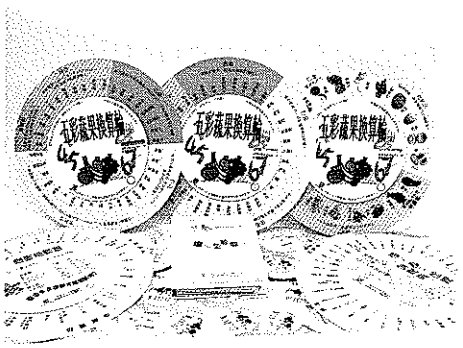
五彩蔬果計劃
Colourful and Bright Fruits and Vegetables Project

學童飲食行為研究報告
Report on Eating Behaviour in School Children








香港中文大學醫學院
健康教育及促進健康中心
Centre for Health Education and Health Promotion
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Content

Executive Summary

The links between dietary habits and health were well established. Diet in childhood is not only an important factor for children's development and learning, also contributing to their long-term health and well-being. To address the problem of the increased prevalence of childhood obesity and the changing public health agenda, the Centre for Health Education and Health Promotion of the Chinese University of Hong Kong launched a comprehensive health promotion initiative namely the 'Colorful and Bright Fruits and Vegetables Project' in 2004. The pilot project embraced health promotion strategies through a Health Promoting School approach and aimed to guide the development of a sustainable policy and environmental change at school that would promote consumption of fruits and vegetables in primary school students. It emphasized the environmental and policy changes in addition to the changes in individual knowledge and attitudes. An integrated approach, entailing improved school eating policies and eating environment at school, training of teachers and parents, involvement of family and community, along with a comprehensive nutrition education programme and the active participation of students was adopted. Training, consultancy service and professional supports were provided to the participating schools throughout the project period, as well as teaching kits and nutrition education materials. Schools were encouraged to incorporate the programme into their school life and utilize the resources and professional support provided by the project to organize nutrition education and promotion activities for their students. This report provides information on the project objectives, strategies, programmes, evaluation plan and the findings of the evaluation.

The project was piloted in 10 local primary schools which were the member schools of the health promoting schools project. A combination of qualitative and quantitative methods was adopted to assess the effectiveness of the Project in terms of the policy and environmental changes of the participating schools as well as the knowledge, attitude and behavioral changes of students and parents after 1 year's implementation in the school. Analysis was also conducted to identify factors affecting students' consumption of fruits and vegetables and factors affecting the project effectiveness. The methods of evaluation included survey questionnaires for students, survey questionnaires for parents, review of school lunch menu, observation and weighed lunch consumption, and schools' feedback survey. The key findings include:

- The major factors affecting student's fruits and vegetables consumption were i) parents' influence including parents' understanding of the benefits of fruits and vegetables; attitude towards easiness of sustaining healthy eating and parents' consumption of fruits and vegetables; ii) availability of fruits and vegetables as snacks and at lunch; iii) perceived peer's attitude towards eating vegetables and fruit and iii) taste of the food;

- Improvement in school policies on healthy eating and both the nutrition quality and quality of school lunch was evident. Weighed school lunch survey results indicated that there was a statistically significant increase of 23.6% ($p=0.007$) in the mean weight of vegetable supplied at lunchtime;

- a statistically significant improvement in nutrition knowledge (58.7% students got a pass in Knowledge Score at baseline vs 73% at the post assessment, $p<0.001$); fruits and vegetables consumption were reported. An overall significant increase of 63.3% ($p<0.001$) in vegetable consumption at lunchtime was recorded;

- evaluation results also showed a reduction in the consumption of certain high fat and high sugar snacks; ice-cream and desserts showed the most significant reduction (-4.6%, $p=0.005$), followed by instant noodles (-3.7%, $p=0.017$), confectionaries (-3.5%, $p=0.036$) and chips (-2.9%, $p=0.042$);

- a statistically significant improvement of parents' nutrition knowledge and their fruits and vegetable consumption (+10.6%, $p<0.001$, +8.5%, $p<0.0010$ and 4.1% , $p=0.041$ respectively).

The findings affirmed that the Health Promoting Schools model is an effective way to integrate a broad range of strategies that complimented each other to foster a supportive environment to improve knowledge and support eating behaviour change in school children and also their parents. Further studies are recommended to test the model in other schools using nutrition promotion as an entry point for developing health promoting schools. While schools cannot be expected to solve the problems of the current trend towards obesity and related physical problem alone, they are well positioned to positively influence what children eat and motivate them to choose healthy choices and develop healthy practices through health education and promotion and build a school environment that fosters and supports healthy practices. In order to help children to achieve the whole-person development and enable them to develop life-long healthy lifestyle, joint efforts of parents, relevant government departments, professional bodies, community and commercial groups are essential to create a healthy and supportive home, school and community environment.

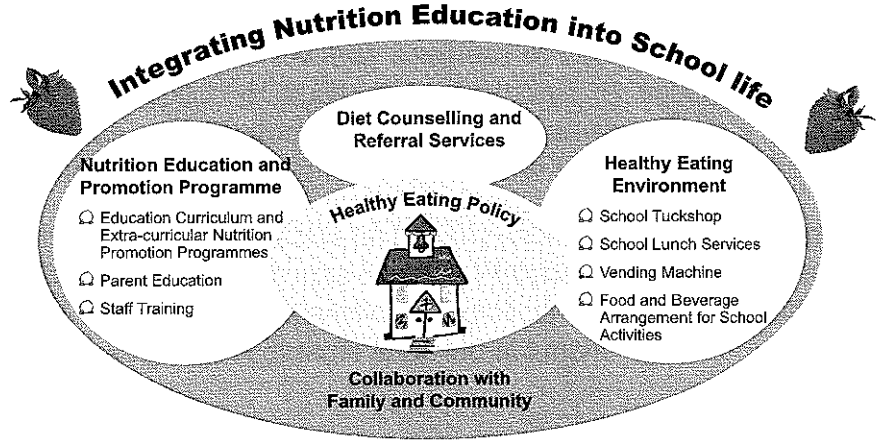
Chapter 1 Project Introduction

Background

There is substantial evidence that having sufficient amount and variety of fruits and vegetables as part of a balanced diet from young age is crucial to lowering the risk of developing long term health problems such as obesity, cardiovascular diseases and certain types of cancers in later life. Insufficient consumption of fruits and vegetables is identified by the World Health Report 2002 to be one of the top five leading global disease burden risk factors.[1] A survey conducted in 7,192 children aged from 10 to 16 in 2001 in Hong Kong indicated that only less than 10% of children followed the recommendation of having five servings of fruits and vegetables a day.[2-3] Childhood is considered as a crucial stage for the formation of healthy eating habits. Schools are an ideal setting for promoting healthy eating initiatives as they can reach a large population of children and provide opportunities for children to practice healthy eating.[4-5] Research has shown that the overall cost-benefit ratio of exemplary Health Promoting School Programme to be 13.8 which compares very favorably with adult-based programmes in non-school setting.[6] In this regard, the Centre for Health Education and Health Promotion (CHEP), Faculty of Medicine, The Chinese University of Hong Kong launched a comprehensive health promotion initiative namely the 'Colourful and Bright Fruits and Vegetables Project' in 2004. This report provides information on the project objectives, strategies, programmes, evaluation plan and the findings of the evaluation.

Project Description

This pilot project aimed to guide the development of a sustainable policy and environmental change at school that would promote consumption of fruits and vegetables in primary school students. The project embraced health promotion strategies through a Health Promoting School approach.[7] It emphasized the environmental and policy changes in addition to the changes in individual knowledge and attitudes. An integrated approach, entailing improved school eating policies and eating environment at school, training of teachers and parents, involvement of family and community, along with a comprehensive nutrition education programme and the active participation of students was adopted. Training, consultancy service and professional supports were provided to the participating schools throughout the project period, as well as teaching kits and nutrition education materials. Schools were encouraged to incorporate the programme into their school life and to utilize the resources and professional support provided by the project to organize nutrition education and promotion activities for their students.



Project Objectives

The project aimed to help primary school children adopt a habit of eating enough fruits and vegetables by creating a supportive school eating environment and culture to enhance awareness, behavioural changes and to support good practices. The specific objectives were to

1. increase schools' capacity to create a supportive environment and culture that help students adopt the healthy eating habit of having recommended servings of fruits and vegetables everyday;

2. enhance the participants' overall awareness and enjoyment of having more fruits and vegetables;

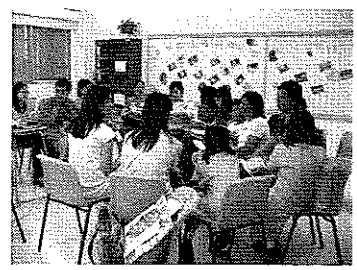
3. increase the fruits and vegetables consumption of the participants.

Target population

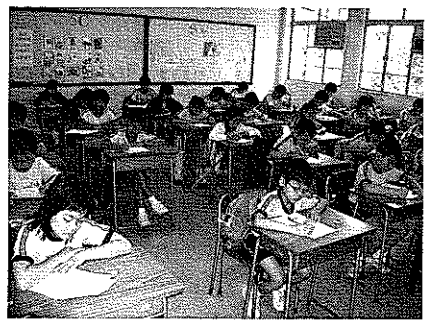
Ten whole-day primary schools located in different districts in Hong Kong have joined the project in which all of them are the member schools of the Hong Kong Healthy Schools Award Scheme.[8] All the schools are Aided Primary Co-educational Schools with student numbers ranged from 380 to 1,200. All schools provided school lunch services to students and nine of them have school tuck shops. Among those schools with a tuck shop, one of them was run by Parent-Teacher Association and the rest were contracted out services.

