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Reliability and Validity of the Instrument Used in the HELIC (Healthy Lifestyle in Children) Study of Primary School Children's Nutrition Knowledge, Attitude and Practice

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ABSTRACT

The objective of this paper is to report on the reliability and validity of a knowledge, attitude and practice instrument used among young primary school children. The instrument was developed as an evaluation tool in the HELIC study and consisted of 23 knowledge, 11 attitude and 10 practice items. A total of 335 Year 2 students from 4 randomly selected primary schools in Selangor and Wilayah Persekutuan participated in the HELIC study. Students were divided into small groups and an enumerator verbally administered the instrument to each group. Reliability for each construct (knowledge, attitude and practice) was estimated as item to total score correlation and internal consistency (Cronbach's alpha). Construct validity was determined through factor analysis and Pearson correlation. Results indicated that 3 attitude and 3 practice items did not correlate significantly to the total score ($p>0.05$). However, the deletion of these items did not significantly alter the Cronbach's alpha coefficients. Internal consistency was good for knowledge ($\alpha=0.68$) but low for attitude ($\alpha=0.37$) and practice ($\alpha=0.36$) constructs. Based on factor analysis, 5 factor-solutions emerged for knowledge and 4 factor solutions for attitude and practice. Sufficient variance was obtained for the factors in knowledge (51.7%), attitude (51.2% and practice (51.0%). There were also significant positive correlations among the constructs ($p<0.01$). In conclusion, the instrument was valid and reliable, especially for the knowledge construct. Further improvements, particularly on the attitude and practice constructs, are needed in order for the instrument to be an effective assessment or evaluation tool in various settings.

INTRODUCTION

Nutrition education has been defined as any set of learning experiences that contributes to voluntary adoption of appropriate eating and other nutrition-related behaviours that are beneficial to health (Contento, 1995). The core components of nutrition education should be on food and food choices that contribute to the total diet or overall pattern of food eaten. Therefore, all foods can fit into a healthful diet if the foods consumed are in moderation, balance and variety and

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combined with regular physical activity (American Dietetic Association, 2002).

In designing an effective nutrition education programme, nutrition professionals need to understand the various factors that are associated with dietary behaviours. In children, the eating behaviours or practices are influenced by various factors which include food access and availability, child feeding practices, food preferences, food neophobia, weight concerns, developmental capabilities and food marketing (Birch and Fischer, 1998; Escobar, 1999; Hill, 2002). Understanding the contributions of these factors to the development of children's eating behaviours may facilitate efforts to improve child health and nutrition.

For school-aged children, there are two goals of nutrition education. First, to enhance the knowledge, attitude and skills of the children that are essential to their understanding of nutrition information and issues and selection of healthy food choices. Second, to reduce the risk of chronic diseases through changes in specific behaviours such as eating adequate servings of fruits and vegetables, consuming milk and dairy products or engaging in physical activity (Lytle, 1995). Enhancements in nutrition knowledge, attitude, perceptions, self-efficacy, outcome expectation and skills are deemed to be the potential mediating and enabling factors for the attainment of appropriate dietary preferences and practices (Axelson and Brinberg, 1992; Parmenter and Wardle, 2000; Vereecken, Van Damme and Maes, 2005)

To measure nutrition knowledge, attitude, preference or practice, the instrument needs to be reliable and valid so that the findings are not biased by the shortcomings of the instrument. In addition, using reliable and valid instruments to measure these constructs can contribute to better quality data that can be the basis for health and nutrition promotion efforts. Despite the importance of validity and reliability, there has been nutrition education research that has failed to test the measurement instruments (Contento *et al.*, 2002).

