

# EVALUATING THE IMPLEMENTATION OF A CANTEEN-BASED FOOD NUTRITION INTERVENTION AMONG SCHOOLCHILDREN: A PROSPECTIVE INTERVENTION STUDY

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## **Abstract**

**Background:** School children are at great risk of nutrition-related chronic diseases. Their eating pattern in school is influenced by the availability of food served within the school environment. The purpose of this paper was to determine the effectiveness of a canteen-based food nutrition intervention, designed according to the theory of planned behaviour, on the knowledge, perception and choices of healthy food among primary schoolchildren.

**Methods:** This was a prospective intervention study using a two-group design. Six school canteens from the ninety-eight primary schools were randomly allocated to an intervention group or a control group. All the food handlers in the intervention group were given a twelve-week training course in food nutrition. On the completion of the course, 293 Standard Six students from these schools, were interviewed with a nutritional questionnaire on food in their school canteens. The training programme for the intervention group and the questionnaire for the students were developed and validated for the study, and a power calculation made for the sample size of students.

**Results:** The students in both groups were homogeneous in gender and body mass. The mean body mass index (BMI) was 19.26 (SD: 0.38) and 19.47 (SD: 0.39) for the intervention and the control group respectively. There were more schoolchildren in the intervention group who purchased foods in school canteens ( $p$  0.0036) of milk and milk products ( $p$  0.034), and white rice ( $p$ <0.001). Fewer purchased fast food ( $p$ <0.001), and more had a better perception towards serving of healthy food ( $p$  0.001). There were no significant differences in the knowledge level ( $p$  0.095) and purchased fruit ( $p$  0.557) between the groups.

**Conclusion:** A school-based nutrition programme was associated with significant improvement in the perception of students towards foods served in school canteens and in their choices of healthy food. The study provided a framework for the design and implementation of future food nutrition intervention in school canteens.

**Keywords:** Canteen Based Food Nutrition Intervention, Perception, Food Choices, School Canteen, Theory of Planned Behaviour

## Introduction

The school can be an opportune setting to provide health and nutrition services to children. In Malaysia, the school is an important provider of breakfast and lunch (1). Failure to serve a healthy diet for the schoolchildren may result in problems of growth and development for them, and may adversely affect their schooling (2, 3). Studies have demonstrated the link between the eating pattern of schoolchildren and the serving of school food (4-6). Most of the food served in school canteen are snacks that are energy-rich and nutrient-poor (7, 8). The popular school food choices are often of low nutritional value (9-11).

The school food environment plays an important role influencing food choices of schoolchildren. Unhealthy foods sold at school canteen contributes to an obesogenic environment (12, 13), and pose a significant risk for the nutritional problems among schoolchildren. The estimated overweight amongst schoolchildren in Asia in 1995 by the World Health Organisation (WHO) was around 2.9%, and it has risen to around 15% among the overweight in Africa, Asia, and the Eastern Mediterranean (14). In Malaysia, a study on 5,995 children aged 7 to 10 years reported the prevalence of overweight of 9.7% and 7.1% for boys and girls, respectively, and 8.4% overall (15). The 2009 Annual Report by the Ministry of Health of Malaysia (16) reported the percentage of overweight and obesity at 6.7% and 6.0% for Standard One and 9.8% and 8.4% for Standard Six students in Malaysia respectively. The highest prevalence of overweight and obesity reported so far amongst schoolchildren of ages between 7 to 10 years in Malaysia was 17.9% for the overweight and 16.4% for the obese (2).

Malaysia faces the dual burden of the emerging overweight problem especially in urban areas and malnutrition in children, especially among the poor (17, 18). The problem of vitamin D insufficiency in schoolchildren was documented in Malaysia by Khor GL, Chee Ws and Shariff ZM et al. (2), in which 35.3% and 37.1% had vitamin D deficiency ( $\leq 37.5$  nmol/L) and insufficiency ( $> 37.5$ - $\leq 50$  nmol/L) respectively. The existence of mild subclinical vitamin A deficiency and iodine deficiency in this age group were also reported (17).

