Nutrition Education Intervention Improves Nutrition Knowledge, Attitude and Practices of Primary School Children: A Pilot Study

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Submitted June 17, 2008; Revised and Accepted November 30, 2008

Abstract

The purpose of this study was to determine the changes in knowledge, attitude and practices of primary school children after receiving a nutrition education intervention for 6 weeks. A validated questionnaire was used to assess knowledge, attitude and practice at pre- and post-intervention. A total of 335 students from four primary schools were assigned to either intervention or comparison group. The intervention group received nutrition education taught by trained school teachers while the comparison group received the standard Health and Physical Education curriculum. A generalized linear univariate procedure was used to compare changes in knowledge, attitude and practice scores between intervention and comparison groups with ethnicity, weight-for-age, mother's and father's employment as confounding factors. There were significant increments ($p<0.001$) in the post intervention mean scores of knowledge (2.17 vs. 0.47), attitude (1.40 vs. 0.32) and practice (0.87 vs. -0.10) items for the intervention group compared to comparison group. The changes in knowledge ($F=17.72$, $p<0.001$), attitude ($F=6.41$, $p<0.05$) and practice ($F=15.49$, $p<0.001$) in the intervention group were maintained even after adjusting for confounding factors. The findings support the importance of providing children with nutrition knowledge to promote healthy dietary behaviors.

***Key words**: Primary School Children; Nutrition Education; Impact Evaluation*

Introduction

In both the developed and developing nations, the prevalence of childhood overweight and obesity are increasing rapidly and is perceived as a major public health concern to many health authorities.[1] Changes in the dietary and physical activity patterns towards frequent snacking, away from home food consumption, intakes of high energy but low nutrient dense foods and sweetened beverages as well as sedentary lifestyle have been implicated in this childhood obesity epidemic.[2] There is increasing evidence that overweight and obesity in childhood and especially in adolescence will not only contribute to adverse health consequences in childhood but also track into adulthood and increase the risk for later development of chronic diseases such as coronary heart disease, high blood pressure, diabetes, hyperlipidemia and some types of cancers.[3]

To prevent both the short and long term health consequences of overweight and obesity, prevention efforts should start early in childhood. Overweight and obesity in childhood and adolescence may result from a complex interaction of genetic, social and environmental factors that may influence eating and physical activity behaviors.[4] Promoting healthy eating practices and regular physical activity in young children have been shown to benefit the health of children as well as later in life. [1]

It has been recommended that effective nutrition interventions for children and adolescents should have a behavioral focus that will minimize the targeted risk factors, utilize theoretical framework, consist of changes to the environment, provide adequate dose and include strategies that are developmentally and culturally appropriate.[5, 6] However, to achieve the desired behavioral changes related to health and nutrition it will require the attainment of adequate knowledge, attitudes, skills and self-efficacy.[7-9] In other words, for children and adolescents to adopt and maintain health-enhancing behaviors, they need to have adequate knowledge of the health concern, attain the right attitudes to deal with the concern and possess the necessary skills and be self-efficacious to assume the health-enhancing behavior.

Nutrition education is defined as 'any set of learning experiences designed to facilitate voluntary adoption of eating and other nutrition related behavior conducive to health and well-being'.[10] It is recognized as an important component in programs and interventions related to health promotion and disease prevention. For school-age children, nutrition education has not only been shown to improve knowledge and skills but also eating and physical activity behaviors as well as health status.[11-14]

Schools can be an effective and efficient medium to influence the health of school children. The school system can have a high penetration rate due to the number of children attending the sessions, provide a formal and informal environment for learning and utilize classroom teaching approaches (i.e. teacher modeling) that are easier to be implemented.[15] Perez-Rodrigo and Arancenta have outlined the characteristics of successful school-based nutrition education programs that focus on dietary practices and physical activity.[16] In summary, a comprehensive and sequential school-based nutrition education is needed to provide school children the knowledge and skills as prerequisites for acquiring healthy nutrition-related behaviors.

The prevailing under-nutrition in some communities and increasing over-nutrition in both the urban and rural areas in Malaysia justify the need to provide health and nutrition interventions to children and adolescents.[17-20] At present, there have been various health and nutrition efforts by the Ministry of Health and Ministry of Education being incorporated into the school system. These include School Health Program, School Health Education Program, School Supplementary Feeding Program and School Milk Program.[21] However, these efforts do not emphasize on the provision of health and nutrition knowledge and skills to the children that is integral to the attainment of health and nutrition related behavioral changes.