Project Activities

Needs Assessment



A comprehensive needs assessment was carried out in 2004. It involved focus group discussion with 15 teachers (2 groups), 25 parents (4 groups) and 114 students (10 groups); questionnaire surveys of 2,728 Primary 4 and Primary 5 students and 2,728 parents; weighed lunch measurements of 32 school lunch samples and 453 students; key informant interviews with the school principal and tuck shop managers. The data was analyzed and used to guide the development of the project programmes addressing the needs of the stakeholders.

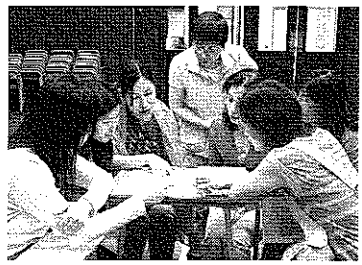


Capacity Building for Teachers

A series of train-the-trainers programmes for teachers were conducted by dietitians to empower participants with nutritional concepts and skills in nutrition education and in building a healthy eating environment and policy in school. The training focused on skill building, problem solving and sharing of good practice. Teachers were invited to share their school progress, the problems faced during implementation and to work out the possible solutions at the workshops. Various tools and guidelines on how to set up a healthy eating school environment and healthy eating policies were disseminated.

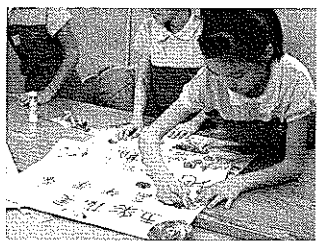
Parent Ambassador Training

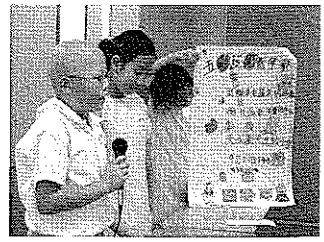
The project highly promoted parent-school collaboration. Workshops were organized for parent ambassadors to raise their health awareness and to equip them with nutrition knowledge and skills in working with schools to cultivate a healthy eating environment and culture.

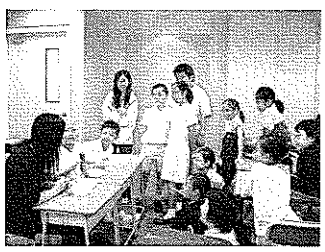


Student Ambassador Training

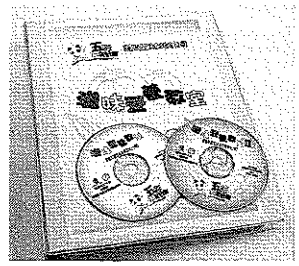
Schools were encouraged to nominate student fruit and vegetable ambassadors to convey health messages to their peers and to assist in carrying out nutrition promotional activities in school. Training workshops were conducted to empower the student ambassadors with communication skills, advocacy skills, teamwork and collaborating ability, nutritional knowledge and nutrition promotion skills.



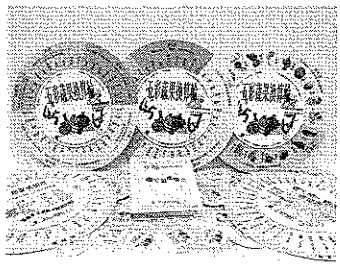


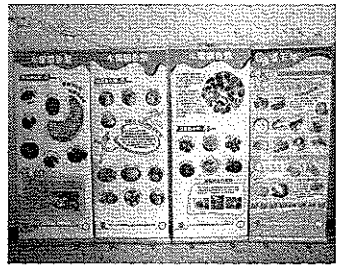


Nutrition Education Teaching Kit and Resource



A user-friendly and interactive nutrition education teaching kit namely "滋味營養教室" together with the handily assisting tools – "Fruits and Vegetables Serving Wheel" were produced and distributed to every project school to facilitate schools in conducting school-based fruits and vegetables promotion and nutrition education. The teaching kit covering a broad range of healthy eating concepts was designed exclusively for students so as to promote healthy lifestyle. Coming in the form of everyday scenarios, the kit provides activities and suggestions on promoting healthy eating for teaching purpose. The activities feature flexibility and promote experiential learning in design, and could be easily fitted into teaching modules or be used for extra-curricular health promoting activities.





Dietetics Consultation

The project dietitians and nutritionists provided constant professional supports and advices to the project schools, including review on schools' healthy eating guidelines and policies; to advise on schools' eating environments such as tuck shop management and school lunch services; to advise and feedback on schools' nutrition education and promotion initiatives; and to write articles for school magazines or monthly correspondence to parents so as to convey healthy eating messages.

Exchange Tour to California

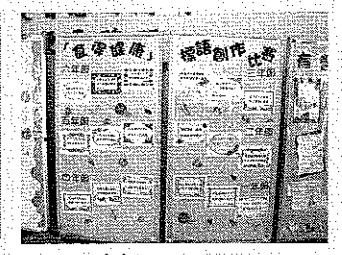
As invited by the US Agriculture Trade Office, a Hong Kong Delegation School Lunch Programme Tour was organized in September of 2005. The members of the delegation included director of CHEP, project dietitians, principals and teachers of the project schools, representatives from Department of Health, representatives from Parents-Teachers Associations and school lunch caterers. During the 5-day tour, the delegates visited the California Department of Education, Department of Food and Agriculture, University of California, Berkeley and California School Nutrition Association for sharing experiences on nutrition education and exchanging ideas on fruits and vegetables promotion initiatives. Delegates also visited the Central Kitchens and a number of primary and secondary schools in California and brought home with invaluable inspiration of promoting healthy eating in the school setting.

School-based Activities

Schools were guided and encouraged to utilize the support and teaching resources provided by the project to organize various interactive school-based nutrition education and promotional activities to enhance students' awareness, to stimulate the sense of learning and to reinforce their health skills. Schools have organized various activities including school radio/TV broadcasting of healthy eating messages, healthy sandwich demonstration, healthy snack sampling, healthy snack promotion campaign, healthy eating award scheme, fruits subscription scheme, recipe design competition, cook book publication, organic farm visits, supermarket tours, exhibitions, informative posters display, etc. Many of the initiatives invited the participation of family members, tuck shop and meal service providers.

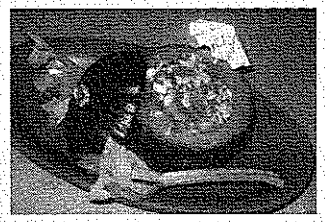
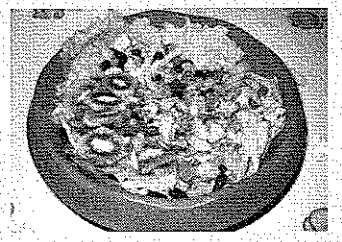

Healthy snack sampling

Fruits subscription scheme

Slogan design competition

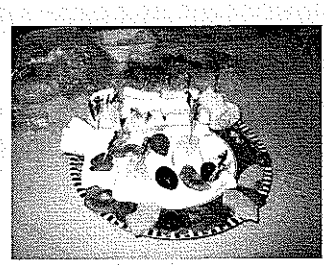
Supermarket tour

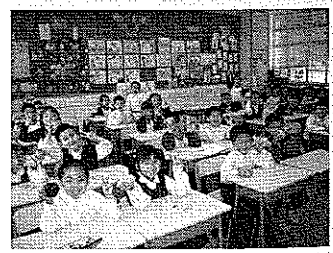
Recipe design competition

Organic farm visit

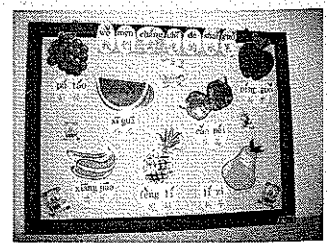




Healthy sandwich preparation and demonstration



Fruity Day



Exhibitions

Evaluation Plan

A combination of qualitative and quantitative methods was adopted to assess the effectiveness of the Project in terms of the policy and environmental changes of the participating schools as well as the knowledge, attitude and behavioral changes of students and parents. Analysis was conducted to identify factors affecting students' consumption of fruits and vegetables and factors affecting the project effectiveness. The methods of evaluation included survey questionnaires for students, survey questionnaires for parents, review of school lunch menu, observation and weighed lunch consumption, and schools' feedback survey. Except for the schools' feedback survey, all evaluations were conducted twice during the pre-assessment period (June – July 2005) and the post-assessment phase (September – November 2006) for comparing the outcomes.

Methodology and findings of the evaluations were reported in Chapter 2, 3 and Charter 4.

Chapter 2 Students and Parents Questionnaire Survey

2.1 Methodology

Data Collection

Two separate sets of questionnaires for students and parents were designed to investigate and evaluate the knowledge, attitude and practice on diet among the participating students and parents. It also served to identify factors influencing students' knowledge and actual consumption of fruits and vegetables. Pilot tests were carried out and the questionnaires were refined prior to the actual study. The survey invited 2 grades of students (primary 4 & 5 in the pre-assessment; primary 4 & 6 in the post-assessment) and their parents from the 10 project schools to participate. The pre-assessment questionnaires were conducted from June to July 2005, which aimed to collect and describe baseline data regarding nutrition knowledge, eating habits and attitudes of participating students and parents, as well as the inter-relationships between them. The post-assessment questionnaires were done from September to November 2006 served to assess any changes in the above parameters and thus the effectiveness of the current project.

Students' questionnaires were administered by trained staff during a classroom session with prior written consents sought from parents. All questions were read out by the trained staff and some difficult concepts, such as portion size were explained with photos and food models to increase the accuracy of the investigation. While parents questionnaires were self-administered at home and returned to school by their children. All questionnaires were anonymous and serial numbers were assigned to students and their parents for matching purpose. The finished students' and parents' questionnaires were then matched for statistical analysis.

