Kuwait child nutrition knowledge questionnaire: validity, reliability and use to assess Kuwaiti schoolchildren's knowledge before and after a nutrition knowledge intervention

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Abstract

Background: Little is known about the nutritional knowledge of children in Kuwait and school-based nutrition interventions are scarce. No validated tool to assess the nutrition knowledge of schoolchildren in Kuwait is available.

Aim: This study determined the validity and reliability of a nutrition knowledge questionnaire in Kuwaiti primary-school children, and measured children's nutrition knowledge before and after a nutrition awareness intervention.

Methods: The questionnaire included five questions to measure nutritional knowledge. The face and content validity were assessed by nutrition and paediatric experts. To assess questionnaire reliability and nutrition knowledge, 642 schoolchildren (8–12 years) were assigned to an intervention, control or reliability group. Each group completed the questionnaire twice, one or two weeks apart. Students in the intervention group attended a nutrition knowledge presentation before completing the questionnaire the second time. Independent and paired samples t-tests were used to assess score differences between and within the intervention and control groups for changes in nutrition knowledge. Pearson correlation coefficients were used to measure score consistency in the reliability group.

Results: Overall, the questionnaire had good content validity and moderate to strong reliability ($r = 0.44$, $P < 0.001$). Students in the intervention group had significantly higher mean nutritional knowledge scores after the intervention (from 3.65 (SD 1.03) to 4.20 (SD 1.02); $P = 0.17$). Control group scores were mostly unchanged.

Conclusions: The Kuwait child nutrition knowledge questionnaire is a valid and reliable tool to assess nutritional knowledge in schoolchildren in Kuwait. Nutrition knowledge of Kuwaiti schoolchildren should be improved using age-appropriate interventions in school.

Keywords: nutrition, knowledge, schoolchildren, questionnaire, Kuwait

Introduction

The prevalence of childhood obesity in Kuwait is as high as 19.9% in children between 5 and 13 years of age *(1)* and has exceeded 30% in adolescents *(2,3)*. Previous studies have found an association between nutritional knowledge and dietary intake, indicating that improving nutritional knowledge at an early age may help promote healthy eating patterns in children *(4,5)*. Little is known about the current levels of nutritional knowledge in young people living in Kuwait. Recent studies reported low overall nutritional knowledge in high-school and college students in Kuwait *(6,7)*. Successful school interventions have been reported in other regions, with some showing improvements in children's diets with an increase in nutritional knowledge *(8,9)*. According to the literature, one reason for failing to report consistent results is because nutritional knowledge before the design of intervention programmes has not been assessed, probably because few valid and reliable nutrition knowledge assessment tools are available *(10–12)*. Researchers aiming to deliver successful school-based interventions to improve nutritional knowledge should therefore identify gaps in nutritional knowledge before designed and implementing such programmes. A nutrition knowledge questionnaire was previously validated for use with adults living in Kuwait *(13)*. A few nutrition knowledge assessment tools for use with schoolchildren have been developed and validated in other regions *(11,14,15)*; however, none has been validated for use in children living in Kuwait or neighbouring countries. Therefore, the primary aim of our study was to develop a valid and reliable nutrition knowledge assessment tool for use in primary-school children in Kuwait. In addition, because delivering a nutrition presentation intervention is part of the validation process, our secondary aim was to evaluate children's nutritional knowledge scores before and after the presentation.

Methods

Questionnaire development

The Kuwait children nutrition knowledge questionnaire is an original self-administered questionnaire developed by two senior dietitians (see supplementary material, available online). It consists of a short demographics section, followed by five multiple choice questions intended to measure nutritional knowledge in children aged 8–12 years living in Kuwait. The questions were developed to assess knowledge of applied nutrition such as energy in food, understanding of nutrition labelling and assessment of portion size. Thus, one question asked about the portion equivalency of a whole fruit, two questions asked about serving size and

caloric content as provided on food labels to assess skills in understanding food labels, one question assessed knowledge of healthy lifestyle recommendations, and one question assessed the ability to identify foods high in fat. The questionnaire was made available in both English and Arabic, and was administered in the main teaching language used at the schools. To assess each item's clarity and any ambiguity, face validity was assessed by a paediatric dietitian who verified the suitability of the questions by testing them on parents and their children in a clinical setting. Furthermore, the final version of the questionnaire was reviewed by an expert panel of dietitians and a consultant paediatrician to determine its content validity index *(16)*. For the purposes of data analysis, score percentages were calculated by adding the total number of correct answers and dividing the result by the total number of questions (five), multiplied by 100.

