

ORIGINAL ARTICLE

Effectiveness of a Nutrition Education Intervention for Primary School Children: the Healthy Kids Programme, Malaysia

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ABSTRACT

Introduction: This paper discussed the effectiveness of “Healthy Kids Programme (HKP)”, specifically in improving the body weight status as well as knowledge, attitude and practice (KAP) of the children. **Methods:** In this longitudinal intervention study, a total of 12 primary schools in Klang Valley were randomly selected and divided into intervention and control groups. There were 386 standard three children participated at baseline. All children in the intervention group participated in the HKP that was conducted by nutritionists. The evaluations included the pre- and post-Immediate Impact survey (IIS) (every topic), and changes in nutrition KAP survey and anthropometric assessment of the children at the beginning and end of every year for three years. **Results:** School children in intervention group reported with an increased in the IIS score for each topic and achieved a significantly higher mean nutrition knowledge score than those in the control group over time. There were no significant differences in mean attitude and practice scores between two groups after the intervention. Children in the intervention group had lower rates of overweight and obesity (pre-test: 27.3%; post-test: 32.5%) than their counterpart (pre-test: 26.6%; post-test: 44.0%). **Conclusions:** The HKP is effective in improving nutrition knowledge of the children. A lower rate of overweight and obesity was observed in intervention group than control group. This approach will contribute towards inculcating healthy eating and active lifestyle habits among Malaysian children that bring about long-term health benefits.

Keywords: Nutrition education, School children, Body weight status, KAP, Overweight and obesity

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INTRODUCTION

Children undergo rapid mental and physical development. Therefore, it is important to ensure that their growth, development and learning potential are optimized through a strong foundation in nutrition to warrant a lifetime of good health (1). Globally, there has been an increasing trend of over-nutrition issue while under-nutrition remains to prevail in both the developed and developing countries (2,3). It is estimated that 50.5 million children were suffered from the negative effects of underweight (2). While the prevalence of underweight has declined (Year 1990: 25.0%; Year 2018: 7.5%), the stunting prevalence among children is 22.2% in year 2017 (2). In Malaysia, the national prevalence of underweight and stunting among children are currently at 6.6% and 8.2%, respectively (4).

As for childhood obesity, it has been on the rise from

32 million to 41 million between the years 1990 to 2016 (5). In Malaysia national survey, about one in six children (15.6%) and one in seven children (14.8%) were overweight and obese, respectively (4). Overweight and obesity during childhood might be contributed to the later adulthood obesity (5). Furthermore, children who were either overweight or obese had higher odds to be diagnosed with cardiovascular diseases (CVDs) and diabetes as compared to their counterparts (5). The complications of childhood overweight and obesity indicate that the needs to design a health intervention program, specifically focus on nutrition aspect, among children in Malaysia.

Nutrition education should be conveyed to children as early as possible since lifelong dietary and physical habits begins to form during childhood (6-7). In a review of 21 international school-based interventions, primary school settings were found to be the ideal setting for school-based interventions for obesity prevention (6-9). Therefore, it is imperative to implement an education programme for primary school students as a sake to improve their nutrition knowledge, attitude as well as to cultivate the practise of well-planned diet and regular

physical activity among school children.

Past researches have shown the success of education-based intervention programs among children in preventing and treating obesity (9-15). These interventions introduced nutrition education in improving dietary habits into the curriculum and modifying inactive behaviours. The effectiveness of the intervention programs is apparent through the reduction of body weight and inactive behaviours such as television viewing; meanwhile, high physical activity level as well as increment of fruits and vegetable intake (8,14,16-18). In Philippines, Dorado et al. (10) organised an education-based intervention to alter children's nutrition knowledge, attitude and behaviour (KAB) among 200 school children. The intervention increased the children's KAB in the intervention group as compared to the control group. In Malaysia, reductions in weight gain, as well as an increase in physical activity and quality of life, were observed among a total of 107 obese children aged from 7 to 11 years old who follows the interventions in changing sedentary behaviours and increasing physical activity (19).

Although topics related to nutrition and health have been incorporated in the school syllabus (20), it may not be systematically taught in all schools. This is probably due to the lack of appropriate educational tools for teachers to use, and lack of confidence among the teachers in imparting proper nutrition knowledge to the children. However, with the suitable learning tools and educational packages, it may increase the school children's knowledge, attitude and practice in nutrition and health (9,20).

