changes. Then, parents of a small group of healthy children aged 1 to 3 who were referred to a Mofid children's hospital were asked to complete the questionnaire. After identifying some minor problems, the NutriCHEQ was slightly edited in order to be suitable for the Iranian community. The edited questionnaire was evaluated by a panel of specialists in the field (pediatricians and nutrition experts in children's nutrition) and underwent a formal validation.

- **Participants:** A total of 155 children aged 12 to 36 months randomly selected from the children from health centers in the northern Tehran province were included in the study.
- **Study Design:** The parents of these children were asked to register all of their dietary foods, beverages and dietary supplements with their amount for three consecutive days. At the beginning of each day, a trained expert from the health center contacted them to get food information recorded on the previous day. Parents did not receive any specific nutritional advice before the study, every food record/recall about daily intake, was according to the parents of the children in the study. The amount, type and name of all foods and beverages were recorded. Parents were asked to specify the amount of food by using units (eg, grams, ml), packaging sizes or household measures (such as cups, teaspoons or tablespoons). The average nutrient intake was evaluated using nutritional specific software (Nutritionist 4 version, Canada) in terms of macronutrient and micronutrient intakes. All parents signed informed consent form. Sick children were not included in the study if the child had an illness other than allergies or was on a diet or if the parent/caretaker did not sign the informed consent form.

The NutriCHEQ questionnaire, which was answered by the mother or the caretaker on the last day, was collected and scored by a trained expert from the health center, according to instructions provided by the original authors of the questionnaire.

NutriCHEQ questionnaire

The NutriCHEQ questionnaire contained three parts, the first part of which was scored, consisting of two sections. The first section contained 4 questions and examined the iron and other key nutrients intake. The second section contained 7 questions and investigated the child's nutritional balance. Possible answers to each question were limited A, B, C. Answers in the "A" category are appropriate or desirable (zero score); in"B" category are less than ideal (score 1); and in "C" category are the potential causes for concern / action (score 2). By collecting scores within each section, a risk indicator for a toddler's nutritional status is obtained, which is designed for evaluation, while the combined scores for sections 1 and 2 are generally ranked on all nutritional aspects. The maximum achievable score is 22 score from sections 1 and 2. The second and third parts were not scored and examined the risk factors associated with parental feeding patterns that affect the child's future

nutritional status and provide a space for parents to address their child's nutrition concerns.

Statistical analysis

To measure the reliability of the first and the second section of the NutriCHEQ questionnaire Cronbach's Alpha test was used. To assess content validity and face validity, the questionnaire was distributed among experts and their views on the questions in the questionnaire were considered and these validities confirmed by the experts. To evaluate concurrent validity, the NutriCHEQ questionnaire was compared with the recall questionnaire, and the Pearson correlation coefficient between the two questionnaires was meseaured. Characteristics of the study population were expressed using descriptive statistics. NutriCHEQ's ability to assess nutritional risk by comparing the child's score in NutriCHEQ and data collected was calculated using two methods: 1) Correlation test for assessing the relationship between points of questions and NutriCHEQ sections with the average intake of nutrients using Pearson correlation coefficient. 2) Children's quartile based on the score obtained from NutriCHEQ was used to determine whether a higher score in NutriCHEQ is associated with lower nutrient density and/or higher prevalence of obesity/overweight or not (using one-way ANOVA and Bonferroni's test).

Results

In this study, 155 toddlers (1-3 years old) were studied and 84 children (54.2%) were male. The mean age was 20.0 ± 6.7 months (range 12-36 months), weight 11.3 ± 1.9 kg (range 7.7-18 kg) and height 83.6 ± 8.7 cm (range 71-102 cm). Demographic and anthropometric characteristics of Iranian children aged 1 to 3 years old and their parents' educational status are summarized in Table 1. According to the WHO growth standard (weight for height), 16 children (10.3%) were underweight, 132 (85.2%) had normal weight and 7 (4.5%) were overweight. There were no significant differences in the sex of children, percentile and Z-score of weight to height and level of parental education between the three age groups. The mean of height and weight of children in the three age groups showed statistically significant difference (P <0.001).