Purpose of Study

This paper discusses on the impact evaluation of a pilot project on nutrition education intervention for school children. The project was designed to promote healthy dietary practices among young primary school children. Our specific objectives were to examine the changes in nutrition knowledge, attitude and practice (before and after intervention) between intervention and comparison groups.

Methods

Description of intervention

The nutrition education intervention was developed based on the Social Cognitive Theory. In the theory,

personal characteristics, behavioral patterns and environmental factors act interdependently to influence human functioning. In this intervention, the nutrition education provided the knowledge and skills required for the children to make the dietary changes both at school and home. Reinforcement of the nutrition concepts taught to the children included hands-on activities, video presentations, exhibitions and display of messages on school bulletin board and canteen. As teachers are perceived as role models for the children, the school teachers were trained to implement the nutrition education activities both in and outside the classroom.

Trained class teachers carried out the intervention over a 6-week period. The intervention comprised six nutrition topics (Food pyramid, Functions of food, Food choices, Breakfast, Snacks, Food Safety) and each topic was taught for 1 hour per week during the Health and Physical Education class. A teaching module for teachers was developed and it contained nutrition information relevant to each topic and instructions for implementation. The teachers attended a two-day training session conducted by researchers on the use of the teaching module. They were also provided with knowledge, skills and relevant resources required for effective delivery of the intervention topics.

The school children in the intervention group were also given a module that emphasizes the important points in each topic and a workbook to enhance their understanding of the topics. Classroom-based teaching, small group discussions, group works, demonstrations, nutrition exhibitions, video presentations, workbook assignments, singing sessions, nutrition contest and display of nutrition messages on schools' bulletin boards and school canteens were the approaches implemented in the intervention to enhance the children's comprehension of the topics.

Throughout the 6 weeks, the comparison group received the standard Health and Physical Education curriculum by the Ministry of Education. The curriculum covers topics such as physical fitness, nutrition, personal hygiene and health and is delivered through classroom-based teaching (1/2 hour per week) and field-based physical activity (1 hour per week) conducted by classroom teachers. The intervention group received the nutrition education intervention in addition to the classroom-based teaching of the standard curriculum. This arrangement was made so that the delivery of the Health and Physical Education curriculum (the classroom-based teaching) in the participating intervention schools is not affected by the implementation of the nutrition education intervention.

Participants

Four urban primary schools were randomly selected from two districts in a southwestern state of Malaysia. The schools were randomized into either intervention (I) or comparison (C) school. A total of 100 second grade students (8 years old) in each school were randomly selected from a list of students provided by the respective school. The students participated in the study only after their parents or guardians were informed on the study and consented to their children's participations.

A power calculation was performed prior to the inception of the study and indicated that at least 80 students (i.e. 40 in the intervention group and 40 in the comparison group) in each intervention and comparison group is required with 90% power to detect a significant difference ($p<0.05$) in nutrition knowledge between the two groups. The final sample consisted of 335 students (n=168 for I; n=167 for C).

Measurements

The students' nutrition knowledge, attitude and practices (KAP) were measured using a validated instrument developed by child health and development experts for this study.[22] The instrument consisted of items reflecting nutrition issues and concerns among primary school children in Malaysia. The items were either formulated or identified and extracted from published questionnaires, scientific literature and text book. Face validity was established by asking 10 school children and 5 teachers on the understanding of the items and appropriateness of the scales or answer choices. The items were also reviewed for suitability, relevance and accuracy by an expert panel comprising a nutritionist, pediatrician and child psychologist. Based on the feedback and recommendations by the expert panel, teachers and children, the items were either retained unchanged, revised or removed. The selected items were then pre-tested with 42 second grade children (8 years old) for clarity and readability of the items and scales as well as the overall instrument. Corrections to the items were made accordingly based on the feedback of the children. A second pre-test was carried out with another 41 second grade children to assess construct validity of the items. Factor analysis was conducted and items with factor loading of less than 0.4 were removed. Internal consistency of the items

was determined through Cronbach's alpha coefficient.