Recognising the lack of a systematically designed nutrition education programme and the urgency need of a primary prevention programme in promoting healthy eating and physical activity, a 3-year Healthy Kids Programme (HKP) was developed to improve nutrition knowledge and promote regular physical activity among primary school children. In this paper, the results of evaluating the effectiveness of the 3-year HKP education module that we developed in improving the knowledge, attitude and practice (KAP) and body weight of the school children are reported.

MATERIALS AND METHODS

Study design and population

The study was a longitudinal intervention study, conducted over 3 years (2011 – 2013). The ethics to conduct the study was obtained from the Research Ethics Committee of Universiti Kebangsaan Malaysia (UKMREC) (NN-136-2015). Approval for data collection in school was permitted by the Ministry of Education, Malaysia. Students from twelve randomly selected national primary schools in Klang Valley, Malaysia participated in the current study. Of twelve randomly

selected primary schools, six of them were in the intervention group, and the remaining six schools were in the control group. Each school allocated one class from Standard 3 to participate in this study. Children whose parents consented were recruited into the study. Children with chronic diseases, physical disability, hearing and learning difficulty were excluded. While 500 children were invited to participate in this study (250 intervention, 250 control), a total of 386 of them agreed to participate (207 intervention, 179 control) at baseline of the study in year 2011 (Year 1). These children were followed up as they entered Standard 4 (Year 2) and Standard 5 (Year 3).

Development of Nutrition Education Package for HKP

A nutrition education package was developed for HKP. It is simple, interactive and user-friendly for both trained facilitators and teachers to be used in implementing HKP among primary school children. The HKP educational package comprises three educational modules and several supportive educational materials. The four main aspects covered in the education modules were health awareness, nutrition, physical activity and hygiene, with a total of six topics for each module. A set of supporting educational materials such as engagement games, educational PowerPoint presentations, worksheets, goal cards and parent leaflets, were developed specifically for each topic, respectively.

The 'fun while learning' concept was emphasised and imparted in the HKP nutrition education package in order to engage and interact with the children during the learning process. Fun interactive activities, such as "act and guess", "role-play", "quiz", and "detective games", were developed for each module to make the nutrition learning process fun and engaging. Nutrition messages were delivered in simple language using PowerPoint presentations and supported with images to educate the children on specific nutrition topics. Worksheets were developed to reinforce the nutrition messages, and goal cards were designed to help the children to monitor their eating habits and lifestyle. Parents were given pamphlets to inform them of what their children have learnt. Parents would know ways to help their children to apply the knowledge learnt into daily practice.

Table I shows the 18 topics of the three modules that had been carried out throughout the three years, including a recap of all the topics in the final session. The modules were specifically designed so that there was an increasing dexterity in the topics as the children moved from standard 3 to standard 5. The first year module (Year 1) emphasised on general aspects of healthy eating, physical activity and personal hygiene. In the second year module (Year 2), the topics focused on the roles of food groups in the food guide pyramid as well as the physical activity pyramid that focused on the types of physical activity. In the module for the final year

Table 1: Topics for modules of Healthy Kids Programme (HKP) throughout the three years

Modules	Aspects	Topics
Year 1 Module	Health awareness	Healthy Habits
	Nutrition	Food Pyramid
	Nutrition	Eating Regular Meals
	Nutrition	Choosing Healthier Meals
	Physical activity	Be Physically Active Everyday
	Hygiene	Personal Hygiene
Year 2 Module	Nutrition	Cereals and Cereal Products for Energy
	Nutrition	Fruits and Vegetables for Health
	Nutrition	Grow Stronger with Protein Food
	Nutrition	Limit Fat, Sugar and Salt
	Physical activity	Let's Exercise and Participate in Sport
	Hygiene	Prepare and Consume Clean and Safe Food & Beverages (F&B)
Year 3 Module	Nutrition	Healthy Cooking Methods
	Nutrition	Read Food Labels and Choose Wisely
	Nutrition	Eating Out Healthily
	Nutrition	Nutrient Imbalance and Its Implications
	Physical activity	Increase Strength and Flexibility
	Recap	Recap of 3 Years Topics

of intervention (Year 3), topics were on the application of healthy eating in the daily life of children, as well as ways to enhance their muscle strength and flexibility.