	Total population	1 year	2 years	3 years	P
Number of participants (n)	155	48	58	49	
Gender (%), male: female	84:71	23:25	35:23	26:23	0.423
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
Anthropometrics					
Weight (kg)	11.3 ± 1.9	10.3 ± 1.9	10.9 ± 1.2	12.8 ± 1.8	<0.001
Height (cm)	83.8 ± 6.7	78.1 ± 4.4	82.5 ± 3.7	90.9 ± 4.9	<0.001
Weight for Height z-scores	-0.4 ± 1.3	-0.2 ± 1.4	-0.6 ± 0.9	-0.6 ± 1.4	0.181
Percentile	36.3 ± 31.3	42.2 ± 32.6	33.1 ± 27.3	34.3 ± 34.0	0.297
Weight for Height z-scores					0.119
Underweight (≥3rd centile)	15 (9.7%)	3 (6.3%)	4 (6.9%)	8 (16.3%)	
Normal (>3rd to ≤96th centile)	135 (87.1%)	43 (89.6%)	54 (93.1%)	38 (77.6%)	
Overweight (>97th centile)	5 (3.2%)	2 (4.2%)	0 (0%)	3 (6.1%)	
WHO centiles (%)					0.100
Underweight (≥3rd centile)	16 (10.3%)	4 (8.3%)	4 (6.9%)	8 (16.3%)	
Normal (>3rd to ≤96th centile)	132 (85.2%)	40 (83.3%)	54 (93.1%)	38 (77.6%)	
Overweight (>97th centile)	7 (4.5%)	4 (8.3%)	0 (0%)	3 (6.1%)	
	n (%)	n (%)	n (%)	n (%)	
Mother's Education					0.490
Primary/Intermediate	5 (3%)	0 (0%)	3 (5%)	2 (4%)	
Secondary	66 (43%)	19 (40%)	27 (47%)	20 (41%)	
Tertiary	84 (54%)	29 (60%)	28 (48%)	27 (55%)	
Father's Education					0.129
Primary/Intermediate	5 (3%)	0 (0%)	3 (5%)	2 (4%)	
Secondary	76 (49%)	19 (40%)	28 (48%)	29 (59%)	
Tertiary	74 (48%)	29 (60%)	27 (47%)	18 (37%)	

Table 1: Demographic and anthropometric characteristics of children aged 1 to 3 years old and their parents' educational status.

To measure the reliability of the first section of the NutriCHEQ questionnaire, which mostly reviews the intake of iron and vitamin D, Cronbach's Alpha test was used, and the reported alpha value was 0.62. For the second section of the questionnaire, which measures the risk factors associated with the feeding pattern, the reliability was reported 0.6, using the Cronbach's Alpha test. To assess content validity and face validity, the questionnaire was distributed among experts and their views on the questions in the questionnaire were considered and these validities confirmed by the experts. To evaluate concurrent validity, the NutriCHEQ questionnaire was compared with the recall questionnaire, and the Pearson correlation coefficient between the two questionnaires reported 0.6, which indicated that the concurrent validity is relatively appropriate.

The mean NutriCHEQ scores for the first section, second sectiont and total, were 2.12 ± 1.23 (range 0-6), 3.43 ± 1.98 (range 0-11) and 5.55 ± 2. 51 (range 0-15), respectively. According to the obtained NutriCHEQ score, in the first section, 49 children (32%) were categorized as low risk (0-1 points), 68 children (55%) were in the moderate risk group (2-3 points) and 20 children (13%) were in the high risk group (4-8 points) (Figure 1). In the second section, 52 children (34%) were categorized as low risk (0-2 points), 84 children (54%) were in the moderate risk group (3-5 points) and 19 children (12%) were in the high risk group (6-11 points) (Figure 2). In total, 28 children (18%) were in the low risk group (0-3 points), 113 children (73%) in the moderate risk group (4-8 points) and 14 children (9%) in the high risk group (9-15 points) (Figure 3).