Participants

Private and public schools in different governorates across Kuwait were invited to participate through email, telephone calls and onsite visits to schools. A convenience sample of schools (*n* = 11) was selected based on the administration's willingness to participate; all were private schools. All schoolchildren aged 8–12 years across each of the 11 schools were invited to participate. Invitation letters and parental consent forms were sent home to parents and/or guardians, and those who provided signed parental consent were included in the study. Consent was also obtained from all participating children before completing the questionnaire.

A total of 750 schoolchildren whose parents provided consent for participation were included in the study. Schoolchildren were recruited with no preference for ethnicity or gender, and both Kuwaiti and non-Kuwaiti students were included in the study. Recruitment was started and completed within the academic year of 2016–2017.

Sample size

A minimum of 500 participants was required to provide an 80% chance of detecting a difference between each group at $P < 0.05$ and 95% confidence interval. Sample size was further confirmed by assessing similar previous work *(12,14,15)* where sample sizes ranged between 201 and 576 children (aged 13–15 years).

Data collection

Participating schools were assigned to one of three study groups (intervention (3 schools), control (4 schools) or reliability (4 schools)) based on the schools' preference and scheduling convenience. Schools able to allocate time for the nutrition presentation were assigned to the intervention group, whereas those that were unable to do so were randomized into the control or reliability groups using simple randomization. Intervention school students completed the questionnaire at baseline (T_0) (before the nutrition knowledge intervention)

and again one week after attending a nutrition presentation (T_1). Control school students also completed the questionnaire at baseline (T_0) and again after one week later (T_1), but did not attend a nutrition presentation. Students in the reliability group completed the questionnaire at baseline (T_0) and again two weeks later, without receiving a nutrition presentation. Administration of the questionnaire took place on school premises in the presence of both the teachers and the research team. The questionnaire took about 15–20 minutes for the children to complete.

Nutrition intervention

An interactive 60-minute nutrition presentation was delivered by a senior dietitian to students in the intervention group after they had completed the questionnaire at baseline (T_0). The presentation covered a number of basic nutrition topics appropriate for this age group, including: portion size and food label interpretation, relationship between healthy eating and good health, and physical activity recommendations based on the guidelines of the Centers for Disease Control and Prevention, United States of America *(17)*. Prior to the delivery of the intervention, schools were asked whether nutrition curricula were in place. No schools included in the study delivered standardized curricula for nutrition education.

Validity and reliability of the questionnaire

Validity of the questionnaire was measured by comparing the nutritional knowledge scores of the group that received the nutrition intervention and the group that did not (control group). This was done by comparing the score differences between the intervention and control groups at T_1, after the intervention group had attended a nutrition presentation that aimed to increase their nutritional knowledge. The reliability group was used to assess the test–retest reliability of the questionnaire, where scores of the same student were compared at T_0 and T_1, with a two-week interval between completing the questionnaire the first and second time. According to the literature, a two-week interval is short enough for children not to have gained additional nutritional knowledge and long enough to have forgotten the answers in the first attempt *(18)*.

Statistical analysis

Demographic differences between the intervention and control groups were assessed at baseline using the independent samples *t*-test for continuous variables and the chi-squared test for categorical variables. Construct validity was assessed using independent samples *t*-tests to analyse differences in scores between the intervention and control groups at both T_0 and T_1. Within-group knowledge scores were also assessed using paired samples *t*-tests to evaluate test score differences for each group at T_0 and T_1. The maximum possible score that could be achieved was 5.0 and mean scores and standard deviations (SD) were calculated for the intervention and control groups at T_0 and T_1 to compare overall score differences. Analysis of variance (ANOVA) was done to test for between-group differences (intervention and

control) in scores by grade. Pearson correlation coefficients were used to evaluate reliability by assessing knowledge score consistency at both the first (T_0) and second (T_1) administration of the questionnaire. Only children in the reliability group (n = 221) were included in the reliability analysis. All data were analysed using *Stata* software, version 14.0. $P < 0.05$ was considered statistically significant.