Implementation of HKP

Trained nutritionists delivered the intervention sessions based on the modules of the HKP. These trained nutritionists conducted the intervention sessions six times a year to the school children in the intervention group. Each intervention session took about an hour to complete. It was carried out in the classroom during the Physical Education/music or co-curriculum sessions, depending on the schools' allocation. Before starting the session, the nutritionists would refresh the previous topic by going through the worksheet or goal card. Then, children would engaged in a short interactive activity that was related to the topic. After that, the nutritionists summarised the key messages of the topic using Power-Point presentations. At the end of the session, the nutritionists would disseminate and brief on the worksheet and goal card to the children as their homework. Parents leaflet on key learning notes was also distributed to the children to be shared with their parents to encourage for home practices. On the other hand, no nutrition education intervention was provided for those children in the control group during the study period.

Evaluation of HKP

The effectiveness of the nutrition education modules was evaluated through the pre- and post- Immediate

Impact survey (IIS), and changes in KAP survey as well as nutritional status assessment of the respondents at the beginning of the school year and end of the school year.

Pre- and post-Immediate Impact Surveys (IIS)

Pre- and post- immediate impact surveys (IIS) were conducted during each educational session, except for topic 6 in Year 3 that was a recap session for all topics over three years. The pre- and post-IIS were conducted before the engagement activity session and after the educational PowerPoint session, respectively. Both pre-IIS's and post-IIS's questions were similar, but the sequence of the questions was different. The questionnaire consisted of five items related to each of the respective module topics. The children were required to answer whether the statements were true or false. Each correct was allocated as 1 point, while an incorrect was allocated as 0 point. An increase in IIS score indicates a better understanding of the particular module topic among the children.

Nutrition KAP Questionnaire

A set of Nutrition KAP Questionnaire, which aimed to reflect the nutritional issues and concerns among school children, was designed and pre-tested by the researchers prior to the nutrition intervention program. The researchers reviewed the components for suitability, relevance and accuracy. Changes were made according to the suggestions from the researchers, school teachers and students. The questionnaire was pre-tested among 137 standard three children (9 years old). The finalised questionnaire consisted of 26 knowledge, 10 attitude and 10 practice items. Internal consistency of the items was determined through Cronbach's alpha coefficient (Knowledge=0.46, Attitude=0.53, Practices=0.54).

Four different options were provided for each of the nutrition knowledge items. A single point was allocated for each correct answer, otherwise, 0 point was allocated. Each attitude item was measured on a 3-point Likert scale, whereby "agree" was given 2 points; "less agree" and "disagree" were given 1 and 0 point, respectively. The practice items were evaluated on a 5-point frequency scale, ranging from "almost every day" to "never". Five points were allocated to "almost every day", four points for "2-3 times a week", 3 points for "once a week", 2 points for "2-3 times a month" and 0 point for "never". The total nutrition KAP scores were computed and converted into percentages (%), respectively. The nutrition KAP scores were further computed into 3 categories based on tertiles, namely low (0 – 33.33%), moderate (33.34 – 66.66%) and high (66.67 – 100%) categories, indicating the level of nutrition KAP performance. Low nutrition KAP score indicated poor nutrition KAP performance, followed by moderate KAP score which indicated moderate nutrition KAP performance, and high KAP score was considered as good nutrition KAP performance.

A set of the KAP questionnaire was distributed to all school children at baseline (Year 1 of intervention). Nutrition education sessions were provided in every two to three weeks for the intervention group's school children., but not for the control group. The similar KAP questionnaire was administered by the children in both groups at the end of Year 1. The whole process was repeated in year 2 and 3.

Anthropometric measurements

Children in both intervention and control groups were measured for their body weight and height to the nearest 0.1 kg and 0.1 cm using SECA digital weighing scale and SECA stadiometer, respectively, during the start of the study and year-end of Year 1, 2 and 3. Each measurement was recorded for two times, and the z scores for height-for-age (HAZ) and BMI-for-age (BAZ) were generated based on the average value of each measurement. HAZ and BAZ were generated using WHO AnthroPlus and compared to the WHO Child Growth Reference (3).