Data processing and analysis

All data were tabulated and analysed by the SPSS package. Tests for association between knowledge, attitude and fruits and vegetable consumption were conducted by using Chi-square Test with the level of significance reported at $p<0.05$. The Chi-square Test was also used to test for association between parents' attitude and fruits and vegetables consumption habit; perceived peers' attitude towards fruits and vegetables and students' consumption. Test for Linear Trend was used to test for relationship between parents' and student's knowledge on fruits and vegetables. In addition, stepwise multiple logistic regression was conducted to identify the major factors and respective relationships with students' fruits and vegetables consumption. Longitudinal comparisons were conducted to determine the impacts of the project by comparing the P.4 students and their parents in 2004-2005 (P.4 (04/05)) with the P.6 students and their parents in 2006-2007 (P.6 (06/07)). Cross-sectional comparisons were also performed to compare the P.4 students and their parents in both study periods (P.4 (04/05) vs P.4 (06/07)).

Data processing and analysis

The survey adopted a Knowledge Score (KS) for students and parents respectively to represent their knowledge about fruits and vegetables. A total of 7 items were included in the student and parent questionnaires respectively to assess the participants' knowledge on fruits and vegetables. Each corrected answer scored 1 mark. KS for both groups was computed as the sum of correct answers for those questions. The range of KS was from 0 to 7 for both students and parents. Table 1 and 2 listed out the items included in the calculation of scores of KS.

Table 1. Students Knowledge Score

Items included in the calculation of students' knowledge score
1. Knowledge about the recommended daily vegetable intake for children
2. Knowledge about the recommended daily fruit intake for children
3. Knowledge about the nutrients available in fruits and vegetables
4. Knowledge about the basic function of fruits and vegetables towards health
5. Knowledge about the healthy eating is important for physical health
6. Knowledge about not consuming fruits and vegetables would affect health status
7. Knowledge about food groups in the Healthy Eating Pyramid

Table 2. Parents' Knowledge Score

Items included in the calculation of students' knowledge score
1. Knowledge about the recommended daily vegetable intake for children
2. Knowledge about the recommended daily vegetable intake for adult
3. Knowledge about the recommended daily fruit intake for children
4. Knowledge about the recommended daily fruit intake for adult
5. Knowledge about the nutrients available in fruits and vegetables
6. Knowledge about the basic function of fruits and vegetables towards health
7. Knowledge about food groups in the Healthy Eating Pyramid

The data collected underwent range checking and logical checking. Unclear and illogical answers would be recoded as invalid. If more than half of the questions were found unanswered or illogical, that questionnaire would be regarded as invalid and would be neglected.

The students and parents questionnaires were matched according to the assigned serial number. Only the matched questionnaires were used for analysis of the associations between students and parents.

2.2 Results

(I) Demographic

Demographics of Students

A total of 3313 and 3016 completed student questionnaires were collected at pre-assessment and post-assessment respectively. After quality checking procedures, 325 (9.8%) and 245 (8.1%) questionnaires were regarded as invalid at the pre-assessment and post-assessment respectively. And therefore, a total of 2,988 primary 4 & 5 students participated in the pre-assessment analysis while 2,771 primary 4 & 6 students participated in the post-assessment survey. The proportions of male and female subjects were almost the same at both pre- and post-assessment. Table 3 summarized the demographics of students participated in the study.

Table 3. Demographics of Students

	Pre- assessment		Post-assessment	
	P.4 (04/05)	P.5 (04/05)	P.4 (06/07)	P.6 (06/07)
Male	760 (50.5%)	738 (49.8%)	656 (49.6%)	722 (49.9%)
Female	746 (49.5%)	744 (50.2%)	667 (50.4%)	726 (50.1%
Total	1,506 (100%)	1,482 (100%)	1,323 (100%)	1,448 (100%)

Demographics of Parents

On the other hand, 2,569 and 2,476 parent questionnaires were used for further analysis in the pre- and post- survey respectively. In both survey, the majority of them are female, accounting for 79.8% in baseline and 79.4% in evaluation survey. Table 4 summarized the demographics of the parents participated in the study.

Table 4. Demographics of parents

	Pre-assessment	Post- assessment
Gender	**(n = 2,569)**	**(n = 2,476)**
Male	20.2%	20.6%
Female	79.8%	79.4%
Educational level	**(n = 2,443)**	**(n = 2,291)**
Primary or below	18.4%	15.5%
Secondary	67.3%	69.9%
Tertiary or above	14.3%	14.6%
Monthly household income	**(n = 2,513)**	**(n = 2,414)**
$10,000 or below	37.4%	35.9%
$10,001 - $20,000	32.0%	32.7%
$20,001 - $30,000	13.2%	14.0%
$30,001 or above	17.4%	17.4%

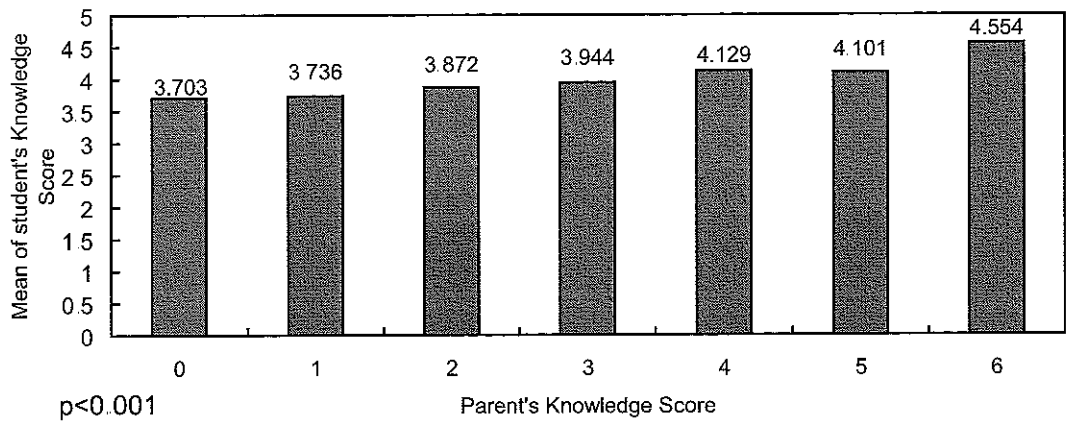
(II) Factors influencing students' knowledge and consumption of fruits and vegetables

The pre-assessment data was used to identify factors influencing students' knowledge and consumption of fruits and vegetables. And the findings were used to guide the project planning and development.

Parents' Knowledge Score

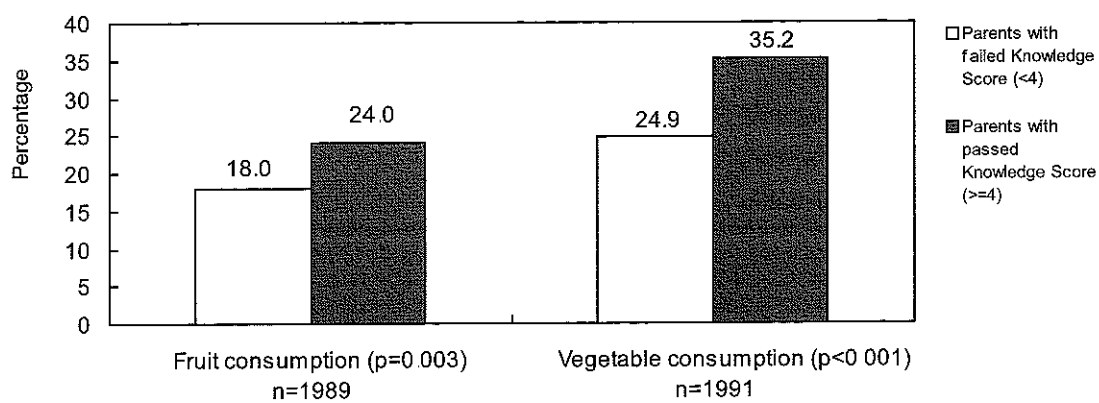
A linear relationship between the Knowledge Score of parents and that of students was found. Those parents had a higher Knowledge Score, the mean knowledge score of their children would also be higher (p<0.001). Chart 1 illustrated the relations of parents' and students' knowledge score.

Chart 1. Relation of parents' and students' Knowledge Score (n= 1892)



A strong association between parent's knowledge on fruits and vegetables and their children's consumption was identified by the Chi-square Test. When the parent participants were catagorised into 2 groups, Pass (those with Knowledge Score >= 4) and Fail (those with Knowledge Score less than 4), a higher proportion of students (24.0% vs 18.0%, p=0.003) who belonged to the Pass parent group consumed sufficient amount of fruits. It indicated that parents with better understanding of fruits and vegetables, their children would have a higher chance of consuming sufficient amount of fruits. Students' vegetable consumption was also associated with parents' knowledge. Higher proportion of students (35.2% vs 24.9%, p<0.001) from the Pass parent group consumed sufficient amount of vegetables.

Chart 2. Percentage of students consumed adequate amount of fruits and vegetables with different knowledge levels of parents

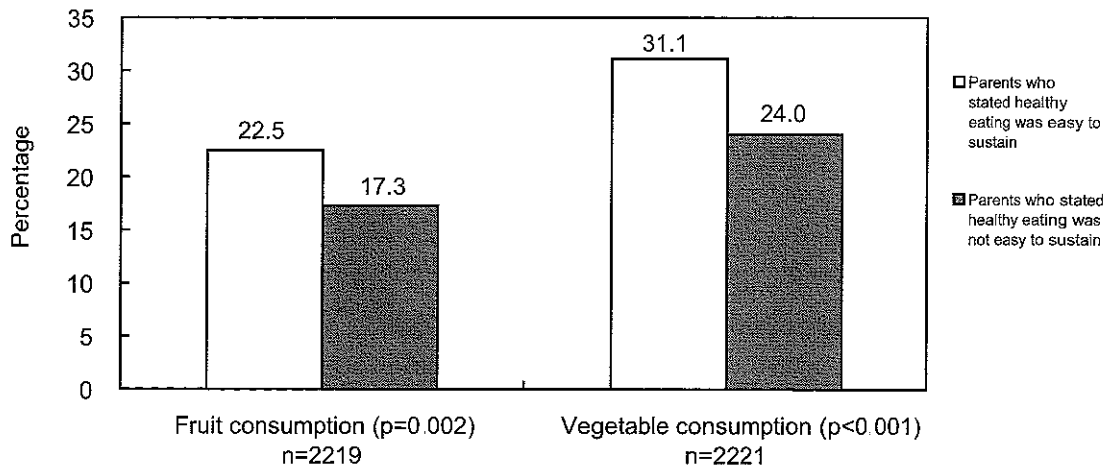


Factors influencing students' knowledge and consumption of fruits and vegetables

Parents' Attitude

Parents' attitude toward easiness of sustaining healthy eating habits was associated well with their childs' consumption of fruits and vegetables. There was a higher proportion of students consuming sufficient fruits (22.5% vs 17.3%, p=0.002) and vegetables (31.1% vs 24.0%, p<0.001) with parents who expressed healthy eating was easy to sustain. Although there may be some indirect factors, the results showed that parents with positive attitude on healthy eating had a higher chance that their children eat healthier.