Ethical approval

Ethical approval for the study was obtained from the Ethical Review Committee of the Office of Research Affairs at the Dasman Diabetes Institute, Kuwait.

Results

Demographic characteristics

A total of 642 children (mean age 10.22 (SD 1.09) years) were included in the final analysis. In all, 108 (14.4%) were excluded as they did not complete the second questionnaire at T_1 because they were absent from school on the day it was given out. Of the 642 children included in the study, 294 (45.8%) attended the nutrition intervention, 127 (19.8%) did not (control group) and 221 (34.4%) were in the reliability group. The sample included about the same number of boys and girls. Intervention and control groups had comparable demographic characteristics with respect to age and sex, but not school grade, nationality and residence (governorate) (Table 1). Since score differences were tested across grades, school grade was not controlled for in the analysis.

Reliability and validity

The Kuwait children nutrition knowledge questionnaire showed good content validity when assessed for efficacy by peer reviewers at the Dasman Diabetes Institute. For the content validity index review of the five items, expert ratings were highest (≥ 80%) for clarity, level of complexity, significance in the specified content area and applicability to the target population. All five items of the questionnaire were therefore retained for the purposes of this study. Results from the test–retest reliability assessment showed that the overall questionnaire had moderate, significant reproducibility in schoolchildren between the ages of 8 and 12 years living in Kuwait (n = 221; r = 0.44, $P < 0.001$), with mean scores remaining almost unchanged when the students completed it the first and second times (3.78 (SD 0.95) to 3.86 (SD 0.91), respectively).

Nutrition knowledge

Mean overall scores of the Kuwait children nutrition knowledge questionnaire were 3.73 (SD 1.00) at baseline and 4.03 (SD 1.00) at follow-up (n = 642). A comparison of the intervention and control groups showed an increase in mean scores at retest in the children who received the intervention, which reflected an 11.0% improvement of percentage correct

score (Table 2). Scores for control school students remained relatively unchanged, with only a slight improvement seen at T_1 (Table 2). An assessment of score differences by grade in the intervention and control groups showed a similar trend, where students in the intervention group scored consistently higher than those in the control group at T_1 across all grades (Table 2). Students in grade 6 showed the greatest improvement in scores (16.8% improvement of percentage correct score), although grade 7 students in the intervention group had the highest score at T_1 (4.48, SD 0.63).

Discussion

Students who received the nutrition intervention scored significantly higher than the controls the second time both groups completed the Kuwait children nutrition knowledge questionnaire. The 11.0% score increase we found is higher than scores reported in similar studies *(14,19)* but lower than those of others *(20,21)*. However, it is important to note that while we delivered a presentation-focused, interactive intervention, it was just one 60-minute session. Other interventions were longer, ranging from 90 minutes to 3 years *(12,14,19–21)*, and the longer length of these interventions may explain the higher score differences some studies found. Despite its short length, the Kuwait children nutrition knowledge questionnaire includes items that cover some of the most relevant nutritional topics for this age group. The short length of the questionnaire did not appear to affect the validity of the results, as shown by the item-specific increase in correct scoring in the intervention group of schoolchildren. Children who received the nutrition intervention scored more correct answers at T_1 on each item than those who did not have the intervention, and average percentage correct scores increased on the second administration (73.0% to 84.0%). Control scores were approximately similar at retest (76.0% to 78.6%). These results are in line with reported values of an American study, which found that students who received the intervention scored higher at retest, while control scores also remained high but relatively unchanged *(14)*. Researchers in South Africa also found that nutrition knowledge in the intervention group significantly improved after completing the an intervention programme (HealthKick) and, as with our study, no significant differences were observed in controls *(22)*. The results obtained with our questionnaire are therefore similar to those observed in questionnaires that are longer and more varied in content.