Data analysis

Statistical software of SPSS version 15 was used to analyse all data in the present study. Non-parametric statistics were used when the data were not normally distributed. Mann-Whitney U test was used to compare the numerical data such as baseline age, parent's income, anthropometric variables and KAP scores between intervention and control groups. Wilcoxon test was applied to compare anthropometric variables and KAP scores within the group. The comparison of categorical data was determined using the Chi-square test. McNemar test was used to determine the difference in the BMI status within the same group before and after the intervention program. The differences in the intervention group's KAP scores over the three years intervention period in comparison with the control group were determined using the Repeated-Measure ANOVA test. The p-value of 0.05 was considered as the level of significance.

RESULTS

Socio-demographic characteristics of subjects

While a total of 386 children (207 intervention, 179 control) were recruited during the baseline study, 152 (77 intervention, 75 control) (39.3%) completed the 3-year study. There were no significant differences in terms of socio-demographic characteristics between the two groups. Majority of the school children in both groups were Malay (Intervention: 85.7%; Control: 89.3%; $\chi^2 = 4.220, p = 0.239$), girls (Intervention: 57.1%; Control: 58.7%; $\chi^2 = 0.036, p = 0.849$), with a mean age of 8.9 ± 0.3 years. As for the occupation of the parents, fathers of both groups were mainly in technical or sales and service field (Intervention: 50.6%; Control: 46.7%; $\chi^2 = 5.197, p = 0.158$), while mothers of both groups were mainly housewives (Intervention: 59.7%; Control: 52.0%; $\chi^2 = 5.814, p = 0.213$).

Immediate Impact Surveys (IIS)

Children in the intervention group completed a total of 17 IIS before and after each education session over the three years (Table II). The mean IIS score in the intervention group increased after completing each education session. For instance, the children showed a better understanding of the food pyramid levels (Year 2), food labels, eating out practices and physical activity level (Year 3), especially for topic 5 on strength and flexibility (Year 3), whereby a mean difference of +19.3 was seen in the post-IIS mean score. Overall, the module topics taught in Year 2 and Year 3 showed greater improvements as compared to topics in Year 1.

Table II: Mean pre-IIS and post-IIS scores

Module Topics	Pre-IIS Mean (SD)	Post-IIS Mean (SD)	Mean Difference
Year 1			
Healthy Habits (n=204)	88.0 (12.6)	94.4 (10.4)	6.4***
Food Pyramid (n=205)	78.1 (20.1)	82.7 (20.5)	4.6***
Eating Regular Meals (n=202)	80.4 (13.9)	86.6 (18.2)	6.2***
Choosing Healthier Meals (n=190)	77.3 (20.7)	79.2 (20.0)	1.9
Be Active Everyday (n=187)	88.2 (14.8)	96.5 (9.6)	8.3***
Personal Hygiene (n=194)	87.7 (13.4)	89.2 (14.9)	1.5*
Year 2			
Cereals and Cereal Products for Energy (n=182)	85.6 (19.8)	87.4 (17.0)	1.8
Fruits and Vegetables for Health (n=170)	77.5 (15.1)	90.8 (13.6)	13.3***
Grow Stronger with Protein Food (n=165)	64.7 (17.8)	80.5 (14.7)	15.8***
Limit Fat, Sugar and Salt (n=167)	61.8 (15.3)	80.0 (18.9)	18.2***
Let's Exercise and Participate in Sport (n=157)	85.9 (16.3)	88.5 (13.8)	2.7
Prepare and Consume Clean and Safe F&B (n=155)	92.1 (18.2)	93.3 (12.7)	1.2
Year 3			
Healthy Cooking Methods (n=139)	83.5 (15.7)	90.9 (15.1)	7.4***
Read Food Labels and Choose Wisely (n=129)	76.0 (16.8)	90.5 (12.1)	14.5***
Eating Out Healthily (n=136)	86.5 (14.1)	98.8 (2.2)	12.3***
Nutrient Imbalance and Its Implications (n=130)	85.9 (13.8)	96.6 (5.8)	10.7***
Increase Strength and Flexibility (n=134)	67.3 (16.2)	86.6 (14.0)	19.3***

Note: *There was significant difference between pre-IIS and post-IIS within intervention group (Wilcoxon test) at * p < 0.05; *** p < 0.001.