The final instrument consisted of 23 knowledge, 11 attitude and 10 practice items. The knowledge questions represented 5 constructs (food, nutrient and function; food and energy; nutrient deficiency; food choices and sources of nutrients) while the attitude and practice questions corresponded to 4 constructs (food intake, food and health, food choices and diet quality). The internal consistency values of knowledge, attitude and practice items were 0.68, 0.61 and 0.66, respectively. Based on the validity and reliability results of the first and second pre-tests, the instrument was deemed to be appropriate for use in the intervention. Examples of nutrition knowledge, attitude and practice items are presented in Table 1.

Each nutrition knowledge item had four answer options. Each correct response was allocated 1 point and an incorrect or no response was allocated 0 point. Each attitude item was on a 3 point-scale. Favorable and unfavorable options were given 2 and 0 points, respectively. The intermediate option (neutral) was given 1 point. The first 6 practice 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 indicated higher knowledge, positive attitude and good practice.

Procedures

The Ministry of Education and the Ethical Committee of School of Medical Sciences, Universiti Sains Malaysia approved the study protocol. Permission to conduct the study in each participating school was also obtained from the principals. All parents or guardians signed the consent forms prior to the study.

The KAP questionnaire was administered to the intervention and comparison groups before the implementation and one month after completion of the nutrition education intervention. All students were gathered either in the classroom, school hall or resource center and 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 recorded their answers on the instrument. Knowledge items were asked first followed by the attitude and practice items.

Demographic and socioeconomic information of the children were obtained from the students' school records. The records are updated annually by the classroom teachers and deemed to be accurate source of information. The children were also measured for their weight and height by a trained nutritionist using calibrated Tanita digital weighing scale (Tanita Corporation, Japan) and Seca body meter (Seca, Germany), respectively. Each measurement was taken twice and the average was used in the calculation of z-scores for weight-for-age (WAZ), height-for-age (HAZ) and weight-for-height (WHZ) using the Epi Info version 3.3.2 (Center for Disease Control, 2005). Underweight, stunting and wasting is defined as WAZ, HAZ and WHZ < -2 SD; WAZ and HAZ > -2 SD or WHZ > - 2 SD $\leq$ x $\leq$ 2 SD indicates normal growth; and > 2 SD for WHZ reflects at-risk of overweight.[23]

Data Analysis

As the data on nutrition knowledge, attitude and practice scores were normally distributed, parametric statistics were applied to the data. The intervention and comparison groups were compared with respect to socio-demographic and anthropometric measurements using t-test and chi-square statistics to identify confounding variables. The mean values with 95% confidence interval are reported for the scores of pre-test and post-test and the changes between pre-test and post-test in the intervention and comparison groups. The mean differences in pre-test and post-test between intervention and comparison groups were evaluated using independent t-test. The difference in nutrition KAP scores within group before and after intervention was assessed using paired t-test. Tests for main effect and two-way interactions between intervention status (intervention or comparison) with ethnicity and weight-for-age z-score of child and parental employment were carried out for change in KAP scores from pre- to post intervention. General linear model (GLM) univariate procedure was utilized to examine the change in KAP scores from pre- to post intervention between the intervention and comparison groups with potentially confounding factors (ethnicity, weight-for-age, father's employment and mother's employment) included as covariates. All data analyses were performed using SPSS for windows version 13.0.

Results

Of the 335 children participated in the study, 168 and 167 were in intervention and comparison group, respectively. The intervention and comparison groups were similar in respect to gender, age, household size, height-for-age and weight-for-height (Table 2). However, the two groups differed ($p<0.05$) in the distribution of ethnicity, employment of parents and underweight status. The comparison group had more Indian but less Chinese children than the intervention group ($\chi^2=8.32$, $p<0.05$). In addition, a higher percentage of children in the comparison group were underweight ($\chi^2=6.47$, $p<0.05$). More parents (fathers and mothers) in the intervention group were in the clerical/sales/service jobs while higher percentages of the parents in comparison group hold administrative and management posts. The percentage of housewife was higher in intervention group while more women in professional occupations in the comparison group ($\chi^2=10.76$, $p<0.05$).

The pre- and post-test mean scores for nutrition knowledge, attitude and practice of the intervention and comparison groups are presented in Table 3. At baseline, there was no significant difference in the mean KAP scores between the intervention and comparison groups. There were consistent and significant increments in the post intervention mean scores of KAP items for the intervention group as indicated by the mean change in nutrition knowledge (Mean change=2.17, $p<0.001$), attitude (Mean change=1.40, $p<0.001$) and practice (Mean change=0.87, $p<0.001$) score between baseline and follow-up. However, no significant difference between pre- and post intervention mean KAP scores was observed for the comparison group. The increments in post intervention mean KAP scores for the intervention group contributed to the significant difference in post-test knowledge ($p<0.001$), attitude ($p<0.01$) and practice ($p<0.01$) between the intervention and comparison groups.