Many initiatives taken in Malaysia and throughout the world to ensure food served in school canteens comply with nutrition standards and guidelines, and healthy canteen strategy and policies (17, 19, 20). However, they appear to be less effective when correlated with the escalating trend of obesity, overweight and undernourished in schoolchildren as reported both locally (15, 18), and internationally (14,21). Particularly in Malaysia where the school is an important provider of breakfast and lunch, the school canteen play an important role influencing, creating and instilling an awareness of healthy diet, and accessibility for their schoolchildren as highlighted by Drummond and Sheppard (22). To improve the intake of a healthy diet among schoolchildren, a canteen-based intervention is necessary.

Many researchers have pointed out that the knowledge conveyed by conventional training courses could not be

assumed to translate into the desired changes in behaviour (23, 24). Rennie (25) raised a concern that the health education theory following the knowledge, attitude and practice (KAP) model predicted limited effectiveness of formal food education. Soon, Singh and Baines (26) highlighted the failure of cascading knowledge and skills to food handlers due to the lack of an effective follow-up, monitoring and mentoring.

There is an urgent need to formulate a comprehensive plan for a more effective intervention programme to serve healthier food in the school canteen as recommended in the Malaysian Dietary Guidelines (27) and the Management Guide for Healthy School Canteen (28). There are several behavioural theories available for the better prediction of health-related behaviours, and the most popular theoretical framework proposed is the Theory of Planned Behaviour (TPB) (29). This research examined the effectiveness of a newly developed canteen-based food nutrition intervention (CB-FNI), by studying the knowledge and perception of healthy food in the primary school children and their choices of healthy food in the school canteen. Using the TPB, CB-FNI targeted the behavioural attitude (BA), the normative belief (NB) and the perceived behavioural control (PBC) of school canteen food handlers, to improve their behavioural intention (BI). The hypothesis believed that the improvement of BA would lead to a desirable behavioural change in the serving of healthy food (25, 30-32).

## Materials and Methods

### Research population and data collection

A prospective intervention study was conducted in the primary school canteens in Kota Bharu, Kelantan, from January 1, 2013, until November 31, 2014. Six schools, from a list of 98 standard primary schools were selected through simple random sampling by using computer software for random sampling. The selected schools were randomly assigned to an intervention or to a control group, with a total of three in each group. All the school food handlers in the intervention group, who were responsible for the cooking and serving of school food, were subjected to the intervention programme.

The impact of this canteen-based intervention was assessed by looking at the school children's knowledge and perception. Data collection was performed 12 weeks after the completion of the CB-FNI course, using a self-administered questionnaire. All Standard Six primary students who attended school on the day of data collection, and who were literate, were recruited as study respondents. The sample size was calculated using the Power and Sample Size software based on the 2.3 mean dietary fat knowledge among schoolchildren as reported by Saksvig and Gittelsohn (33). After considering an additional 20% attrition rate, the study required 140 students in each group. The students of these selected schools were gathered in the hall and were given a set of the questionnaires on the knowledge and perception towards

healthy food, and food choices. Students were reminded not to imitate or discuss with friends. A researcher read each question one by one and students were asked to follow and write down their responses at the same time. A brief explanation was made if there were students who had difficulty in understanding the questions. The process of selection of the unit sample and the respondents are summarised in a flowchart presented in Figure 1.

As the study was conducted in the government schools, ethical approval was obtained from the Ministry of Education [Reference No: KP(BPPDP)603/5/JLD.02(43)]. Ethical approval was also obtained from the Human Research Ethics Committee, Universiti Sains Malaysia (Reference No: USM/KK/PPP/JEPeM [259.3. (16)]).

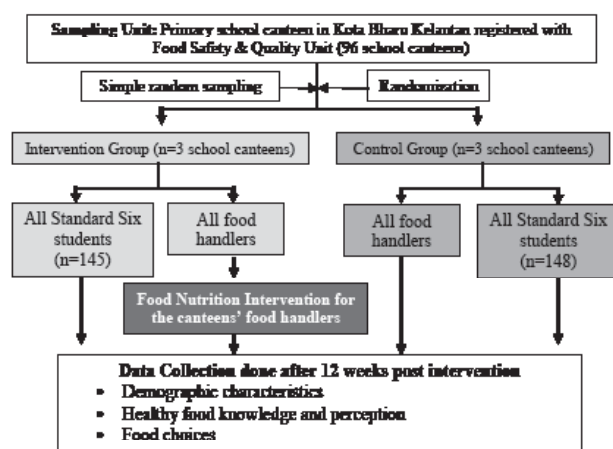


Figure 1: Study flow chart

### Questionnaire design

The questionnaire consisted of four sections: the students' particulars of gender, body height and weight; the food choices in school; the knowledge of a healthy diet; and the assessment of the students' perception toward the serving of healthy foods in the school canteen. This questionnaire was developed based on literature reviews (34, 35) and a previous study conducted by National Coordinating Committee on Food and Nutrition of the Ministry of Health of Malaysia (36).