The aim of this paper is to report on the validity and reliability of an instrument that was developed for use in the HELIC (Healthy Lifestyle in Children) Study. The instrument was specifically designed to assess nutrition knowledge, attitudes and practices of young primary school children. At present in Malaysia, there is no published nutrition knowledge, attitude and practice instrument for young primary school children that has been developed with validity and reliability ensured. Although the instrument has gone through validity and reliability testing (Siti Sabariah, 2003), the testing was limited to a smaller and homogenous sample. This paper attempts to assess the validity and reliability of the instrument based on its administration to a large and heterogeneous sample with an intention that the information will contribute to future application of this instrument.

MATERIALS AND METHODS

Study Background

The nutrition knowledge, attitude and practice instrument was an evaluation tool developed for use in the HELIC (Healthy Lifestyle in Children) Study. The main objective of the study was to promote healthy nutrition and physical activity and to prevent smoking among primary school children. The study was conducted in four states, namely Selangor, Pahang, Kelantan and Wilayah Persekutuan. This paper will only report on the validity and reliability of the instrument administered in the HELIC Study conducted in Selangor and Wilayah Persekutuan.

Sample

A list of Sekolah Kebangsaan (SK) in Selangor and Wilayah Persekutuan was obtained from the Ministry of Education. Four SK were then randomly selected for the HELIC study. A total of 335 Primary 2 students participated in the study. Detailed information on sampling procedures and sample size calculation are described elsewhere (Siti Sabariah, 2003). The study protocol was approved by the Ministry of Education and the Education Departments of Selangor and Wilayah Persekutuan. Permission to conduct the study in the school setting was also obtained from the school principals.

Subjects

The subjects for the HELIC Study were school children in Primary 2 (8 years old). This age group was selected based on several reasons. First, the children are in the process of developing eating habits that may track into adulthood and consequently influence future health. Second, early exposure to health and nutrition education is important to motivate children to acquire nutrition knowledge and skills for the development of sound eating behaviours (Guarino, Wittsen and Gallo, 1984). Although Primary 1 students would ideally fit into these criteria, they were not selected as it was felt that they were still in the process of adjusting to the school environment.

Development of Instrument Items

The instrument was designed as a form that consisted of items reflecting nutrition issues and concerns among children. A list of knowledge, attitude and practice items was developed based on item formulation or identification and extraction from published questionnaires, scientific literature and textbooks. A panel comprising experts in nutrition, psychology, paediatric, child development and education was convened to ensure face and content validity of the items. Asking the children and teachers if they understood the questions and felt that the scales or answer choices were appropriate was also carried out to assess face validity. Face validity refers to the appropriateness of the items and the overall questionnaire for the target group from the viewpoints of an expert panel, the target group or individuals working with the target group (Talmage and Rasher, 1981; Lacity and Jansen, 1994). Content validity addresses the extent to which the items represent the many dimensions of a construct of interest (e.g. knowledge, perception, attitude) and is usually established by content experts (Sapp and Jensen, 1997). The expert panel reviewed the list of items for suitability, relevance and accuracy. Each item was considered, thoroughly discussed and eventually was either retained unchanged, edited or removed based on the recommendations by the expert panel.

The selected items were then pretested with 42 Primary 2 students from Sekolah Kebangsaan Jalan Bukit 1, Kajang, Selangor. The first pre-test was conducted to evaluate the clarity and readability of the items and the overall instrument. Besides the feedback from the students, the teachers' opinions were also sought, thus adding to the face validity of the instrument. Problems raised and identified by students and teachers were noted and corrections to the instrument were made accordingly.

A second pre-test was carried out with another 41 Primary 2 students from the same school to assess construct validity of the items. Factor analysis of items in each construct was conducted and items with factor loading of less than 0.4 were removed from the instrument. Based on the analysis, 5 factor-solutions (food, nutrient and function; food, health and

fitness; nutrient deficiency; food choices; source of nutrients) were identified for knowledge and 4 factor-solutions (food choices; diet quality; food intake; food and health) each for attitude and practice. The internal consistencies of knowledge, attitude and practice constructs were 0.68, 0.61 and 0.66, respectively (Siti Sabariah, 2003). Based on the validity and reliability results of the second pre-test, the instrument was deemed to be appropriate to be used in The HELIC Study. This final instrument consisted of 23, 11 and 10 knowledge, attitude and practice items, respectively.