The change in mean KAP scores was used as a measure of the students' improvements over the period of the intervention. The change in mean scores for knowledge, attitude and practice were significantly associated with intervention status, ethnicity, weight-for-age, mother's employment and father's employment, indicating that each of these variables has an effect on the change in KAP scores. However, there was no significant interaction between intervention with ethnicity, weight-for-age and parental employment (data not shown)

The change in mean scores for knowledge ($F=18.35$, $p<0.001$), attitude ($F=6.94$, $p<0.01$) and practice ($F=15.96$, $p<0.001$) were significantly different between the intervention and comparison groups (Table 3). The significant differences in knowledge ($F=17.72$, $p<0.001$), attitude ($F=6.41$, $p<0.05$) and practice ($F=15.49$, $p<0.001$) between these two groups were maintained even after adjusting for ethnicity and weight-for-age of the children and parental employment (Table 4).

The correlation between change in overall nutrition knowledge with change in attitude and dietary behaviors for the total sample, comparison and intervention groups is generally weak (Table 5). For the total sample, there is a significant correlation between change in knowledge with change in attitude ($r=0.20$, $p=0.001$) and practices ($r=0.21$, $p=0.002$). While similar results were obtained for the intervention group (knowledge and attitude – $r=0.17$, $p=0.03$; knowledge and practice – $r=0.20$, $p=0.008$), the comparison group showed no significant correlation between the change in nutrition knowledge with attitude and practices.

Discussion

This pilot study was conducted to assess the effectiveness of a school-based nutrition education program for primary school children. Findings of this study showed that the nutrition education intervention produced significant improvements in nutrition knowledge, attitude and practices among primary school children. Similar findings were reported in other studies.[12-14, 24] We also demonstrated that the change in nutrition knowledge is concomitant with changes in dietary attitude and behaviors in the intervention group but not in the comparison group (Table V). This finding indicates that nutrition knowledge is integral to the achievement of healthful dietary behaviors and consequently in the improvement of diet quality.[8]

In children, food consumption is associated with foods that are available and accessible at homes.[25, 26] Several studies have reported that despite adequate nutrition awareness and knowledge and positive attitude towards healthy nutrition, lack of food availability and accessibility experienced by the children or individuals in low socioeconomic households may remain as an important deterrent in the achievement of a healthy and varied diet.[27, 28] In this study, as information on household income and educational level of parents was not available for

many of the children, we used parental employment as indicators of the children's socioeconomic status. It is worthwhile to note that compared to the comparison group, the intervention group consisted of a higher proportion of parents in lower employment categories and mothers who were housewives. Yet, the intervention group had significant improvement in dietary knowledge, attitude and practices at post intervention compared to the comparison group. We also demonstrated that the effects of the nutrition intervention on knowledge, attitude and practices were independent of occupational category of the parents (Table IV) in that the change in mean scores for knowledge, attitude and practice did not differ much between before and after statistical adjustment for parental occupations. Perhaps, despite limited food availability and accessibility, the diet-related knowledge and skills provided through the intervention may not only enhance the children's home food selection but also may be put in good use in food purchases at school.

A sufficient implementation period of nutrition intervention is required to achieve changes in children's nutrition knowledge, dietary attitudes and habits.[6, 29] The School Health Education Evaluation reported that 10-15 hours were required to produce 'large' effect in knowledge and a minimum of 50 hours to produce behavioral changes.[30, 31] Several studies have shown that an implementation period of 5 to 13 weeks was sufficient to improve children's health and nutrition knowledge but may produce variable impact on behaviors.[7, 12, 24, 32-34] However, other studies with a longer period of implementation for nutrition intervention have consistently reported better behavioral outcomes.[11, 35-37] Our study showed that by participating in at least 6 hours of nutrition education, there was a statistically significant improvements ($p<0.001$) in overall nutrition knowledge, attitude and practices for the intervention group (Table III)

A successful nutrition intervention should also include content and teaching strategies that are developmentally appropriate for the children and address changes in the environment.[6, 38] Fun and interesting health and nutrition education activities will increase the children's attention and motivation to learn and consequently change their health and dietary practices.[39, 40] In addition, changes in the physical environment (i.e. the school system) are conducive to promote positive behavioral outcomes related to nutrition in children.[41, 42] In this present study, the nutrition education intervention incorporated the 'fun while learning' concept into its various activities. Besides the traditional classroom-based teaching, other activities such as group discussion on nutrition topics, demonstrations, nutrition contest, workbook assignments, video presentations and singing sessions were also included to enhance learning among the students. The intervention also created a school environment that aimed to increase the awareness of healthy nutrition and lifestyle through provision of nutrition information to teachers, nutrition exhibitions and display of nutrition posters in school canteens and classroom and on school bulletin boards.