The knowledge section consisted of 5 closed-ended questions. Each question was scored with one point for the correct answer and zero points for incorrect or unsure answers. A validation study was done amongst 269 primary students for the analyses of the items. To allow a good differentiation between the high- and low-scorers and the difficulty or ease of the questions, the cut-off point of 80% for the difficulty index and the 0.2-0.8 discrimination index were used, for the inclusion in the final questionnaire (37,38).

The perception section consisted of 5 items and had been validated with Cronbach's alpha 0.780 and factor loading value from 0.589 and 0.830. The positive item was scored two points for "agree", 1 point for "unsure" and zero point

for "disagree" choices. Negative items were scored in the reverse order.

### Intervention plan and materials

The content development of the CB-FNI was based on the Malaysian Dietary Guidelines 2010 (27), the Management Guide for Healthy School Canteen (28) and the baseline data gathered during a pilot study. Ten experts in the field, including two food handlers and two food managers, reviewed the CB-FNI content to ensure its appropriateness and feasibility. The CB-FNI targeted school food handlers to improve school food serving. TPB was utilised in the design of the CB-FNI by targeting the enabling factors for behavioural change; the behavioural attitude (BA), normative beliefs (NB), and perceived behavioural control (PBC) (25, 30-32).

In targeting BA of food handlers, a positive belief toward the consequences of serving a healthy diet for students and an increase in their concern about disadvantages related to unhealthy dietary intake were instilled. To improve the NB, the intervention focused on the aspirations of Malaysian Ministries of Health and Education, as stated in the Malaysian Food Pyramid and guidelines. Lastly, the intervention focused on reducing the barriers, improving beliefs and self-capability of food handlers to perform the intended behavioural changes to enhance PBC. The intervention was conducted in 40 minutes of interactive presentations and visual materials, a 15 minute period of questions and discussion, followed by a 10 minute serving of a healthy tea prepared with a recommended amount of sugar. Finally, all the respondents were given a colourful booklet regarding a balanced diet for students. To ensure the full attendance of school food handlers, the interventions were carried out during the weekend when their canteen was not in operation.

### Statistical analysis

Statistical analyses were performed using the SPSS version 21.0. This study used a Pearson Chi-square analysis to compare the differences of categorical variables and the Independent t-test for numerical variables. However, when the categorical variables had an expected count of cell <5 by more than 20%, a Fisher's Exact-test was used. A *p*-value of less than 0.05 was taken as significant.

### Results

#### Demographic characteristics of respondents

From the six schools randomly assigned to the intervention and the control group, all Standards Six primary students who attended school on the day of data collection were recruited. The proportion of boys and girls in both groups were almost similar, and the non-significant *p*-value indicated that both groups were homogenous. The body mass index of students in both groups was in the normal range as shown in Table 1.

**Table 1:** Comparison of respondents' characteristics between intervention and control group (n=293)

Variables	Intervention (n=145) Frequency (%)	Control (n=148) Frequency (%)	Test statistics (df)	p-value
Gender				
Boy	71 (24.2)	71 (24.2)	0.029 (1) <sup>¥</sup>	0.907 <sup>¥</sup>
Girl	74 (25.3)	77 (26.3)		
BMI	19.26 (0.38) <sup>§</sup>	19.47 (0.39) <sup>§</sup>	0.389 (291) <sup>€</sup>	0.698 <sup>€</sup>

§Mean (sd)

¥Chi-square test

€Independent t-test

The significant level was set at <0.05

### Healthy food knowledge and perception

Table 2 showed the score on knowledge of healthy food among the primary school students, assessed through 5 closed-ended questions. The possible maximum score for knowledge was 5. The results from the Independent t-test showed a higher total score in knowledge in the control group compared to the intervention group. However, the difference was not significant. The total score for students' perception toward the serving of healthy food in school canteen represent the cumulative score of five assessed items. The Independent t-test demonstrated that the total score of the students' perception toward serving of healthy food in school canteen in the intervention and control group was statistically significantly different, ( $p=0.001$ , 95% CI: -1.73, -0.46). The mean total score in the intervention group (6.7, SD: 2.50) was much higher compared to the control group (5.6, SD: 3.03) (Table 2), with 11% score unit difference.