The knowledge construct had 23 multiple-choice items. Each item had four answer options. Each correct response was allocated 1 point and an incorrect or no response was allocated 0 points. For attitude, there were 11 items on a 3 point-scale. Favourable and unfavourable options were given 2 and 0 points, respectively. The intermediate option (neutral) was given 1 point. The practice construct consisted of 10 items. The first 6 items were assessed on a 4 point-scale, ranging from 'almost everyday' to 'never'. One point was given to responses of ' almost everyday' and 'several times a week' while 0 for 'sometimes' and 'never' . The last four items had 4 answer options. The correct answer was given 1 point and 0 for others. The respective maximum scores for nutrition knowledge, attitude and practice items were 23, 22 and 10, with higher scores indicating higher knowledge, positive attitude and good practice.

Procedure

All Primary 2 students were gathered either in the classroom, school hall or resource center. The students were informed on the purpose of the study and the measurements to be made during the session. Students were then divided into groups of five students. An enumerator was assigned to each group and each student was given the instrument. Each item was read aloud twice by the enumerator after which students were asked to choose and record their answers on the instrument. Knowledge items were asked first, followed by the attitude and practice items. The measurement sessions varied from 30 - 60 minutes, depending on the ability of the students to comprehend the knowledge, attitude and practice items.

Statistics

Item analysis was conducted by computing Pearson correlations between each item and the total score for the items within the same construct. The correlation of the individual item was calculated when the item was omitted from the composite score (Streiner & Norman, 1995). Deletion of items with low item to total score correlation ($r<0.2$) should increase the internal consistency of the instrument. Internal consistency of the instrument was estimated using Cronbach' s a coefficient and it reflects the consistency of the items that are pooled together as a construct (Cronbach, 1951).

Construct validity is the extent to which the construct of theoretical interest has been successfully operationalised (Morris, Fitz-Gibbon and Lindheim, 1990). Construct validity of the items was determined by examining the correlation of items to each other through factor analysis with varimax and oblique rotations. Oblique rotation is a technique that increases the ability to discriminate among factors. Varimax rotation provides justification of the factors through explained total variance. Construct validity of the instrument was also estimated with Pearson correlations among the three constructs of knowledge, attitude and practice. All data were analysed with the Statistical Package for the Social Sciences 11.0 (SPSS, Chicago, IL USA).

RESULTS

Table 1 shows the demographic and socioeconomic characteristics of the sample. A total of 335 Primary 2 students in the four schools participated in the study. The sample consisted of 170 (50.7%) and 165 (49.3%) boys and girls, respectively. A majority of the children were Malay (76.4%), followed by Chinese (14.0%), Indian (7%) and others (3%). The socioeconomic status of the students was reflected in the schools they attended with middle- to high-income groups represented by SK Bukit Damansara and SK Taman Tun Dr. Ismail while low- to middle-income groups were represented by SK Selayang Baru and SK Taman Selayang 2. Only 162 (48%) parents provided information on household income and the reported mean income was RM2406.63 $\pm$ 1588.72.

Reliability

Item analysis of the constructs (knowledge, attitude and practice), measured as item-to-total score correlations is presented in Table 2. Six items (items 1, 3 and 10 of attitude and items 5, 8 and 9 of practice) did not correlate significantly with the total score. The Cronbach's alpha coefficients for knowledge, attitude and practice total scales were 0.68, 0.37 and 0.36, respectively.