Chart 3. Percentage of students consumed adequate amount of fruits and vegetables with parents of different attitude toward healthy eating



More than half of the parents (50.3%) stated that it was not easy to sustain healthy eating habit. "Healthy food does not taste good", "healthy food lacks of variety" and "lacks of time to prepare healthy food" were rated by the respondents as the top three commonest reasons for not easy to sustain healthy eating habits.

Table 5. Distribution of reasons for not easy to sustain healthy eating habits (n = 1,236)

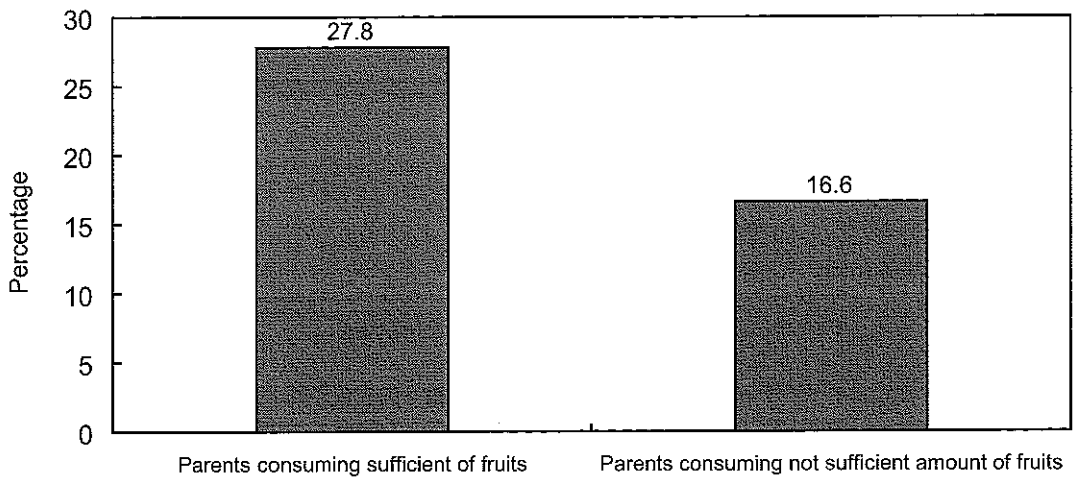
Reasons	Sample percentage (%)
Healthy food does not taste good	44.1
Healthy food lacks variety	36.9
Lacks time to prepare healthy food	32.0
Frequently eat out	24.8
Healthy food is more expensive	18.5
Healthy food is not easy to buy	7.8

Factors influencing students' knowledge and consumption of fruits and vegetables

Parents' Fruits and Vegetables Consumption

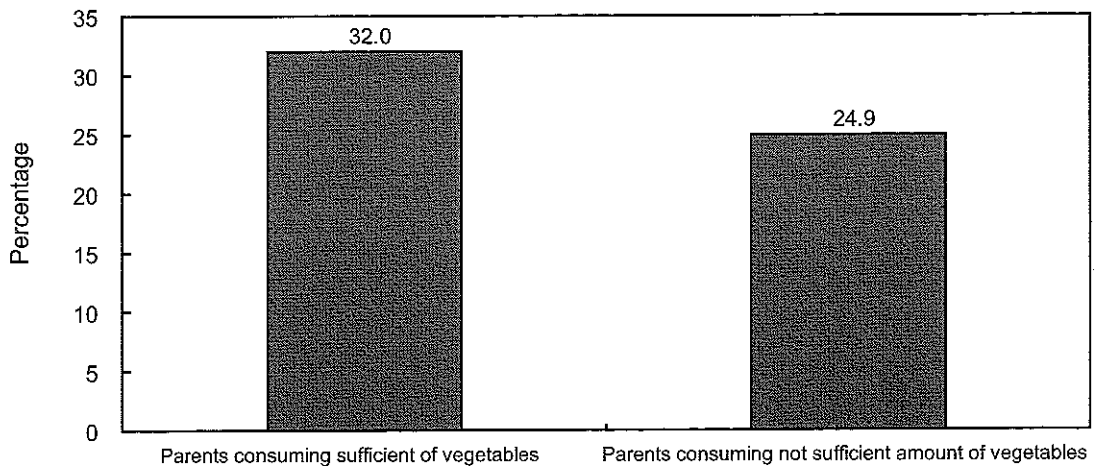
The amount of fruits and vegetables consumed by parents associated well with their child's consumption. The survey results showed that when parents consuming sufficient amount of fruits, their children would have a higher chance (27.8% vs. 16.6%, p<0.001) of having recommended amount of fruits. The same observation applied to vegetables consumption. There was a higher proportion (32.0% vs. 24.9%, p<0.001) of students consuming sufficient amount of vegetables when their parents having adequate vegetables.

Chart 4. Percentage of students consumed adequate amount of fruits in relation to parents' fruit consumption (n = 2228)



p<0.001

Chart 5. Percentage of students consumed adequate amount of vegetables (n = 2259)



p<0.001

Factors influencing students' knowledge and consumption of fruits and vegetables

Frequency of Offering Fruits and Vegetables as Snacks

Table 6. Influence of offering fruits and vegetables as snacks by parents on students' consumption

	Students' fruits consumption (n =1705)		
	Inadequate consumption	Adequate consumption	Statistical significance
Parents offered fruits as snack at least daily	71.6%	28.4%	p<0.001
Parents offered fruits as snack less frequent than daily	83.3%	16.7%	
	Students' vegetables consumption (n = 1744)		
	Inadequate consumption	Adequate consumption	Statistical significance
Parents offered vegetables as snack at least daily	64.5%	35.5%	p<0.001
Parents offered vegetables as snack less frequent than daily	77.6%	22.4%	

A strong association was found between the practice of offering fruits and vegetables as snacks by parents and the actual consumption of students. When parents offered fruits as snacks at least daily, there were higher chances (28.4% vs 16.7%, p<0.001) that their children could consume adequate amount of fruits. Similarly, when parents offered vegetables (e.g. baby tomato or carrot) as snack at least daily, more students (35.5% vs 22.4%, p<0.001) could consume adequate vegetables.

Factors influencing students' knowledge and consumption of fruits and vegetables

Peer's Influences

Table 7. Association of perceived peer's attitude towards fruit and vegetable eating with students' consumption of fruits and vegetables

	Students' fruits consumption (n = 2930)		
	Inadequate consumption	Adequate consumption	Statistical significance
Students who agreed their peers like eating fruits	77.7%	22.3%	p=0.005
Students who disagreed their peers like eating fruits	79.0%	21.0%	
	Students' vegetables consumption (n = 2930)		
	Inadequate consumption	Adequate consumption	Statistical significance
Students who agreed their peer like eating vegetables	70.7%	29.3%	p=0.001
Students who disagreed their peer like eating vegetables	66.3%	33.7%	

Students who agreed their peers (classmates and friends) like eating fruits showed a higher chance (22.3% vs 21.0%, p=0.005) to consume adequate fruits. This revealed that perceived peer's attitude towards fruit eating had a strong association with student's fruits consumption. However, the phenomenon did not apply on vegetables consumption of the participating students.

Factors influencing students' knowledge and consumption of fruits and vegetables

Students' Knowledge Score

Table 8. Association of students' knowledge about fruits and vegetables with students' own consumption

	Students' fruits consumption (n = 2829)		
	Inadequate consumption	Adequate consumption	Statistical significance
Students with Knowledge Score >=4 (Pass)	77.2%	22.8%	p<0.001
Students with Knowledge Score <4 (Fail)	85.3%	14.7%	
	Students vegetables consumption (n = 2838)		
	Inadequate consumption	Adequate consumption	Statistical significance
Students with Knowledge Score >=4 (Pass)	67.7%	32.3%	p<0.001
Students with Knowledge Score <4 (Fail)	80.9%	19.1%	

The results indicated that the actual consumptions of fruits and vegetables were also affected by students' understanding and attitude towards these foods. Students with better knowledge about fruits and vegetables (Knowledge Score>=4 or Pass) have a higher proportion consumed adequate amount of fruits (32.3% vs 19.1%, p<0.001) and vegetables (22.8% vs 14.7%, p<0.001).