Nutrition Knowledge, Attitude and Practices (KAP)

As shown in Table III, there was consistent and significant increment in the mean knowledge score in intervention group than control group over the 3 years ($p < 0.05$). No significant changes in the mean attitude score for both groups over time ($p = 0.504$). On the other hand, both intervention and control groups had significant increased in the mean practice score at T5 as compared to T0 ($p < 0.05$), yet the changes were not significantly different between groups over time ($p = 0.066$).

As for nutrition KAP categories, there was a large proportion of the intervention children who had improved their nutrition knowledge, with increased score of more than 50% (Table IV). The percentage of

Table III: Mean KAP scores, between group differences and changes in KAP scores for intervention and control groups

Variable	Intervention (n=77)	Control (n=75)	p-value ^a	Changes in KAP scores as compared to T5			
	Mean (SD)	Mean (SD)		Mean difference (95% CI)	p-value ^b	Mean difference (95% CI)	p-value ^c
Knowledge							
T0	55.6 (9.9)	53.9 (11.6)		23.0 (17.4, 28.5)	0.0001*	12.5 (7.5, 17.6)	0.0001*
T1	62.2 (10.7)	54.9 (11.8)		16.4 (11.5, 21.3)	0.0001*	11.5 (7.6, 15.5)	0.0001*
T2	66.4 (13.2)	62.6 (12.9)	0.0001*	12.2 (7.4, 17.1)	0.0001*	3.8 (-0.04, 7.7)	0.055
T3	71.3 (15.3)	64.0 (15.0)		7.3 (2.2, 12.4)	0.001*	2.5 (-1.7, 6.6)	1.000
T4	73.0 (14.4)	66.3 (14.2)		5.6 (0.9, 10.3)	0.006*	0.2 (-3.6, 4.0)	1.000
T5	78.6 (14.6)	66.5 (13.0)		-	-	-	-
Attitude							
T0	80.9 (13.2)	76.1 (16.3)		-4.5 (-10.9, 1.9)	0.540	0.7 (-7.0, 8.4)	1.000
T1	80.5 (15.0)	80.6 (15.6)		-4.2 (-10.6, 2.3)	0.836	-3.9 (-10.9, 3.2)	1.000
T2	78.9 (16.4)	77.5 (14.7)	0.504	-2.5 (-9.5, 4.4)	1.000	-0.8 (-7.5, 5.9)	1.000
T3	80.6 (12.3)	77.9 (15.7)		-4.2 (-9.0, 0.5)	0.132	-1.2 (-7.1, 4.7)	1.000
T4	77.3 (13.8)	77.4 (14.6)		-1.0 (-5.6, 3.7)	1.000	-0.7 (-6.4, 5.1)	1.000
T5	76.4 (14.4)	76.7 (15.6)		-	-	-	-
Practice							
T0	72.8 (8.1)	68.4 (9.7)		4.6 (1.1, 8.2)	0.002*	9.0 (5.0, 13.0)	0.0001*
T1	78.1 (9.3)	74.7 (10.1)		-0.7 (-4.3, 2.9)	1.000	2.7 (-1.2, 6.6)	0.565
T2	76.5 (9.3)	76.1 (8.0)	0.066	0.9 (-2.5, 4.3)	1.000	1.3 (-2.0, 4.7)	1.000
T3	76.7 (7.6)	75.4 (8.5)		0.7 (-1.7, 3.1)	1.000	1.9 (-1.2, 5.1)	0.939
T4	76.6 (8.2)	76.6 (8.9)		0.8 (-1.5, 3.2)	1.000	0.8 (-1.9, 3.5)	1.000
T5	77.4 (8.1)	77.4 (8.4)		-	-	-	-

Note: T0: Early of Year 1, T1: End of Year 1, T2: Early of Year 2, T3: End of Year 2, T4: Early of Year 3, T5: End of Year 3

^a Comparison of KAP scores between intervention group and control group over time

^b Changes in KAP scores for intervention group

^c Changes in KAP scores for control group

*indicates significant differences (p<0.05)