There are limitations in the implementation of our nutrition education intervention and the evaluation instrument that may influence the study findings and generalization. Even though the classroom teachers were trained to carry out the implementation of the nutrition intervention and related teaching aids were provided, there might be variations in teaching styles of the teachers that could impact learning by children. Continuous monitoring of teaching and discussions with teachers was carried out to ensure the teachers were consistent and motivated in implementing the intervention. Due to time, financial and human resource constraints, the nutrition education intervention was conducted only in urban schools. Thus, the effectiveness of the intervention cannot be generalized to children in the rural areas with different socioeconomic background. Differences in the exposure to nutrition information, family environment and food availability and accessibility could influence the children's responses to the nutrition education intervention. There may also be limitations related to the nutrition knowledge, attitude and practice items as an evaluation instrument. For example, dietary practices were assessed using practice statements (e.g. food chosen for snack; frequency of taking breakfast) and not actual energy and nutrient intakes or food consumption that may indicate the outcomes of dietary behaviors. Finally, the effects of the intervention were assessed a month after the intervention ended in which the short gap between the completion of the intervention and the post intervention test may aid the retention of improved nutrition knowledge, attitude and practice. However, whether these positive effects will persist or are attenuated in the long run is beyond the scope of this study.

Conclusion

The present study showed that the nutrition education intervention conducted over a period of 6 week has a positive impact on nutrition knowledge, attitude and

practice of primary school children. The implementation period of the intervention, its concept, content, and presentation strategies and support from teachers and schools are the major factors that have contributed to the outcomes of the intervention. The provision of necessary nutrition knowledge and skills to children in promoting healthy dietary behaviors is integral to long-term health and nutrition of children as dietary behaviors established during childhood may well extend into adolescence and adulthood. It is equally important to address the factors within the child's familial environment such as increasing parental awareness on ways to make healthful foods more available and accessible at homes for their children, encouraging breakfast consumption, avoiding excessive control of children's food intake and modeling of healthy food behaviors.[43] As parents provide both genetic and eating environments[44], further studies are imperative to understand their influences on children's dietary behaviors. Besides parental influence, there is also an increasing concern on the impact of food marketing through television and marketing strategies on dietary intake of children.[45] More studies are urgently needed to understand the relationship between food marketing and health and nutrition of children. Nevertheless, concerted efforts from various segments of the society such as the family, school, community, media, government and food industry is crucial to create an environment that facilitates children to establish healthy eating behaviors.

Acknowledgements

This research was funded by the Ministry of Science, Technology and Innovation of Malaysia through the Intensification Research Priority Area (IRPA) Grant.

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Table 1. Sample items of nutrition knowledge, attitude and practice used in HELIC Study

Construct	Example of Items
Knowledge	1. A good source of calcium is ……..
	2. To have a healthy weight, one must eat right and be physically active
	3. Fast foods (burgers, nuggets, fried chicken, pizza) contain much ……..
	4. Food is important for ……..
	5. Breakfast is important to give the energy we need throughout the morning
	6. Which one is a balanced diet?
	7. Food that is low in fat is …….
	8. Which of the level of the food guide pyramid that we need to consume the most?
	9. Fruits are good snack
	10. The brain needs nutrients to function
Attitude	1. Breakfast is important to me
	2. I like to try different foods
	3. The taste of food is more important than its nutrient content
	4. I like to eat vegetables
	5. I do not have to worry about my food intake now because I am still small
	6. I only eat healthy food when I am sick
Practice	1. How often do you take breakfast?
	2. How often do you eat sweets, chocolates, ice-creams, candies?
	3. During school recess, I will eat ……
	4. How often do you eat fast food?
	5. How often do you take food for breakfast?
	6. For lunch, I will take …..
	7. What types of food do you take for snack?