Factors influencing students' knowledge and consumption of fruits and vegetables

Students' Attitude

Table 9. Association of attitudes toward fruits and vegetables with students' consumption

	Students' fruits consumption		
	Inadequate consumption	Adequate consumption	Statistical significance
Students reported they liked eating fruits	79.4%	20.6%	n=2838
Students reported they disliked eating fruits	93.2%	6.8%	p<0.001
	Students' vegetables consumption		
	Inadequate consumption	Adequate consumption	Statistical significance
Students reported they liked eating vegetables	69.2%	30.8%	n=2952
Students reported they disliked eating vegetables	88.3%	11.7%	p<0.001
Students reported they agreed vegetables were unpalatable	87.8%	12.2%	n=2956
Students reported they disagreed vegetables were unpalatable	70.4%	29.6%	p<0.001
Students reported they agreed vegetables were tasteless	81.9%	18.1%	n=2957
Students reported they disagreed vegetables were tasteless	71.1%	28.9%	p<0.001
Students reported they agreed vegetables were hard in texture	81.9%	18.1%	n=2955
Students reported they disagreed vegetables were hard in texture	71.7%	28.3%	p<0.001

The results showed a strong association between students' attitudes toward fruits and vegetables, and their actual consumption. Students with positive attitude towards fruits and vegetables were more likely to consume adequate amount of these foods. It implied that changing students' diet attitude should be regarded as a priority for promotion of fruits and vegetables consumption.

Questions were include in the survey to ask students to rank the factors that they would consider when choosing fruits and vegetables. Taste of the food was reported to be the top consideration for students in choosing fruits and vegetables, followed by the nutritional value and whether their mother frequently prepare the foods.

Factors Affecting Students' Fruits and Vegetables Consumption

Results of Stepwise Multiple Logistic Regression

Table 10. The results of stepwise multiple logistic regression identified that the following factors as the predominant factors affecting whether students consumed adequate amount of vegetables

Factor		Odds ratio	95.0% C.I. for Odds ratio	
1 more correct answer of students in knowledge questions		1.231	1.104	1.373
Gender	Male	0.811	0.636	1.033
	Female	1.000		
Students' attitude towards eating vegetable	Like	3.038	2.025	4.559
	Dislike	1.000		
Parent's vegetable consumption	Adequate	1.315	1.021	1.694
	Inadequate	1.000		
Parent's fruit consumption	Adequate	1.572	1.203	2.054
	Inadequate	1.000		
Parents regards their children's eating habit	Healthy	1.844	1.243	2.734
	Unhealthy	1.000		
Students' consumption on Chips	>3/4 times per week	0.529	0.365	0.767
	<3 times per week	1.000		
Students' consumption on Fresh fruit juice	>3/4 times per week	1.690	1.320	2.164
	<3 times per week	1.000		
Family income	$10,000 or below	1.000		
	$10,001 - $20,000	1.403	1.040	1.892
	Above $20,000	1.794	1.331	2.416

Factors Affecting Students' Fruits and Vegetable Consumption

Results of Stepwise Multiple Logistic Regression

Table 11. The results of stepwise multiple logistic regression identified that the following factors as the predominant factors affecting whether students consumed adequate amount of fruits

Factors		Odds ratio	95.0% C.I. for Odds ratio	
1 more correct answer of students in knowledge questions		1.258	1.114	1.420
Gender	Male	0.692	0.526	0.910
	Female	1.000		
Students' attitude towards eating fruits	Like	3.778	1.154	12.362
	Dislike	1.000		
Students' consumption of Fresh fruit juice	>3/4 times per week	2.356	1.799	3.086
	<3 times per week	1.000		
Students' classmates/friends also like eating fruits	Agree	1.000		
	Disagree	0.836	0.506	1.382
	Don't know	0.633	0.477	0.841
Parent's fruit consumption	Adequate	1.939	1.461	2.573
	Inadequate	1.000		
Parents regards their children's eating habit	Healthy	1.457	1.056	2.011
	Unhealthy	1.000		
Parents education level	Primary	0.610	0.387	0.962
	Secondary	0.621	0.438	0.881
	Tertiary or above	1.000		

To sum up, the findings from stepwise multiple logistic regression indicated that girls were more likely to consume adequate amount of both fruits and vegetables than boys. Students' knowledge and attitude towards fruits and vegetables, students' consumption of fresh fruit juice, parents' consumption and parents' perception about their children's diet were found to be positively associated with students' fruits and vegetables consumption. Students' consumption on chips was negatively associated with students' vegetable consumption. Perceived peers' attitude towards fruit consumption was positively correlated with students' fruit consumption, but not for the vegetable consumption.

Regarding the family background, monthly family income was found to be positively associated with students' vegetable consumption, while parents' education level was positively associated with fruits consumption. Parents' fruit consumption contributed positively to both fruits and vegetables consumption of their children.

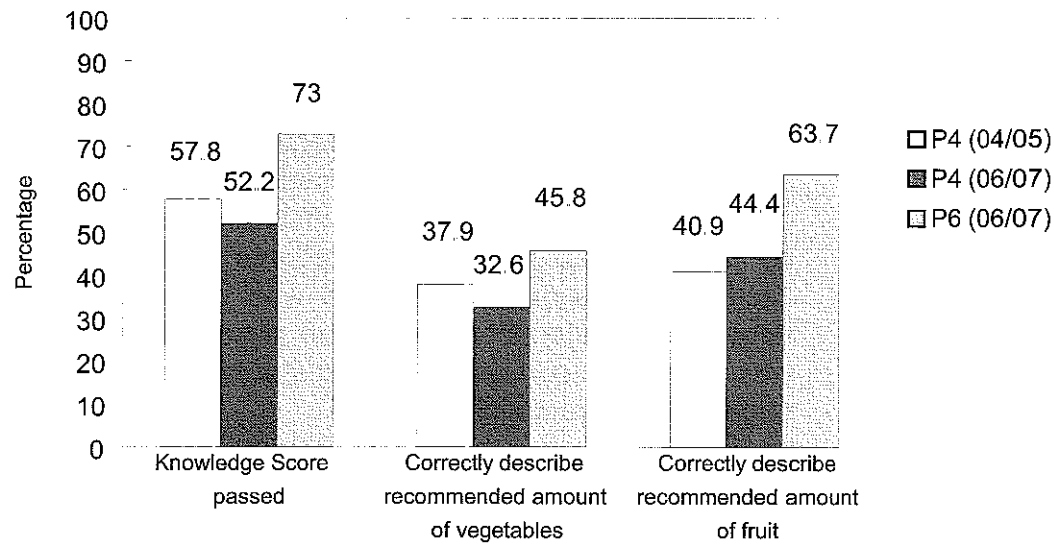
(III) Impacts of the Project on Students' and Parents' Knowledge, Attitude and Fruits and Vegetables Consumptions

The findings reported in this part highlighted the major countable changes on various aspects regarding the knowledge, eating habits and attitudes of participating students and parents. Longitudinal comparison was carried out by comparing the P.4 students in the pre-assessment (P.4 (04/05)) and the P.6 students in the post-assessment (P.6 (06/07)). Cross-sectional comparison of P.4 students at both phases were also included.

Students' knowledge about fruits and vegetables

Longitudinal comparison revealed that the proportion of students who got a pass (4 marks or above) in Knowledge Score increased significantly from 57.8 % in the pre-assessment to 73.0 % in the post-assessment ($p<0.001$). Whereas the cross-sectional comparison of P.4 students showed a decrease of 5.6% of students ($p=0.003$) getting a pass in Knowledge Score. Majority of students (more than 86%) at both phases could correctly label all food groups in the Healthy Eating Guide. Most students knew that fruits and vegetables are rich in vitamins and dietary fibers, but a significantly less student could correctly identify that fruits and vegetables contain minerals. The longitudinal comparison showed a significantly more students could correctly describe the recommended amounts of fruits and vegetables ($p<0.001$). However, there were still considerable proportion of students failed to describe the correct recommended amount of fruits (55.6% of P.4 students and 36.3% of P.6 students) and vegetables (67.3% P.4 students and 54.2% of P.6 students) in the post-assessment survey.

Chart 6. Students' Knowledge about Fruits and Vegetables

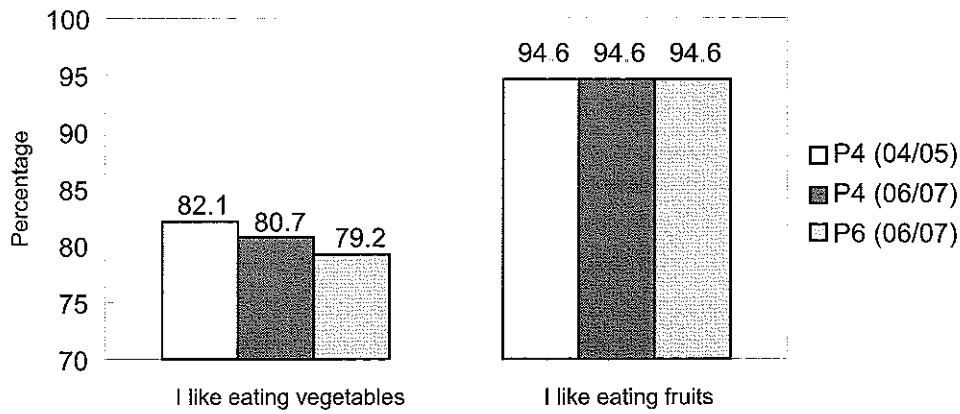


Impacts of the Project on Students' and Parents' Knowledge, Attitude and Fruits and Vegetables Consumptions

Students' attitude towards fruits and vegetables

Majorities of students (94.6%) stated that they liked eating fruits and the figures remained the same in the evaluation. On the other hand, there were 82.1% of students reported they liked eating vegetables at the pre-assessment survey. The proportion decreased slightly to 79.2% at the post-assessment survey.