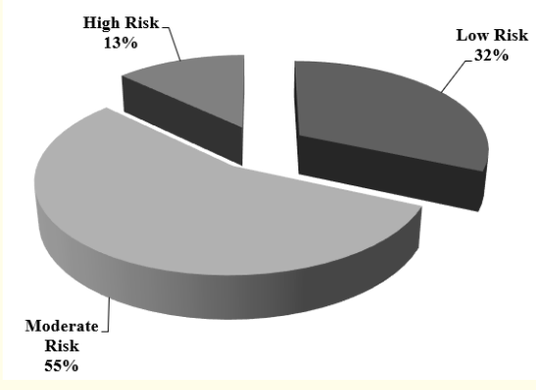

Figure 1: Distribution of NutricheQ risk categories for Section 1 in Iranian preschool children aged 1-3 years who participated in the NutriCHEQ validation study.

According to the score obtained from each section of NutriCHEQ questionnaire, children were assigned to separate risk groups and the average consumption of any food was determined individually, based on a 3-day recall.

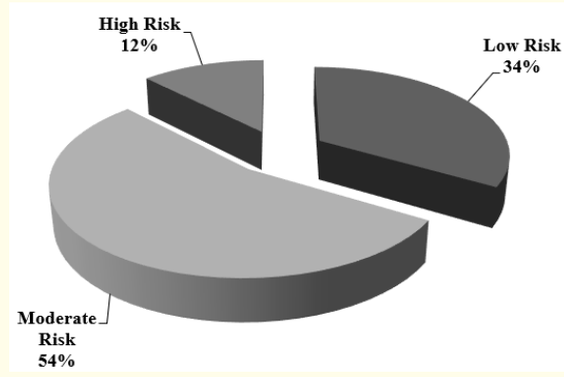

Figure 2: Distribution of NutricheQ risk categories for Sections 2 in Iranian preschool children aged 1-3 years who participated in the NutriCHEQ validation study.

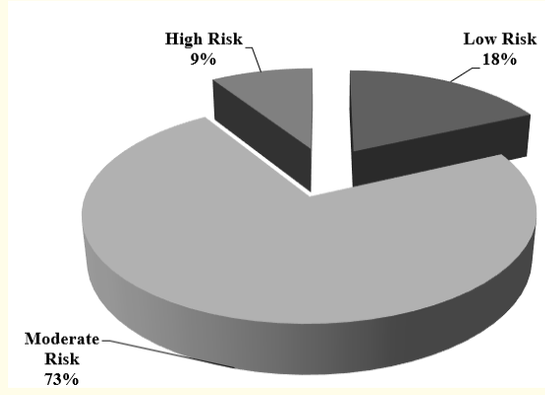

Figure 3: Distribution of NutriCHEQ risk categories for the total NutriCHEQ scores (Sections 1 and 2) in Iranian preschool children aged 1-3 years who participated in the NutricheQ validation study.

The results of statistical analysis for assessing the existence of a significant difference between the use of nutrients and micronutrients are summarized in Table 2. Since the scores of each section are different to identify the risk group, the analysis was performed separately for each section. Each analysis compared the average consumption of any food that was extracted from a 3-day recall.

In the first section of the NutriCHEQ questionnaire, a statistically significant difference was found between the risk groups, in terms of percentage of carbohydrate energy (P = 023), protein (P <0.001), protein energy content (P = 0.009), fat (P = 0.042), Folate (P = 0.048), vitamin D (P <0.001), vitamin E (P <0.001), Iron (P = 0.001), Calcium (P <0.001), Potassium (P <0.001) and Zinc (P = 0.049). However, there was no significant difference between the risk groups in terms of carbohydrate intake, energy intake from lipids and intake of vitamin A (P> 0.05).