**Table 2:** Comparison of the knowledge and perception scores towards healthy food served at school canteens between intervention and control group amongst Standard Six primary students (n=293)

Variables	Mean total score (sd)		Mean difference (95% CI <sup>§</sup> )	t-stat (df)	p-value <sup>¥</sup>
	Intervention (n=145)	Control (n=148)			
Knowledge score on healthy food	3.0 (1.06)	3.2 (1.21)	0.22 (-0.04, 0.49)	1.676 (291)	0.095
Perception score towards school foods	6.7 (2.50)	5.6 (3.03)	-1.09 (-1.73, -0.46)	-3.37 (283)	<b>0.001</b>

§Confidence interval

¥Independent t-test

Students' food choices

Students in the intervention group showed a significantly higher percentage (99.3%) in purchasing food in their school canteens compared to those in the control group (94.6%). In purchasing milk and milk products, those in the intervention group (32.4%) presented with a significantly higher proportion than those in the control group (20.9%). The purchasing pattern of fast foods was found to be much lower in the intervention group (5.5%) than those in the control group (44.6%), and this difference was strongly significant ( $p<0.001$ ). A strong significant difference ( $p<0.001$ ) was also found in the purchase of white rice, where those in the intervention group (75.9%) presented a higher proportion compared to those in the control group (41.9%). However, there was no significant difference in the purchase of fruit between the intervention and control groups. Refer to Table 3.

**Table 3:** Comparison of food choices in school canteens among Standard Six primary students between intervention and control group (n=293)

Variables	Intervention (n=145) Frequency (%)	Control (n=148) Frequency (%)	Test statistics (df)	p-value
Frequently purchased food in school canteens				
Yes	144 (99.3)	140 (94.6)		0.036 <sup>€</sup>
No	1 (0.7)	8 (5.4)		
Purchased milk or milk products today				
Yes	47 (32.4)	31 (20.9)	4.931 (1)	<b>0.034<sup>¥</sup></b>
No	98 (67.6)	117 (79.1)		
Purchased fruit today				
Yes	8 (5.5)	6 (4.1)	0.345 (1)	0.557 <sup>¥</sup>
No	137 (94.5)	142 (95.9)		
Purchased fast foods today				
Yes	8 (5.5)	66 (44.6)	59.248 (1)	<b>&lt;0.001<sup>¥</sup></b>
No	137 (94.5)	82 (55.4)		
Purchased white rice today				
Yes	110 (75.9)	62 (41.9)	34.864 (1)	<b>&lt;0.001<sup>¥</sup></b>
No	35 (24.1)	86 (58.1)		

¥Chi-square test

€Fisher's Exact test

Discussion

Early intervention during childhood is crucial to achieving the maximum impact to reduce the negative outcomes of unhealthy food intake. This study hypothesised that food handlers would serve nutritious and healthy food following their CB-FNI. These behavioural changes would be determined by the improvements in students' food choices and a positive perception of food served in school canteens.

### ***Effectiveness of the CB-FNI on the students' knowledge and perception***

The results from the CB-FNI for food handlers were assessed by the perception of the students in food preferences (39) and food safety risks (40). The findings showed a significantly better students' perception score in the intervention group, indicating merit in this intervention. The study found that the knowledge level of students regarding healthy food was not significantly different. We had expected to find no difference in the knowledge level between the two groups as the study intervention did not focus on improving students' knowledge. These results suggested that the high score in the students' perception in the intervention group was not influenced by their knowledge level. Thus, this finding indicated that the main influence for the improved perception was the success of the CB-FNI in changing the behaviour of food handlers and motivating them to serve more healthy foods.