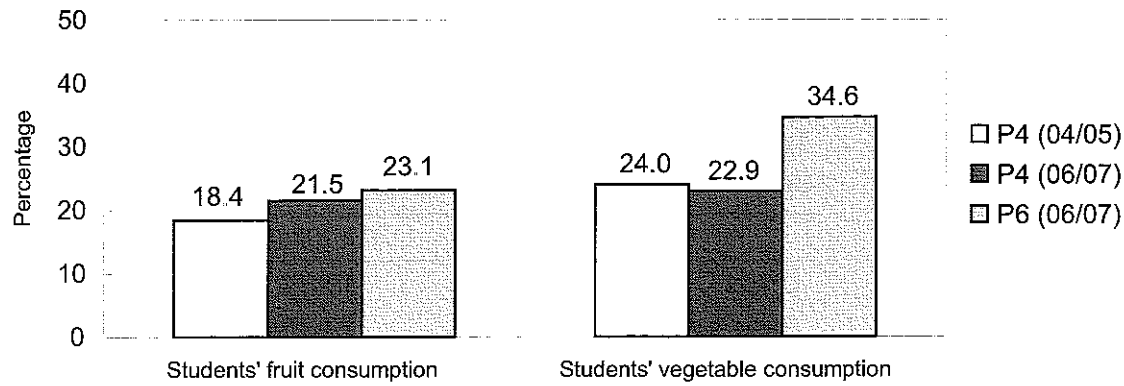
Chart 7. Students' Attitude Towards Fruits and Vegetables



Students' consumption of fruits and vegetables

Longitudinal comparison showed that a significantly higher proportion of students were consuming adequate amount of fruits (18.4% vs 23.1%, p = 0.002) and vegetables (24.0% vs 34.6%, p < 0.001). Cross-sectional comparison indicated that a significantly higher proportion of students consumed adequate amount of fruits (18.4% vs 21.5%, p=0.04) and the percentage of students who consumed adequate vegetable remained nearly the same at both phases (24.0% vs 22.9%, p=0.49)

Chart 8. Percentage of student consumed adequate amount of fruits and vegetables



Impacts of the Project on Students' and Parents' Knowledge, Attitude and Fruits and Vegetables Consumptions

Student's consumption of high sugar and high fat snacks

Chart 9, Chart 10 and Table 12 showed the consumption of high sugar and high fat snacks among the students under the study. Longitudinal comparison revealed that the consumption of certain high fat and high sugar snacks by students was reduced in the post-assessment survey. Soft-drinks and sugary drinks (-8.2%, p<0.001), ice-cream and desserts showed the most significant reduction (-4.6%, p=0.005), followed by instant noodles (-3.7%, p=0.017), confectionaries (-3.5%, p=0.036) and chips (-2.9%, p=0.042). A slight decrease in the consumption of deep fried foods was reported, but it was not statistically significant (-0.9%, p=0.551). The same trend was shown in the cross-sectional comparison, except that for chips, a slight increase in consumption was reports (0.8%, p=0.603)

Chart 9. Percentage of Students Consumed High Fat Snacks more than 3 times per week

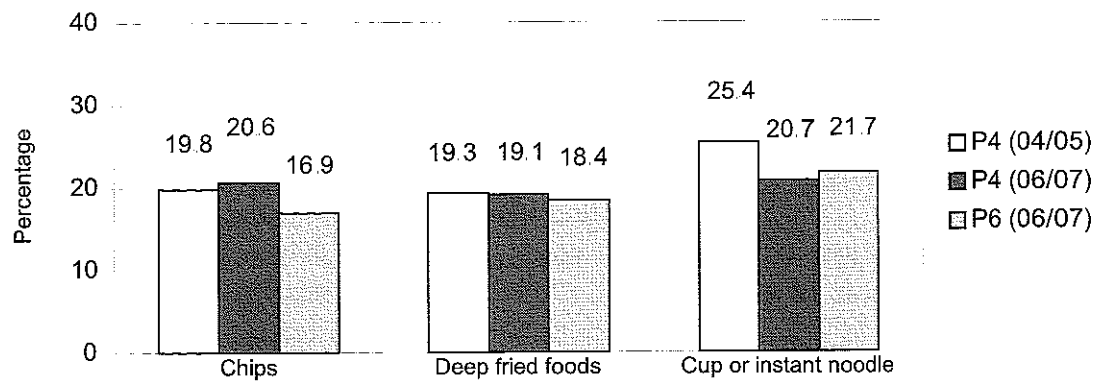


Chart 10. Percentage of Students Consumed High Sugar Snacks more than 3 times per week

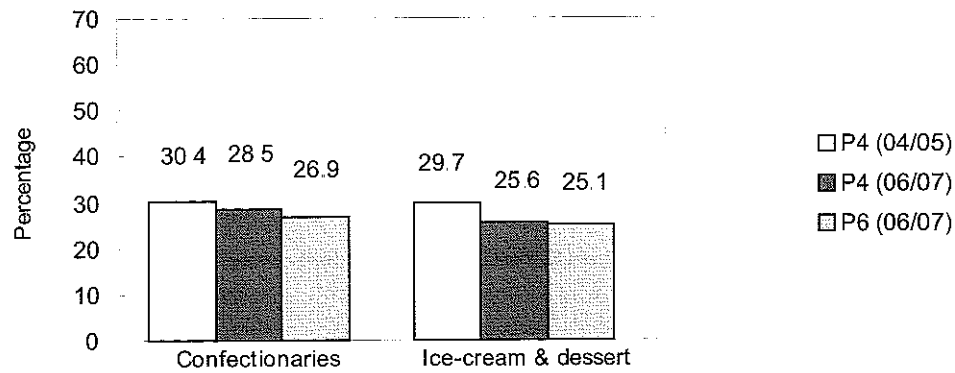


Table 12. Longitudinal comparison of percentages of students consumed high fat and high sugar more than 3 times per week

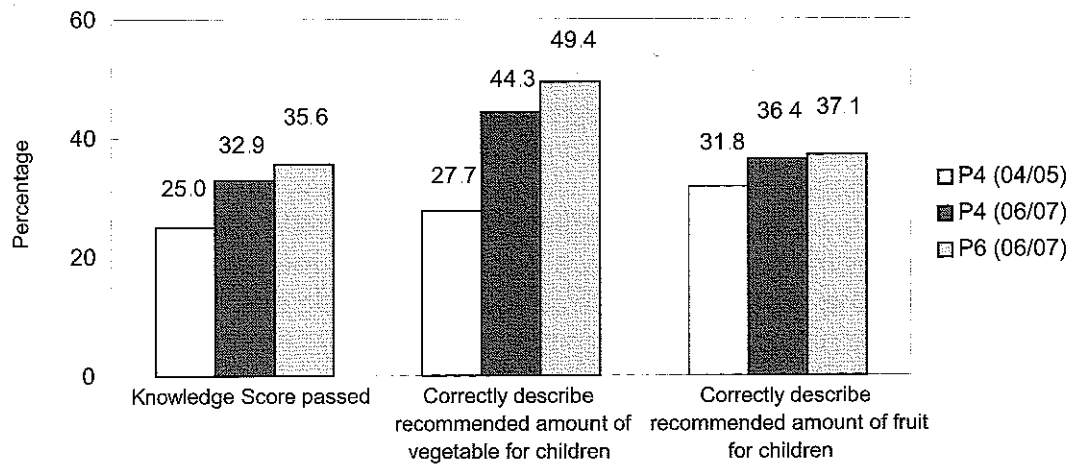
	P.4 (04/05)	P.6 (06/07)	Difference [1]	P-value
Chips	19.8%	16.9%	-2.9%*	0.042
Deep fried foods	19.3%	18.4%	-0.9%	0.551
Cup or instant noodles	25.4%	21.7%	-3.7%*	0.017
Confectionaries	30.4%	26.9%	-3.5%*	0.036
Ice-cream & desserts	29.7%	25.1%	-4.6%**	0.005

[1] Chi-square test used *** P-value < 0 001 ** P-value < 0 01 * P-value < 0 05

Impacts of the Project on Students' and Parents' Knowledge, Attitude and Fruits and Vegetables Consumptions

Parent' knowledge about fruits and vegetables

Chart 11. Parents' Knowledge about Fruits and Vegetables



As mentioned in previous section, parents' knowledge about fruits and vegetables was found to be a strong factor influencing their children's fruits and vegetables consumption. The proportion of parents who got a pass mark (4 marks or above) increased from 25.0% in the pre-assessment to 35.6% longitudinally ($p<0.001$) and 32.9% cross-sectionally ($p<0.001$) in the post-evaluation. This indicated that there was a significant increase of the overall understanding of fruits and vegetables of the parents in the project schools.

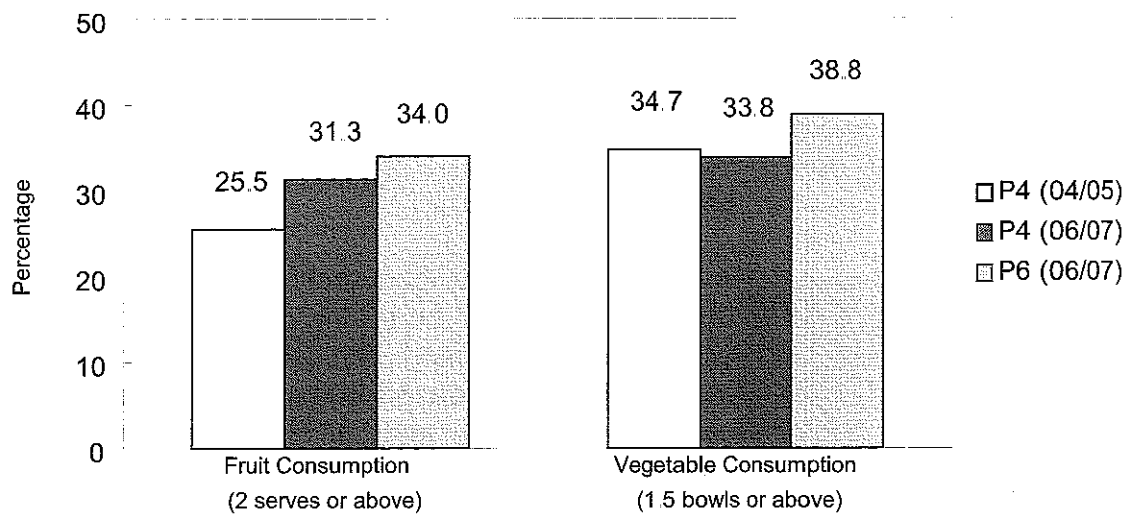
The most obvious improvement was found in the recognition of correct recommended amount of fruits and vegetables for their children. In pre-assessment survey, only 27.7% and 31.8% of the parents respectively could correctly describe the recommended amount of fruits and vegetables for children. These figures significantly increased to 49.4% ($p<0.001$) and 37.1% ($p=0.080$) respectively for the longitudinal comparison at the post-assessment survey.