Table 2. Sample demographic and socioeconomic characteristics and growth status

Factor	Intervention (n=168)	Comparison (n=167)	Chi-Square/ t-test
Gender *n (%)*			$\chi^2 = 0.07$, p=0.78
Male	84 (50.0)	86 (51.5)	
Female	84 (50.0)	81 (48.5)	
Ethnicity *n (%)*			$\chi^2 = 8.32$, p=0.04 *
Malay	126 (75.0)	130 (77.8)	
Chinese	30 (17.9)	17 (10.2)	
Indian	7 (4.2)	17 (10.2)	
Others	5 (3.0)	3 (1.8)	
Age *Mean (SD)*	7.99 (0.3)	7.9 (0.3)	t = 0.20, p=0.84
Household size *Mean (SD)*	6.11 (2.1)	6.07 (1.9)	t = 0.19, p=0.85
Employment (Father) *n (%)*			$\chi^2 = 6.89$, p=0.03 *
Professional	23 (13.7)	20 (12.0)	
Administration/ Management	58 (34.5)	81 (48.5)	
Clerical/Sales/ Service	87 (51.8)	66 (39.5)	
Employment (Mother) *n (%)*			$\chi^2 = 10.76$, p=0.01*
Professional	13 (7.7)	21 (12.6)	
Administration/ Management	20 (11.9)	38 (22.8)	
Clerical/Sales/ Services	88 (52.4)	74 (44.3)	
Housewife	47 (28.0)	34 (20.4)	
Weight-for-age *n (%)*			$\chi^2 = 6.47$, p=0.01*
< -2 SD	8 (4.8)	21 (12.6)	
$\geq$ -2 SD	160 (95.2)	146 (87.4)	
Height-for-age *n (%)*			$\chi^2 = 1.44$, p=0.23
< -2 SD	11 (6.5)	17 (10.2)	
$\geq$ -2 SD	157 (93.5)	150 (89.8)	
Weight-for-height *n (%)*			$\chi^2 = 2.89$, p=0.24
< -2 SD	35 (20.8)	45 (26.9)	
-2 SD $\leq$ x $\leq$ 2 SD	114 (67.9)	110 (65.9)	
> 2SD	19 (11.3)	12 (7.2)	

< -2 SD – underweight (weight-for-age), stunting (height-for-age), wasting (weight-for-height)
> -2 SD or – 2 SD $\leq$ x $\leq$ 2 SD – normal
> 2 SD – at-risk of overweight
* $p < 0.05$

Table 3. Mean differences in knowledge, attitude and practice between intervention and comparison groups

Factor	Intervention Mean (95% CI)	Comparison Mean (95% CI)	Mean difference (95% CI)
Knowledge			
Pre-test	15.76 (15.18, 16.33)	15.10 (14.59, 15.62)	0.65 (0.12, 1.42)
Post-test	7.92 (17.40, 18.45) [a] ***	15.57 (14.96, 16.19)	2.35 (1.55, 3.15) [b] ***
Attitude			
Pre-test	14.27 (13.75, 14.79)	14.25 (13.77, 14.73)	0.02 (-0.72, 0.69)
Post-test	15.67 (15.21, 16.14) [a] ***	14.57 (14.11, 15.04)	1.10 (0.45, 1.75) [b] **
Practice			
Pre-test	.59 (5.30, 5.88)	6.01 (5.72, 6.29)	-0.42 (-0.01, 0.82)
Post-test	6.46 (6.18, 6.73) [a] ***	5.91 (5.61, 6.22)	0.55 (0.14, 0.96) [b] **

[a] Significantly different between pre-test and post-test within group(paired t-test)
[b] Significantly different between intervention and comparison groups (independent t-test)
** $p < 0.01$; *** $p < 0.001$

Table 4. Mean change[a] in nutrition knowledge, attitude and practice between intervention and comparison groups

Factors	F value	p
Knowledge	17.72	0.000
Attitude	6.41	0.012
Practice	15.49	0.000

[a] Adjusted for ethnicity, weight-for-age, father's employment and mother's employment

Table 5. Correlations between changes in nutrition knowledge, attitude and practice

Factors	Intervention (n=168)	Comparison (n=167)	Total (n=335)
	---------- (r) ----------		
		Knowledge	
Attitude	0.19**	0.07	0.20**
Practice	0.20**	0.10	0.21**

**p< 0.01