	Low risk group	Moderate risk group	High risk group	P-value
	NutriCHEQ Section 1			
Score	0-1	2-3	4-8	
Number	49	86	20	
Carbohydrate (g)	131 ± 46.5	140 ± 48.4	123.6 ± 53.4	0.314
Carbohydrate (%TE)	49.8 ± 4.7	47.8 ± 5.5	46.13 ± 6.9	0.023
Protein (g)	33.1 ± 14.6	44.7 ± 12.7	43.5 ± 16.4	<0.001
Protein (%TE)	2.86 ± 1.8	3.74 ± 1.70	2.90 ± 1.70	0.009
Fat (g)	35.7 ± 10.7	41.0 ± 13.6	41.5 ± 11.5	0.042
Fat (%TE)	33.2 ± 4.32	35.6 ± 5.90	35.40 ± 5.20	0.394
Folic acid (µg)	126.5 ± 70.2	145.3 ± 63.4	109.1 ± 58.7	0.048
Vitamin A (µg)	444.5 ± 70.2	500.4 ± 421.7	517.4 ± 408.4	0.559
Vitamin D(µg)	4.40 ± 3.3	0.94 ± 1.2	1.2 ± 0.51	<0.001
Vitamin E (µg)	8.50 ± 3.38	6.6 ± 2.3	5.90 ± 1.32	<0.001
Iron(mg)	7.21 ± 2.85	5.71 ± 2.40	5.65 ± 1.22	0.001
Calcium (mg)	525.06 ± 177.2	5.71 ± 325.9	420.50 ± 247.6	<0.001
Potassium (mg)	396.8 ± 177.2	1451.65 ± 496.9	1549.35 ± 521.10	<0.001
Zinc (mg)	6.70 ± 2.97	5.10 ± 2.30	5.23 ± 1.50	0.049
	NutriCHEQ Section 2			
Score	0-2	3-5	6-14	
Number	52	84	19	
Sugar (g)	54.4 ± 21.9	51.8 ± 23.7	48.7 ± 29.4	0.657
Saturated fatty acid (g)	13.5 ± 8.32	12.2 ± 5.64	11.1 ± 4.09	0.305
Saturated fatty acid (%TE)	10.9 ± 5.25	10.2 ± 4.79	9.4 ± 3.14	0.487
Dietary fiber (g)	9.10 ± 4.98	7.95 ± 4.33	6.16 ± 3.36	0.046
Thiamin(mg)	0.77 ± 0.35	0.61 ± 0.31	0.52 ± 0.36	0.005
Riboflavin (mg)	1.20 ± 0.40	1.13 ± 0.34	0.96 ± 0.29	0.038
Niacin (mg)	7.74 ± 3.37	7.07 ± 4.52	6.97 ± 4.36	0.615
Folic acid (µg)	185.72 ± 104.5	144.09 ± 90.2	148 ± 45	0.042
Vitamin C (µg)	87.7 ± 70.4	55.1 ± 52.02	69.10 ± 63.6	0.010
Sodium (mg)	802.70 ± 506.25	613.40 ± 411.30	634.05 ± 344.53	0.047
Potassium (mg)	1579.77 ± 558.83	1427.08 ± 506.40	1249.23 ± 481.15	0.045
Calcium (mg)	517.48 ± 329.42	419.68 ± 239.42	356.28 ± 220.91	0.041
Phosphorus (mg)	729.66 ± 342.96	653.21 ± 289.29	515.12 ± 260.92	0.032
Fruit (g)	195.26 ± 106.46	176.19 ± 116.62	96.81 ± 94.08	0.004
Vegetable (g)	117.89 ± 85.9	113.92 ± 72.5	121.53 ± 69.8	0.909

Table 2: Intake of micronutrients and macro nutrients according to the risk groups (NutriCHEQ score Sections 1 and 2).

In the second section of the NutriCHEQ questionnaire, there was a significant difference between the groups in terms of daily intake of fiber (P = 0.046), vitamin B1 (P = 0.005) and vitamin B2 (P = 0.082). However, there was no significant difference between the groups in terms of sugar intake, saturated fatty acids and percentage of energy from them (P> 0.05).