Impacts of the Project on Students' and Parents' Knowledge, Attitude and Fruits and Vegetables Consumptions

Parents' consumption of fruits and vegetables

The results indicated that a significant increase of fruits and vegetables consumption was found in parent participants. Longitudinal comparison showed that an increase of 8.5% ($p<0.001$) of parents consumed sufficient amount (2 serves) of fruits in the evaluation survey and an increase of 4.1% ($p=0.041$) for vegetable consumption.

Chart 12. Percentage of Parents Consumed Adequate Amount of Fruits and Vegetables



Parents' attitude towards easiness of sustaining healthy eating habits

When asking the parents if it was easy to sustain healthy eating, a slight increase in the proportion of parents gave positive answers, 50.4% in the post-assessment and 49.7% in the baseline survey.

Chapter 3 Evaluation of school lunches and students' consumption

3.1 Rationale

With the gradual implementation of whole-day schooling in Primary School, school lunch plays an important role in improving the health and education outcomes of children. A nutritionally balanced lunch provides one-third of the energy and nutrients that a child requires for normal growth and development. School lunch supply is an indicator of the eating environment in schools and the students' consumption provides an insight on the students' actual eating habits. This project evaluated the factors influencing students' vegetable consumption at school lunch so as to provide information for strategic development of effective nutrition intervention programmes and environmental intervention strategies. In addition, weighed school lunch survey and 5-day lunch menu review were conducted during June-July 2005 and September-November 2006 as the pre-assessment and post-assessment respectively in all the ten participating schools to provide quantitative and qualitative information correspondingly.

3.2 Methodology

Weighed School Lunch Survey

The weighed school lunch survey aimed to determine school lunch food supply and the actual food consumptions of students in the participating schools, and to identify the relationship between school lunch food supply and students' vegetable consumption at school lunch. The data collected from the survey was analyzed by the statistical software, SPSS and T-tests were used to assess the changes in food supply and the change of food consumption for the pre and post assessment. The results of the survey were expressed as means ± standard deviation (SD), with the level of significance reported at $p<0.05$. The relationship between the quantity of foods supplied and students' consumption was analyzed by Pearson Correlation using the data of 2006 weighed school lunch survey.

School Lunch Food Supply

To assess the school lunch food supply, three samples of each menu from all participating schools were collected on the day of evaluation. Each sample was carefully divided into three food groups, including cereals, vegetables, protein (including meat, poultry, fish, egg and bean) foods, and sauce so as to estimate the weight of each food group by using an electronic scale which had been corrected to 1.0 gram. Collected data of each menu was then averaged from the three samples for further analysis.

Students' Consumption

Students' actual food consumptions were estimated from measuring the plate waste of individual students. Finished lunch boxes from students who had subscribed to school lunch were collected and the plate wastes were then weighed by using the same mechanism as the sample menus. The amount of different food groups consumed by students was calculated from the difference between the weight of sample lunch boxes and the plate wastes of individual subjects. The data were then grouped according to school for statistical analysis. One class of students was randomly chosen from both primary four students (P.4 (04/05)) and primary five students (P.5 (04/05)) from each participating school for the pre-assessment carried out during June to July 2005. One class of primary four students (P.4 (06/07)) and one class of primary six students (P.6 (06/07)) from each participating school were included for the cross-sectional and longitudinal comparison respectively during September to November 2006. Comparison among P.4 students in the pre- and post-assessment eliminated the confounding effect on consumption due to age difference.

5-day School Lunch Menu Review

A 5-day School Lunch Menu Review was carried out to assess the nutrition quality of school lunch boxes. Lunch menus were collected from the participating schools for a quality review on one-week period (5-schooldays period) in both pre- and post- assessments. The weighed lunch survey and the lunch menu review were conducted in the same week. The assessments were carried out with reference to the eight nutrition recommendations on school lunch quality that focus to control fat (especially saturated fat) and salt contents and promote dietary fiber supply from vegetable and whole grains[9]. Each set of menu choice was reviewed by a nutritionist and it was compared with the set nutrition recommendation. The collected data were then pooled for descriptive analysis. Table 13 listed the quality standards used for the analysis.

Table 13. The quality standards used for the school lunch menu review

Assigned code	Content of nutrition recommendations	Rationale
Standard 1	**Vegetables** are supplied every day	To increase vegetable supply
Standard 2	**Whole grains** are supplied in at least one menu choice on all school days	To promote dietary fiber supply
Standard 3	Reduced fat dairy products or other **calcium-rich food** items are supplied in at least one menu choice on all school days	To help meeting the calcium needs of children
Standard 4	Grains and **cereals** with **added fat or oil** should not be supplied on more than 2 school days	To limit total fat intake
Standard 5	**Fatty cut** of meat and poultry with skin should not be supplied on more than 2 school days	To limit saturated fat intake
Standard 6	**Processed and preserved** meat and egg products should not be supplied on more than 2 school days	To limit fat and salt intake
Standard 7	**Preserved vegetables** should not be supplied on more than 2 school days	To limit salt intake
Standard 8	No **deep-fried food** items should be supplied on any school days	To limit total fat intake

3.3 Results

(I) Number of School Lunch Menu Choice Provided by Schools

All participating schools provided 3 or 4 school lunch menu options for their students at the pre-assessment period in 2005. During the post-assessment period, 2 of the participating schools adopted a canteen approach for school lunch and a standard menu was provided each day, and the rest of them were offering 3 or 4 menu options for their students to choose from.

Table 14. The number of school lunch menu choices provided by schools.

No. of menu choices	1	2	3	4
Pre-assessment	0 (0%)	0 (0%)	6 (60%)	4 (40%)
Post-assessment	2 (20%)	0 (0%)	3 (30%)	5 (50%)

Remark: Numerals outside brackets=number of schools in the category; numerals inside brackets= percentage schools in the category

(II) School Lunch Supply – Results of Weighed School Lunch Survey

Quantity of Different Foods Supplied

37 and 30 menus were collected respectively in the pre- and post-assessment. Data of each menu was based on a sample of 3. Table 15 summarized the measured weight of different food supplied at school lunch in the pre- and post-assessment period respectively.

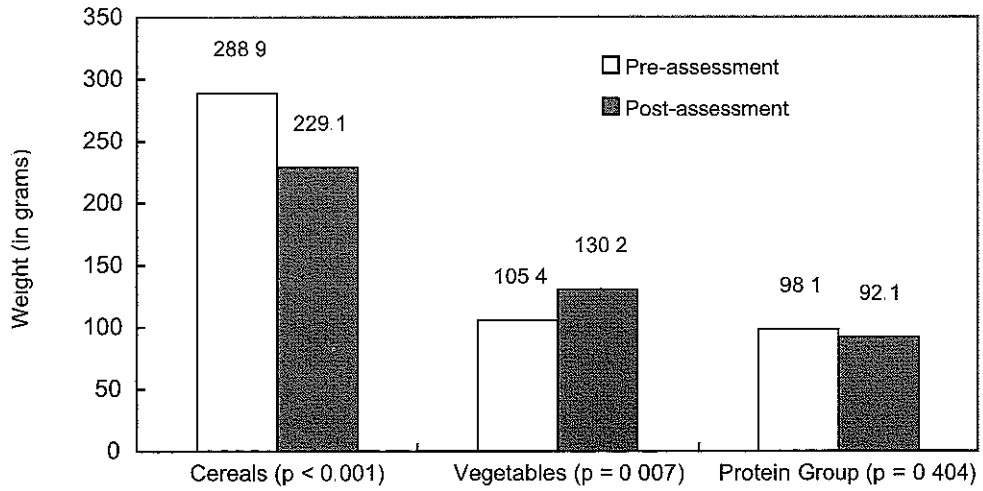
Table 15. Measured weight of different foods supplied at school lunch in grams

	Grains and cereals		Vegetables		Protein Group [1]	
	Pre-assessment (n = 37)	Post-assessment (n = 30)	Pre-assessment (n = 37)	Post-assessment (n = 30)	Pre-assessment (n = 37)	Post-assessment (n = 30)
Mean ± SD (gram)	288 85 ± 94 06	229 06 ± 81 02	105 38 ± 67 27	130.22 ± 55.41	98.12 ± 49.21	92 07 ± 49.59
95% C.I	270.38 307.33	211.69 246 43	92 17 118 60	118.34, 142.10	88.45 107 78	81 44 102 70
Range (gram)	137 - 537	20 - 407	0 - 292	22 – 248	0 - 218	0 - 264
Change [2] (gram)	-59 79*** (p < 0 001)		+24 8** (p = 0.007)		-6 05 (p = 0 404)	
95% C.I. of difference	34.28, 85.31		-42.78, -6.89		-8.21, 20.31	
Recommended quantity [3] (gram)	≥ 200		≥ 90		60 – 100	

[1] Including meat, poultry fish, egg and beans.
[2] T-tests used *** P-value < 0.001 ** P-value < 0.01
[3] With reference to the Nutritional Guidelines on School Lunch for Primary School Students published by the Department of Health The Government of HKSAR[9]

The result indicated that there was a significant increase of 24.8g (23.6%) in the mean weight of vegetables supplied (p = 0.007). The mean cereal weight was 288.9g at baseline, and significantly decreased to 229.1g in the evaluation (-20.7%, p<0.001). No significant change in the mean weight of protein group food supplied at school lunch was observed. Chart 13 demonstrated the change in different food supplied at school lunch during pre- and post-assessment.