Table IV: KAP score categories of intervention and control group at pre- and post-test

Characteristics	Intervention (n=77)	Control (n=75)	p-value	Intervention (n=77)	Control (n=75)	p-value
	Pre-test (Early of Year 1) n (%)	Pre-test (Early of Year 1) n (%)		Post-test (End of Year 3) n (%)	Post-test (End of Year 3) n (%)	
Knowledge score						
Low	0 (0.0)	2 (2.7)	0.332	2 (2.2)	0 (0.0)	0.0001*
Moderate	66 (85.7)	64 (85.3)		8 (10.4)	36 (48.0)	
High	11 (14.3)	9 (12.0)		67 (87.0)	39 (52.0)	
Attitude score						
Low	0 (0.0)	2 (2.6)	0.094	0 (0.0)	0 (0.0)	0.637
Moderate	12 (15.6)	20 (26.7)		17 (22.1)	19 (25.3)	
High	65 (84.4)	55 (73.3)		60 (77.9)	56 (74.7)	
Practice score						
Low	0 (0.0)	0 (0.0)	0.003*	0 (0.0)	0 (0.0)	0.611
Moderate	15 (19.5)	31 (41.3)		8 (10.4)	6 (8.0)	
High	62 (80.5)	44 (58.7)		69 (89.6)	69 (92.0)	

Note: Low: 0-33.33; Moderate: 33.34-66.66; High: 66.67-100

*indicates significant percentage difference between groups (p<0.05)

intervention group (87.0) in high knowledge category was higher than the control group (52.0%) (p=0.001). The percentage of intervention group in high attitude category (77.9%) in post-test had decreased by 6.5% as compared to pre-test (84.4%), but the percentage was still higher than the control group (74.7%). For practice score category, children in intervention group with high practice category had increased about 10% as compared to pre-test.

Nutritional status

Double burden of malnutrition exists in both groups at pre- and post-study (Table V). While about one-fourth of the children were either overweight or obese, more than 10% of the children were thin. No significant differences in body weight, height, BAZ and HAZ between the two groups at each pre- and post-test. However, significant changes in these four parameters were observed within each group overtime (p<0.05).

Table V: Nutritional status of children in the intervention and control groups at pre- and post-test

Characteristics	Intervention (n=77)		Control (n=75)	
	Pre-test (Early of Year 1) n (%)	Post-test (End of Year 3) n (%)	Pre-test (Early of Year 1) n (%)	Post-test (End of Year 3) n (%)
	Mean (SD)			
Weight (kg)	28.7 (9.9)	40.6 (14.1) ^a	29.0 (9.3)	41.8 (13.5) ^a
Height (cm)	131.7 (6.8)	145.1 (7.7) ^a	130.3 (6.4)	143.9 (7.6) ^a
Height-for-age z-score (HAZ)	-0.02 (1.08)	-0.15 (1.10) ^a	-0.24 (1.01)	-0.33 (1.09) ^a
BMI-for-age z-score (BAZ)	-0.44 (1.95)	0.13 (1.80) ^a	-0.02 (1.71)	0.52 (1.68) ^a
	n (%)			
Stunting	3 (3.9)	2 (2.6)	2 (2.7)	4 (5.3)
Not stunting	74 (96.1)	75 (97.4)	73 (97.3)	71 (94.7)
Thinness	16 (20.8)	11 (14.3)	8 (10.7)	5 (6.7)
Normal	40 (51.9)	41 (53.2)	47 (62.7)	37 (49.3)
Overweight	10 (13.0)	9 (11.7)	10 (13.3)	15 (20.0)
Obesity	11 (14.3)	16 (20.8)	10 (13.3)	18 (24.0)
Overweight & Obesity	21 (27.3)	25 (32.5)	20 (26.6)	33 (44.0) ^b

Note:

^a indicates significant mean difference between pre-test and post-test within group (p<0.05)^b indicates significant percentage difference between pre-test and post-test within group (p<0.05)

The prevalence of stunting among the intervention group at post-test was slightly lower by 1.3% as compared to the pre-test. The overall prevalence of stunting was higher by 2.6% at post-test in the control group. The increased prevalence of normal weight (1.3%) and decreased in prevalence of overweight (1.3%) were observed in the intervention group, but not in the control group. While both groups had a lower prevalence of thinness at the post-test, a greater decrease was found in the intervention group (6.5%) than the control group (4.0%). The total numbers of school children with overweight and obesity of both groups were high at the post-test, but the control group (44.0%) showed higher prevalence than the intervention group (32.5%). Although the higher rates of overweight and obesity as reported in the intervention group at the post-test, this difference was not statistically significant (Table V). In contrast, there was a statistically significant increased rate of overweight and obese in control group over time (p<0.05).