According to the total score of the NutriCHEQ questionnaire, the quartiles were determined so that 28 children (18%) were in the first quartile, 56 children (36%) in the second quartile, 40 children (26%) in the third and 31 children (20 Percent) were in the fourth quartile (Table 3). Sex distribution between the quartiles indicated that in the second and third quartiles, the girls were assigned to a greater number (P = 0.021). However, there was no significant difference between the mean ages of individuals in different quartiles. Data showed that there was a significant difference between NutriCHEQ total quartile score in terms of daily fiber intake (P = 0.039). There was, however, no significant difference between

	Quartile 1		Quartile 2		Quartile 3		Quartile 4		P*
Total NutriCHEQ score (Sections 1 and 2)	0-3		4-5		6-7		8-13		0.021
N	28		56		40		31		
Gender (Male: Female)	16:12		32:24		14:26		22:9		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Age (years)	1.89	0.83	2.14	0.77	1.80	0.76	2.13	0.81	0.128
Nutrient analysis									
Energy (MJ)	4.71	1.3	4.7	1.4	5.10	1.6	4.83	1.7	0.674
Protein (% TE)	12.24	4.7	12.93	3.8	13.30	2.5	12.41	3.7	0.620
Carbohydrate (% TE)	49.90	14.6	49.24	12.6	53.47	10.6	52.10	11.3	0.359
Dietary fiber (MJ)	11.0	4.7	10.2	4.4	9.1	4.0	8.1	3.8	0.039
Total fat (% TE)	39.80	11.8	39.72	12.6	35.10	9.8	37.34	10.9	0.209
Sat. fat (% TE)	12.65	6.2	11.21	3.5	10.91	4.5	11.40	4.8	0.467

Table 3: Mean daily intakes of nutrients for Iranian children from the National Preschool Nutrition Survey by quartiles of total NutriCHEQ score (Sections 1 and 2).

quartiles of NutriCHEQ total score in terms of energy (P = 674), percentage of energy derived from protein (P = 0.620), percentage of energy derived from carbohydrates (P = 359), percentage of energy derived from fats (P = 0.209) or in percentage of energy derived from saturated fats (P = 0.467).

Discussion

Toddlers' life is an important period for growth, development and health in children [1-3]. The adequacy of nutrient intake in this sensitive period plays a vital role for their health in the short and long term. Nutritional deficiencies created during this period are almost hard to compensate [3-7]. This implies the need for timely, accurate and cost-effective screening of toddlers in terms of nutritional risk. Traditional methods of checking food intake such as recalling and recording food are time consuming and expensive. Therefore, an appropriate nutrition assessment questionnaire for toddler diet should be simple and provide results based on food groups [13]. Regarding the lack of a valid questionnaire for assessing the diet of toddlers in Iran, this study was carried out to validate the NutriCHEQ questionnaire which not only evaluates nutrition intake but also it evaluates eating habits that affect the child's health in future [17].

Using Cronbach's Alpha test, the reliability of the first section of the Nutritional questionnaire was 0.62 and for the second section of the questionnaire was 0.6. Rice and colleagues reported 0.5 for NutriCHEQ reliability. Normally, a score of 0.7 for alpha is acceptable. Rice and colleagues argued that their low score (0.5) could be due to the small number of cases on a scale, the multi dimensionality of the instrument, and the inclusion of positive and negative statements in the questionnaire [18].

Content validity and face validity were confirmed by local experts. The concurrent validity of the NutriCHEQ questionnaire was compared with a recall and the results showed that the validity of the concurrent validity was relatively good and the Pearson correlation coefficient between the two questionnaires reported 0.6. Therefore, the NutriCHEQ questionnaire seems to be a worthy successor to the recall questionnaire in various studies, however, more studies are needed.

When using the NutriCHEQ questionnaire, and based on the scores obtained from different sections of the questionnaire, three nutrition risk groups were identified [17]. In the present study, 13% of children were at high risk. In a study which was conduct on 247 Lebanese children, 20% of children were at high risk. They stated that most Lebanese children were at low or moderate risk, which could be a sign of good eating habits in these children [19].

In the study which was conduct on 371 Irish preschool children 30% of children over two years of age were overweight or obese [18]. In the present study, according to WHO standard percentiles, seven children (4.5%) were overweight, of which four children (8.3%) were one year old and three children (6.1%) were three years old.