Validity

The results of factor analysis of knowledge, attitude and practice items are presented in Tables 3 to 5. The factor loadings after an oblique rotation for each construct revealed 5 factor-solutions for knowledge and 4 factor-solutions each for attitude and practice. Using varimax rotation on the responses to the knowledge, attitude and practice items, sufficient variance was obtained to justify the factor-solution in each construct. The 5 factor-solutions for knowledge accounted for 51.7% of the total variance and the 4 factor-solutions for attitude and practice explained 51.2% and 51.0% of the total

Table 1. Characteristics of the study sample (N=335)

Variable	*Mean (Std.Dev)*	*n (%)*
Gender		
Male		170 (50.7)
Female		165 (49.3)
Ethnicity		
Malay		256 (76.4)
Chinese		47 (14.0)
Indian		24 (7.2)
Others		8 (2.4)
Age	7.99 (0.28)	
School		
SK Bukit Damansara		82 (24.5)
SK Taman Tun Dr. Ismail		84 (25.1)
SK Selayang Baru		86 (25.7)
SK Taman Selayang 2		83 (24.7)
Household Size	6.09 (1.97)	
Household Income (n=162)	2406.63 (1588.72)	

Table 2. Item-to-total score correlations (ITC) and internal consistency (Cronbach α) for knowledge, attitude and practice items

Characteristic	*ITC*		*α deleted**	*Cronbach α**
	r	*p*		
KNOWLEDGE				**.68**
Food, nutrient, function				
1. Food pyramid	.31	.00	.66	
2. Food & growth	.27	.00	.67	
3. Balance meal	.26	.00	.67	
4. Source of energy	.30	.00	.67	
5. High fat food & disease	.39	.00	.66	
6. Weight, diet & exercise	.27	.00	.67	
7. Nutrient & disease	.35	.00	.66	
8. Nutrient & attention	.34	.00	.66	
9. Healthy breakfast	.23	.00	.67	
10. Importance of meals	.23	.00	.67	
Food and energy				
11. Breakfast & energy	.15	.01	.68	
12. Energy for activity	.21	.00	.67	
Nutrient deficiency				
13. High sugar food	.21	.00.	68	
14. Stunting	.21	.00	.68	
15. Poor cognition	.23	.00	.67	
Food choices				
16. Fast foods	.30	.00	.67	
17. Snacks	.21	.00	.67	
18. Breakfast	.30	.00	.67	
19. High salt foods	.24	.00	.67	
Source of nutrients				
20. Low fat foods	.14	.01	.684	
21. Body growth	.25	.00	.671	
22. Calcium	.11	.04	.685	
23. Grain & cereals	.22	.00	.698	
ATTITUDE				**.37**
Food intake				
1. Amount of food	.10	.08	.33	
2. Vegetables	.13	.02	.35	
3. Try new food	.04	.45	.38	
Food and health				
4. Importance of breakfast	.17	.00	.34	
5. Breakfast & cognition	.11	.03	.35	
6. Healthy body	.15	.01	.33	
Food choices				
7. Healthy vs tasty food	.24	.00	.31	
8. Eat everything	.20	.00	.32	
9. High fat foods	.22	.00	.31	
Diet quality				
10. Food variety	.05	.33	.38	
11. Nutritious food	.25	.00	.30	
PRACTICE				**.36**
Food choices				
1. Healthy snacks	.14	.01	.34	
2. High salt food	.21	.00	.29	
3. High sugar food	.30	.00	.26	
Diet quality				
4. Food at school	.11	.03	.28	
5. Food for lunch	.10	.06	.28	
Food intake				
6. Fast foods	.21	.00	.30	
7. Beverages at breakfast	.20	.00	.28	
8. Balance breakfast	.05	.33	.28	
Food and health				
9. Balance meal	.09	.09	.32	
10. Breakfast & cognition	.21	.00	.30	