DISCUSSION

HKP offers opportunities for school children to be informed about food and nutrition, motivating and empowering them to choose nutrition-related behaviours, which is beneficial to health. The educational package was designed in a way that the modules can be taught by trained teachers, during the Physical Education lesson or co-curriculum session. The educational messages and supportive educational materials can be easily implemented by conducting trainings for teachers. The

whole series of six modules can be concluded that the intervention needs a total of six hours in a year, thus posing a minimal interruption to regular school syllabus.

The changes in nutrition knowledge, attitude and practices (KAP) within the intervention group are among the primary outcome to justify the effectiveness of the HKP. The present study found that there were significant and consistent improvements in terms of nutrition knowledge among school children within the intervention group over time. Besides, the knowledge improvement was greater in the intervention group than those in the control group. The results are consistent with past researches that nutrition education increases the knowledge about nutrition, especially healthy eating habits (18, 22-24). Nutrition knowledge is important as it increases awareness of healthy eating; and in return, encourages them to practice healthy eating such as eating fruits and vegetables (16,17,24).

It was presumed that the increase in nutritional knowledge would positively influence one's attitudes towards healthy eating and active living, which would further lead to healthy practices and behaviours (23,25). However, no significant changes in nutrition attitude was observed within and between the groups in the present study. As compared to adults, children appear to be less concerned about their general health. A lower level of perceived vulnerability on health among children might explain the undifferentiated attitude towards nutrition aspects. Besides, changes in the number of hours for nutrition education programs could impact the overall efficiency of the study. Through multiple nutrition education sessions in a year, changes in students' nutrition knowledge could be observed with at least a minimum of 15 hours/year, but long-term improvement in attitudes and behaviour of the students would require at least 50 hours/year (26, 27). Hence, longer duration of nutrition education is needed to achieve the positive changes in attitude on nutrition. Furthermore, attitude on nutrition may be influenced by other factors. The children understand the importance of healthy eating and the nutritional value of healthy foods, but their attitude towards healthy eating is unenthusiastic; and this could also be due to their food preferences as children tend to dislike the taste of vegetables (23,25).

The children's attitude towards nutrition may be influenced by their motivation to practice a healthy lifestyle (16,23,28) and it was discovered that attitude mediates dietary behaviours (29). This justifies the needs to have the right attitude to enforce a long-term effectiveness in healthy living. Nutrition education should also include the application of appropriate theories to improve the children's motivation in living a healthy life (23). In order to increase interest towards nutrition knowledge and intention to improve eating habits of the students, it is suggested to incorporate fun, interesting and interactive activity-based nutrition

education sessions in the nutrition education programs (30-32). It is also important to improve the children's health practices and behaviour to improve their attitudes. van Stralen et al. (29) showed that self-efficacy mediates physical activity and it is important to ensure the children have high self-efficacy to develop healthy behaviours. Furthermore, an intervention to change the environment may be needed to achieve satisfactory changes in health behaviours and the children's school may be the perfect setting for the intervention (7). Another important aspect that may facilitate the behavioural changes of the children is parental involvement and support in nutrition intervention (27, 33-35).

Due to the increased nutritional knowledge, the children could successfully practice good nutrition and healthy lifestyle. HKP is not only concerned about imparting knowledge to the children, but also finding ways to connect with parents of school children with the aim to stimulate their participation in their child learning process throughout the intervention. Sharing of relevant knowledge with parents through leaflet on key learning notes for each session would further encourage home practices. Hence, significant improvement in practice related to nutrition was shown within the intervention group over time. The largest increased in nutrition practice score was reported within the first year of intervention and a slightly downward trend was noted after that. Without any motivation to change, children might fall back to their old habits. Incentives, reinforcement and rewards might be essential to motivate children in healthy practising. Parents are responsible and heavily influence children's healthy behaviour (11,23,36). Exposure to parents' pre-existing healthy practices might enable the children to exhibit similar healthy practice. On the other hand, a healthy school food environment is another component that may impact children's food selection towards healthier foods (37-43). Healthy Canteen Guideline may enable school canteens to serve healthy food choices to help the growth and maintain children's health as well as to reduce risk of diet-related chronic diseases. Food environment especially the canteen may need to be included for future nutrition intervention in ensuring significant improvement in attitude and practices.