Further assessment by grade showed that: intervention school students in grade 7 had the highest scores at retest; score increases differed significantly across middle-to-older grades between intervention and control students; and students in higher grades appeared to have benefitted more from the intervention. Findings from another study also show that students in higher grades had markedly higher scores on a questionnaire before and after an intervention to increase nutrition knowledge, although in this case all students were exposed to the intervention *(12)*. Thus, while the nutrition intervention effectively increased all scores in the Kuwait children nutrition knowledge questionnaire at T_1, it was especially advantageous to older children. Students in higher grades are typically more adept at understanding

material but are also more heavily burdened with other school work; without an intervention, older students may disregard the importance of the questionnaire or refrain from refreshing their nutritional knowledge. This was seen in our study where control students in grade 7 scored higher than the intervention group at baseline but significantly lower at retest. In addition, within-group differences showed significant score increases for the intervention group in grades 4 to 7. These results are more favourable than those described in a similar study where only children in grade 2 appeared to score higher at retest *(12)*.

The moderate to strong test–retest reliability of the overall questionnaire is comparable to that reported in similarly short questionnaires *(12,14)*. However, a longer questionnaire used by a study in Texas had stronger reliability correlations *(23)*. Interestingly, questions from the nutrition knowledge category of the questionnaire used in the Texas study showed the weakest reproducibility ($r = 0.40$), especially for serving size and label literacy items *(23)*. This was seen in our study, where the lowest correlations were reported in questions associated with reading nutrition labels.

Our study has several strengths. First, the Kuwait children nutrition knowledge questionnaire is the first valid and reliable nutritional knowledge assessment tool for children in Kuwait, without age or gender bias. Second, the short length and time needed to complete the questionnaire and receive the intervention made recruitment relatively easy, and the simplicity of the questions compared to other questionnaires allowed for easier comprehension. Finally, the short yet effective intervention was less time-consuming for students and was not a burden on busy school schedules. Some limitations to our study should be noted: given that all participants were recruited from private schools, the results may not be generalizable to children attending public schools in Kuwait. Moreover, randomization of intervention and control students was not done because the intervention schools were recruited based on their agreement to allocate time for the nutrition presentation. This may increase the possibility of selection bias and reduce the ability to generalize results to other populations.

Conclusion

Increasing nutritional awareness in schools is both beneficial and necessary for the health of schoolchildren. The Kuwait children nutrition knowledge questionnaire is the first valid and reliable tool for the assessment of nutritional knowledge in schoolchildren aged 8 to 12 years living in Kuwait. Results from the study, while promising, require further validation in the public-school setting. This questionnaire has the potential to identify gaps in nutritional knowledge and nutrition curricula in primary schools in Kuwait and neighbouring countries. When accompanied by a nutrition intervention, the questionnaire can be used to help develop more effective and well-designed school-based nutrition intervention programmes aiming to improve nutrition knowledge and prevent obesity-related diseases in later life. Future studies should consider testing the Kuwait children nutrition knowledge questionnaire

in the general school-aged population of Kuwait by implementing the questionnaire in both public and private schools.

Competing interests: None declared.

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Table 1: Demographic characteristics of the children in the intervention and control groups

Variable	Intervention groups (*n* = 294)	Control groups (*n* = 127)	*P*-value[a]
Age (years), mean (SD)	10.12 (1.06)	10.20 (1.2)	0.54
Sex, no. (%)			
Female	142 (48.3)	66 (52.0)	0.49
Male	152 (51.7)	61 (48.0)	
Nationality, no. (%)			
Kuwaiti	198 (67.4)	62 (48.8)	< 0.001
Non-Kuwaiti	96 (32.6)	65 (51.2)	
School grade, no. (%)			
3	–	3 (2.3)	
4	98 (33.3)	44 (34.65)	< 0.001
5	105 (35.7)	28 (22.0)	
6	62 (21.1)	35 (27.6)	
7	29 (9.9)	17 (13.4)	
Governorate, no. (%)			
Capital	100 (34.0)	18 (14.2)	
Hawalli	159 (54.1)	33 (26.0)	< 0.001
Al-Farwaniya	14 (4.8)	–	
Al-Ahmadi	4 (1.4)	63 (49.6)	
Al-Jahra	5 (1.7)	9 (7.1)	
Mubarak-Al Kabeer	12 (4.1)	4 (3.2)	

SD: standard deviation.