* Cronbach alpha if item deleted
ITC = Item- total correlation

Table 3. Factor analysis of knowledge items

	Factor 1 Food nutrient and function	Factor 2 Food and energy	Factor 3 Nutrient deficiency	Factor 4 Food choices	Factor 5 Source of nutrients
1. Food pyramid	0.464				
2. Grains & cereals					0.458
3. Low fat foods					0.588
4. Healthy breakfast	0.493				
5. High sugar foods			-0.462		
6. Energy for activity				-0.424	
7. High salt foods		0.596			
8. Body growth					0.515
9. Food & growth	0.451				
10. Breakfast				-0.419	
11. Calcium					0.541
12. Balance meal	0.462				
13. Snacks				0.469	
14. Source of energy	0.450				
15. High fat food & disease	0.493				
16. Weight, diet & exercise	0.459				
17. Nutrient & disease	0.492				
18. Poor cognition			-0.445		
19. Importance of meals	0.499				
20. Fast foods				-0.416	
21. Breakfast & energy		0.660			
22. Stunting			-0.492		
23. Nutrient & attention	0.532				

Only factor loadings with an absolute value >0.400 are displayed in the table.

Table 4. Factor analysis of attitude items

	Factor 1 Food choices	Factor 2 Food and health	Factor 3 Food intake	Factor 4 Diet quality
1. Importance of breakfast		.724		
2. Amount of food			-.580	
3. Breakfast & cognition		.528		
4. Food variety				.619
5. Nutritious food				.741
6. Vegetables			.544	
7. Healthy body		.786		
8. Healthy vs tasty food	.627			
9. Eat everything	.706			
10. High fat foods	.652			
11. Try new food			.702	

Only factor loadings with an absolute value >0.400 are displayed in the table.

Table 5. Factor analysis of practice items

	Factor 1 *Food choices*	*Factor 2* *Diet quality*	*Factor 3* *Food intake*	*Factor 4* *Food and health*
1. Food at school		.619		
2. Food for lunch		.765		
3. Healthy snacks	-.563			
4. Fast foods			.615	
5. High salt foods	.654			
6. Balance meal				.726
7. Breakfast & cognition				.767
8. Beverages at breakfast			.606	
9. High sugar foods	.669			
10. Balance breakfast			.559	

Only factor loadings with an absolute value >0.400 are displayed in the table.

Table 6. Correlations among knowledge, attitude and practice

Variables	*Knowledge* *r*	*Attitude* *r*	*Practice* *r*
Knowledge	-	0.34**	0.26**
Attitude	-	-	.20**
Practice	-	-	-

** $p<0.01$

variance, respectively. Table 6 showed that there were significant positive correlations among knowledge, attitude and practice constructs.

DISCUSSION

Item analysis through item-to-total score correlation (ITC) should indicate which items ought to be removed or retained in order to increase internal consistency (Cronbach's α). There were six items (3 attitude and 3 practice items) that did not correlate significantly with the total score of the respective construct as there was little variation in the students' responses. About 66% of the students did not agree with the statement (item 1 of attitude) that they had to eat a lot of food for growth. A majority of the students (70%) agreed that they need to eat a variety of food and they like to try new foods (items 10 and 3 of attitude). For practice items, more than half of the students (60-70%) frequently (almost every day or many times in a week) eat a balanced meal (item 9) and drink only at breakfast (item 8). Most of them (87%) choose the right combination of foods (rice, meat and vegetables) to reflect a balanced meal for lunch (item 5 of practice). It has been recommended that items with low item to total score correlation ($r<0.2$) should be deleted from the instrument (Streiner and Norman, 1995; Johnson, Wardle and

Griffith, 2002). However, when the items with r<0.2 (including the six items which were not significantly correlated to the total score) were deleted from their respective contructs, the deletion did not alter the Cronbach's alpha coefficient significantly (0 - 0.05).