Despite lower rates of overweight and obesity were reported in the intervention group (32.5%) than the control group (44.0%), the positive impact on anthropometric changes in this intervention was not obvious. Follow-up for anthropometry assessment with children post-intervention might be needed to determine the sustainability and likelihood of long-term impact of this intervention. Application of other indicators such as waist circumference and body composition may help to improve the interpretation of intervention effectiveness. Other health-related outcomes such as improved fitness should be taken into account in evaluating the intervention program in these growing children.

In the present study, the KAP data were self-reported by the children, which may be considered as one of the limitations. Self-assessment responses in dietary and nutrition research are prone to social desirability, whereby the respondents tend to respond in a certain way in order to prevent criticism (44). Children may overestimate their self-reported activity and underestimate sweetened beverage intake (45). This could affect the effectiveness of the intervention program and measures to control social desirability bias should be taken into consideration in future research (44). It was also reported that the accuracy of assessment reduces when the children are unmotivated to complete the questionnaire (46). Nonetheless, self-reported KAP questionnaire is one of the most common instruments used in determining the effectiveness of nutrition education intervention. Besides children, future research may consider assessment through the teachers, parents and even their peers and observations.

The recruitment and maintaining eligible children within the duration of the study were major challenges in any of the longitudinal studies. Attrition was well recognised as a common problem in long-term dietary interventions (47). Hence, the research team had expected a higher percentage of discontinued participation and attrition for this 3-year intervention study as compared to other similar studies with shorter study duration. The drop-out rate increased from 8.0% to 36.8% over the three years due to some schools discontinued their approval for the intervention sessions to be conducted during the teaching and learning period. The sessions were conducted during the co-curriculum sessions or weekend, and had resulted in the poor attendance as children may have to rely on their transport arrangement availability and timing. In addition, there were a total of 27 children (13.0%) from the intervention group and 19 children (10.6%) from the control group who had transferred to other classes and schools over the past three years; hence, further contributed to the drop out in the current study. Even though this posed a challenge to the study, this may also be the strength as there were not many longitudinal intervention studies in Malaysia conducted as long as three years period. Future studies may need to explore ways to sustain the interests and supports of schools and students to be involved in longitudinal intervention studies.

CONCLUSION

In the present study, a nutrition education package was developed and evaluated. The encouraging results obtained from this study show that the intervention group did benefit from the HKP conducted over three years. The current findings demonstrated that the HKP was effective in imparting nutrition knowledge to school children without a formal change to the school curriculum. Therefore, it is expected that the educational package can be used by the Ministry of Education to

improve the nutrition knowledge and nutritional status of Malaysian school children. It is suggested that the schools incorporate the HKP among school children as one of the key school activities. They are encouraged to work together with local nutritionists to implement the educational programme. Continuous monitoring of students' body weight status by nutritionists and school teachers are also important in order to enable early detection of underweight or overweight problem and carry out timely intervention. By systematically implementing the programme in schools throughout the country, it is envisaged that it will contribute towards inculcating healthy eating and active lifestyle habits among Malaysian children. In cognisance of the prevailing of overweight and obesity and the persistence of under nutrition among Malaysian schools' children, it is imperative that nutrition education be urgently implemented.

ACKNOWLEDGEMENTS

We would like to extend our gratitude to the children for their participation in this study and the schools for their cooperation. We would like to place on record our appreciation to Nestle Malaysia Berhad for funding this study. The authors also acknowledge the secretariat services rendered by Versacomm Sdn Bhd, particularly Ms Muhaini Hussin in assisting the Nutrition Society of Malaysia in planning and implementation of the Healthy Kids Programme in Malaysia.

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