Several studies have called for wider approaches in intervention such as in healthy eating promotions that are targeted at students (1, 40); targeted at other key stakeholders (41, 42); and targeted at policymakers (4, 5, 43). However, this study has proven that by focusing on the behavioural changes of food handlers using TPB, there were positive practices to serve more healthy foods that were positively perceived by schoolchildren. This heartening positive result could contribute to the small but growing body of literature that highlights the success of the TPB-based intervention in increasing the availability of healthy food and improving the school's canteen environment.

### ***Effectiveness of the CB-FNI on the students' food choices***

Findings on the food choices of primary schoolchildren demonstrated that nearly half of them frequently purchased food available in the school canteen. These results were similar to findings from a cross-sectional study conducted in 287 U.S. schools that involved 2,314 children in grades 1 through 12 (44). They reported that 40% of the schoolchildren had consumed one or more school foods on a typical school day. This indicated that canteen foods are widely consumed by primary schoolchildren. This supports the need to serve healthy and nutritious food within the school's food environment.

Students in the intervention group demonstrated a significantly higher percentage in the purchase of food in school canteens compared to students in the control group.

Those in the intervention group were 4.7% higher than the control group regarding the frequency of purchasing food in school canteens. Although the difference was small, it could still suggest supporting the argument that school canteens can still generate profit from selling healthy foods, as highlighted by Fox, Meinen (45) and Setter, Kouris-Blazos (42).

The study also found that a higher percentage (11.5%) of students chose milk and milk products in the intervention group, compared to the control group. This showed an improvement in the number of milk and milk products served in the intervention group as compared to the control group. This research did not assess students' preferences towards vegetables. It is because in a typical Malay menu, vegetables are never served alone unless they are added to white rice or noodles. A significantly higher percentage of children who chose white rice suggested that these schoolchildren would be purchasing foods that had added vegetables, indicating the effectiveness of CB-FNI in motivating food handlers to serve healthier foods.

This study found that the percentage of students who purchased fast food in the intervention group (5.5%) was significantly lower than in the control group (44.6%). The lower percentage of children who purchased fast food in the intervention group might be influenced by the better availability of healthy food as demonstrated in this study, namely milk products and vegetables. Their choice again highlighted the important role of school canteen to improve healthy eating pattern among schoolchildren by improving the availability of healthy foods.

This study failed to improve the students' preferences towards fruits. Even though we expected the intervention group to serve more fruits compared to the control, the availability of fruits still did not persuade the students to purchase any. This finding was in agreement with the cross-sectional survey of schoolchildren in nine developed European countries of Norway, Spain, Iceland, Denmark, Portugal, Austria, Netherlands, Sweden and Belgium, which documented that the fruit and vegetable intakes of 11-year-old children were far from the population goals and food-based dietary guidelines on national and international levels (46). However, Evans, Christian (47) pointed out that improving fruit intake was easier compared to vegetable intake by schoolchildren. Adding to this line of thought, Yen and Tan (48) proposed that any intervention programme that aimed at increasing fruit intake should be targeted and tailored to individuals. Some studies which resulted in significant changes in fruit intake by schoolchildren emphasised broader intervention approaches, lower food prices, and parental behavioural changes by giving social support and increased home-availability of fruits and vegetables (49, 50).

Information on schoolchildren's food choices with regards to the food served in school canteens, and their perception in this dimension are the preliminary indicators to determine the effectiveness of the school-based intervention. The information is useful for plans in healthy

food serving by the school canteens to increase students' consumptions of a healthy diet. This argument is supported by many studies that childhood eating pattern influenced their development and learning capabilities (2, 3, 14), and their future adulthood morbidity (8, 51). Furthermore, the study findings could help the policymakers on the need to create food policies and standards, as well as to improve the current guidelines. Lastly, ideal future intervention programmes should include other key stakeholders with the students by integrating the programme within the classroom curriculum.

### Conclusion

In conclusion, this study provided support for the effectiveness of a canteen-based intervention targeted on the behavioural attitudes, normative beliefs and perceived behaviours of food handlers. The intervention successfully improved students' perception towards foods served by school canteen and improved their healthy food choices. Thus, it offered the potential to reduce the incidence of nutritional problems amongst primary schoolchildren.

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### Competing interests

The authors declare that they have no competing interests.

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