[a]Independent samples *t*-test for continuous variables; chi-squared test for categorical variables. Significance set at *P* < 0.05.

Table 2: Mean scores at T_0 (before the nutrition intervention) and at T_1 (after the intervention) in intervention and control schools by school grade ($n = 421$)

School grade	Intervention schools ($n = 3$)					Control schools ($n = 4$)					P-value T_0[a]	P-value T_1[b]
	No. of students	Mean score (SD) T_0	% correct	Mean score (SD) T_1	% correct	No. of students	Mean score (SD) T_0	% correct	Mean score (SD) T_1	% correct		
3	0	–	–	–	–	3	4.67 (0.58)	93.4	4.33 (0.58)	86.6	< 0.05	0.25
4	98	3.65 (1.01)	73.0	4.13 (1.01)*	82.6	44	3.34 (0.86)	66.8	3.57 (1.11)	71.4	0.19	< 0.05
5	105	3.71 (1.00)	74.2	4.12 (1.17)*	82.4	28	3.89 (1.13)	77.8	4.04 (0.79)	80.8	0.68	0.34
6	62	3.47 (1.13)	69.4	4.31 (0.90)*	86.2	35	4.09 (0.89)	81.8	4.23 (0.69)	84.6	< 0.05	< 0.05
7	29	3.83 (1.00)	76.6	4.48 (0.63)*	89.6	17	4.12 (0.93)	82.4	4.00 (1.12)	80.0	0.25	< 0.05
Total	**294**	**3.65 (1.03)**	**73.0**	**4.20 (1.02)**	**84.0**	**127**	**3.80 (0.99)**	**76.0**	**3.93 (0.96)**	**78.6**	**0.17**	**< 0.05**

Within-group analyses for differences in mean scores between T_0 and T_1 were done using paired samples t-tests. Significant difference were found for the interventions group ($P < 0.05$) but not the control group.

[a]Between-group analyses using ANOVA to test differences in mean scores across grades at T_0 (significance set at $P < 0.05$).

[b]Between-group analyses using ANOVA to test differences in mean scores across grades at T_1 (significance set at $P < 0.05$).

Supplementary material

SUPPLEMENTARY MATERIAL – KCNKQ QUESTIONNAIRE

Demographics:

Student name: ………………………. **Nationality:**……………………………………

Date of birth: ……………………………… **School name:**…………………………………

Age: ……………...   **School grade / Year:**…………………………

Gender: ◯ Boy   ◯ Girl   **Home address / Area:** ……………………….

Child Food Knowledge Questionnaire

Please tick what you think is the correct answer:

Nutrition facts	
Serving size = ½ cup (67 g)	
Total serving per pack = 16	
Amount per serving	
Calories 100	**Calories from fat** 0
	% daily value*
Total fat 0 g	0%
Trans fat 0 g	0%
Cholesterol 0 mg	0%
Sodium 60 mg	3%
Total carbohydrates 22 g	7%
Fibre 0 g	0%

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1. One whole fruit (e.g. an apple) is equivalent to:

○ 2 cups   ○ 4 cups   ○ 1 cup   ○ 3 cups

2. How much is one serving size in the product on the right? according the nutrition fact label

○ 3 cups   ○ 2 cups   ○ 1 cup   ○ ½ cup

3. How many calories is there in one serving label on the right? according to the Nutrition Fact

○ 50 calories   ○ 100 calories

○ 150 calories   ○ 200 calories

Sugar 15 g		
Protein 3 g		
███████████		
Vitamin A 2%		
Vitamin C 0%		
Calcium 45%		
Iron 0%		
*Percentage daily values are based on 2000 calorie diet		

4. What is the recommended hours for watching TV, playing computer and video games and smartphones per day?

○ 3 hours   ○ 1–2 hours

○ More than 2 hours

5. Adding salad dressing, butter, and cheeses to your food is considered high in fat:

○ True   ○ False