The first part of the questionnaire examines the consumption of milk, meat and fish and determines the intake of iron, vitamin D, protein and lipids. In this study, iron intake in children at high risk was higher than the DRI-Estimated Average Requirements (3 mg/d). With the help of the NutriCHEQ questionnaire, children one-to-three years old at risk for iron deficiency could be identified and, if necessary, blood tests and nutritional interventions per-

formed to prevent the negative effects of iron deficiency on growth and brain development [17]. The protein intake in this group was higher than the DRI (13 g/d) and the intake of vitamin D was less than the DRI-Estimated Average Requirements (10 µg/d). In the study of Rice., et al. the majority of nutrients in Irish children were sufficient; however, insufficient vitamin D, iron, dietary fiber and, to a lesser extent, vitamin A and Zinc were observed [18].

The iron intake among Italian children in the high risk group was low, and protein and fat intake were reported high. Also, iron and vitamin D intake was lower than recommended in all children. Due to high protein and fat intake, the risk of obesity and cardiovascular disease is higher in Italian children in the high risk group [17]. In a study which was conduct on Lebanese children any relationship between nutrition and scores of the questionnaire was not observed, and it was explained by insufficient accuracy in completing the questionnaire by the mother or career, since they believed that a group of people, such as mother, nurse, grandmother and grandfather, might feed the child during the day [19].

The second part of the questionnaire examined the parental feeding method, the environmental factors, the balance or imbalance of the child's nutrition, which is associated with increased health risks and dietary habits in the future. The higher the score obtained in this section, means lower consumption of fruits and vegetables that reflects higher risk [19]. Fruits and vegetables are important sources of vitamins and minerals, and they play an important role in the health of children due to the development of satiety, since they prevent excessive eating and subsequently obesity and overweight [17]. In this study, fiber and fruit consumption in high-risk group children was lower than the other groups. Fiber and fruit consumption dropped in Italian children from low-risk group to high-risk group. In children less than two years old, receiving low fiber is associated with an increased risk of constipation and appendicitis. In the present study, the level of vitamin C in children was lower in the moderate-risk group, but it was lower in the Italian children in high-risk group children. This may have a role in iron deficiency [16,17].

The analysis of food intake related to risk score in the study of Rice., et al. showed that intake of key nutrients, including iron, zinc, vitamin D, fiber, calcium, fruits and vegetables in children in the highest quartile for risk score were significantly lesser than children in lowest quartile. In the present study, this significant difference was observed in the amount of dietary fiber intake. These results confirm that children with the higher NutriCHEQ score had a lower quality in food intake [18].

The NutriCHEQ questionnaire identifies toddlers who are likely to receive less or more of some macronutrients and micronutrients due to nutritional imbalances [17]. By using the NutriCHEQ questionnaire, nutritional problems also can be quickly identified in children aged 1 to 3 who have inadequate intake of nutrients, which has previously been shown to introduce possibilities to make nutritional interventions on a timely, targeted, and cost-effective basis [18]. Parents and experts also confirmed the fast and convenience of the questionnaire.

In this study, the relationship between many nutrients and obtained score in NutriCHEQ questionnaire was found, which was consistent with the study of Morino, Rice and colleagues, but did not fit with the study of Aramouny., et al. They did not observe this relationship, and expressed that this is due to the inadequacy of completing the food recall [19].

Limitations

Experts were trained similarly but their perceptions were not the same, thus we had to train other experts. Also, for accuracy of the questionnaires we had to fill them several times. Due to these reasons, the study was taken much longer.

Conclusion

The NutriCHEQ questionnaire seems to be a reliable and convenient tool for professionals and parents to identify children aged 1 to 3 who are at nutritional risk. With the help of this questionnaire, children at nutritional risk can be quickly identified and targeted nutrition interventions. The NutriCHEQ questionnaire is also a complete tool and can be used with a broad range of comprehensive guides for parents (Persian ones are available for Iranian). However, further studies are recommended considering training the experts and following them to reduce the limitations.

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