In the present study, the Chronbach's alpha coefficients for knowledge, attitude and practice were 0.68, 0.37 and 0.36, respectively. During the pre-testing of the instrument (Siti Sabariah, 2003), the reported alpha coefficient was similar for knowledge (α=0.68) but higher for attitude (α=0.61) and practice (α=0.66). The different internal consistencies for the attitude and practice constructs reported in both studies could be due to the sample in which the instrument was administered. In the present study, the sample consisted of students from low to upper income and the major ethnic groups. However, the pre-test sample was mostly Malay students from low- to middle-income households.

Although α=0.7 is considered an acceptable cut-off value for a psychometric construct, the alpha coefficient can be lower if the construct has fewer than 10 items and there is evidence of validity and justified theoretical and practical reasoning for the inclusion of the items (Lowenthal, 2001). In the present study, the internal consistency of the knowledge items was good (α=0.68) but low for both attitude (α=0.37) and practice (α=0.36) items. Since discarding the items with low item to total score correlations (r<0.2) did not significantly alter the Cronbach's alpha coefficients, it is possible that the low internal consistencies for these constructs may be partially attributed to the small number of items (10-11 items) included in the instrument. If more items are to be added to the constructs, the number of items should not burden the students as too many items may require longer time for the students or they may lose the interest to respond to the items.

In a well-designed measurement, factor analysis will reveal patterns in responses to the items that correspond to the dimensions of the construct being measured. The factors obtained for knowledge, attitude and practice in the present study confirmed the factors for each construct reported by Siti Sabariah (2003). These factors are considered to effectively reflect the many dimensions of nutrition knowledge, attitude and practice that were measured in this study.

We showed that there are significant correlations among knowledge, attitude and practice scores that contribute to construct validity of the instrument. Nutrition knowledge, attitude and behaviour or practice have consistently been reported to have significant inter-correlations (Axelson & Brinberg, 1992; Colavito *et al.*, 1996; Harnack *et al.*, 1997; Anderson *et al.*, 1998; Wardle, Parmenter and Waller, 2000; Long, Martin and Janson-Sand, 2002). The significant positive correlations among these constructs indicate that students who are exposed to or gain nutrition knowledge will have positive changes in attitudes that eventually will result in improved dietary behaviours or practices. The low correlations among the constructs could be partially explained by the inability of the HELIC instrument to measure child food preference, self efficacy and stages of dietary change which may be other important variables in the knowledge-attitude-behaviour pathway (Domel *et al.*, 1996; Resnicow *et al.*, 1997; McDonnel, Roberts and Lee, 1998; Vereecken, Van Damme and Maes, 2005). For example, nutrition knowledge may not have any significant impact on dietary behaviours if the individual is not ready to make dietary changes or if he feels that he is not capable to change the behaviour.

CONCLUSION

This study examined the reliability and validity of nutrition knowledge, attitude and practice items (23 knowledge, 11 attitude and 10 practice) of HELIC instrument that was developed for use with Malaysian primary school children. In general, the instrument is found to be valid as evidenced by face validity, content validity and construct validity. However, to improve the internal consistency of the attitude and practice items, it is suggested that more items should be added to the existing instrument.

Due to limited resources, we were not able to conduct extensive validity and reliability testing for the instrument before its administration in the HELIC Study. It is recommended that further reliability (e.g. item analysis, test re-test reliability) and validity (e.g. criterion-related validity) evidences of the instrument be established. The evidences are essential especially if the instrument is to be used as an effective assessment or evaluation tool with children from diverse cultural and income backgrounds.

The developed HELIC instrument has several potential applications. First, it can be used to meet specific research objectives for a group or population of Malaysian school children. For example, the instrument can be used to investigate the relationship between nutrition knowledge and attitude with dietary intake in which the obtained information can be the basis for nutrition promotion efforts. Second, it can also serve as an evaluation tool to measure the success of nutrition education or intervention to improve food-related behaviours of children. As there is a lack of valid and reliable instruments available to measure nutrition knowledge, attitudes and practices among school children in Malaysia, the development and testing of the HELIC instrument is certainly a significant contribution to the field of nutrition in Malaysia.

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