Chart 13. Weight of foods supplied in school lunch in pre- and post- assessment

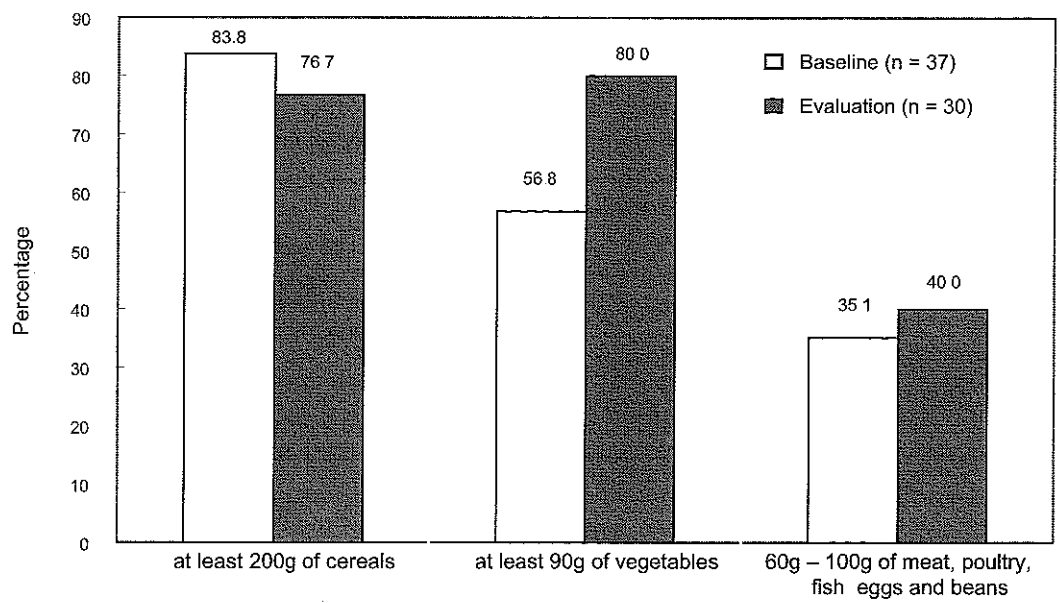


School Lunch Supply – Results of Weighed School Lunch Survey

Meeting the Recommended Quantity of Different Food Groups

With reference to the Nutritional Guidelines on School Lunch for Primary School Students published by the Department of Health, Hong Kong Special Administrative Region, at least 5 servings of grains and cereals (equivalent to around 200g rice or noodles, or 250g spaghetti or macaroni), 1 serving of vegetables (equivalent to 85g of cooked leafy vegetables or 90g of gourds), and 1.5-2.5 servings of meat, poultry, fish, eggs and beans (equivalent to 60-100g foods of such kind) should be provided for P.4 to P.6 students at school lunch. Chart 14 illustrated the percentage of school lunch menus meeting the various food groups' recommendation quantitatively.

Chart 14. Percentage of School lunch menus meeting various recommendations (quantitatively)



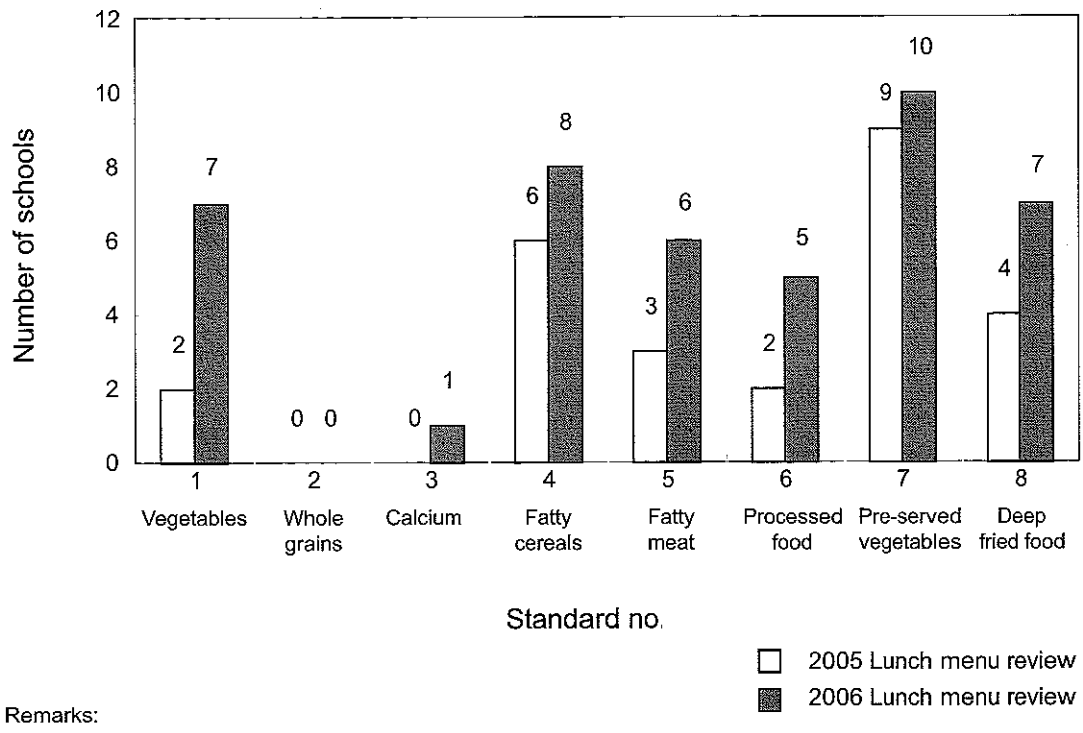
The proportion of school lunch providing at least one serving of vegetables increased from 56.8% to 80.0%. 8.1% of the school lunch provided no vegetables at all at baseline, while all school lunch provided some vegetables in the evaluation, with a minimum of 22g. A higher percentage of school lunch provided 60 – 100g of meat, poultry, fish, eggs and beans in 2006. The proportion of lunch menus supplying 1.5 times of meat, poultry, fish, eggs and beans as recommended (ie 140g or above) was 18.9% at baseline, and it decreased to 10.0% in the evaluation.

(III) School Lunch Supply –Results of 5-day School Lunch Menu Review

Results of 5-day School Lunch Menu Review

Improvement in the quality of school lunch supply in terms of increasing the supply of vegetables and limiting the fat (especially saturated fat) and salt contents was observed. Amongst the 8 selected nutritional standards, an increase in number of schools meeting the standards was observed in 7 standards. During the pre-assessment period, only 2 participating schools could achieve the recommendation of supplying some vegetables in all menus everyday (Standard 1). The figures increased to 7 schools in the post-assessment. 7 schools supplied fatty cut of meat and poultry of skin (Standard 5) on more than 2 school days during the pre-assessment and the number of schools decreased to 4 at post-assessment. 8 schools supplied processed meat (Standard 6) on more than 2 school days during pre-assessment and the number of schools decreased to 5 in the post-assessment. 1 school supplied preserved vegetables in 3 school menu during the pre-assessment period and none of the participating schools provided any preserved vegetable during the post-assessment period. Only 4 schools did not provide any deep-fried food items (Standard 8) during the pre-assessment period and the school numbers increased to 7 during the post-assessment period. No school could meet all the standards no. 4 to 7 during the pre-assessment period, while 4 schools could achieve that in the post-assessment. Chart 15 illustrated the number of schools meeting the set nutrition recommendations.

Chart 15. No. of schools meeting the nutritional recommendations



Remarks:

Standard 1 = Vegetables are supplied every day
Standard 2 = Whole grains are supplied in > 1 menu choice on all school days
Standard 3 = Reduced fat dairy products or other calcium-rich food items are supplied in > 1 menu choice on all school days
Standard 4 = Grains and cereals with added fat or oil should not be supplied on > 2 school days
Standard 5 = Fatty cut of meat and poultry with skin should not be supplied on > 2 school days
Standard 6 = Processed and preserved meat and egg products should not be supplied on > 2 school days
Standard 7 = Preserved vegetables should not be supplied on > 2 school days
Standard 8 = No deep-fried food items should be supplied on any school days

School Lunch Supply –Results of 5-day School Lunch Menu Review

Supply of Whole Grains or Calcium Rich Food at school Lunch

The results indicated that Standard 2 and Standard 3 were the weakest part for the schools. Standard 3 aims at promoting calcium content in school lunch; however, no school could achieve that in pre-assessment, while 1 school met the standard in post-assessment. No school lunch could achieve standard 2, which is to increase dietary fibre from whole grains for students, during both review periods.

Further analysis of the number of school days supplying whole grains or calcium-rich foods was conducted by pooling data of all the 10 participating schools together to make up a total of 50-day menu reviews. The results of the analysis showed that there was an increase in the number of school days that whole grains and calcium-rich foods were supplied in at least one menu choice. Table 16 illustrated the total number of days supplying whole grains or calcium-rich foods in the 50-day menu reviews.

Table 16. Total number of days supplying whole grains or calcium-rich foods in the menu review for the 10 project schools at pre- and post assessment (Total 50 School days in each review)

	Pre-assessment (n = 50)	Post-assessment (n = 50)
No. of school days that whole grains were supplied in at least one menu choice	3	6
No. of school days that calcium-rich foods were supplied in at least one menu choice	37	46

(IV) Students' Food Consumption during School Lunch – Results of Weighed School Lunch Survey

Study Sample

Table 17. Proportion of students subscribed for school lunch and the number of students participated in the food consumption study

	Pre-assessment		Post-assessment	
	P.4 (04/05)	P.5 (04/05)	P.4 (06/07)	P.6 (06/07)
Total Number of students in the project schools	1,760	1,734	1,572	1,738
Students subscribed for school lunch	1,256 (71.4%)	1,335 (77%)	1095 (69.7%)	1,339 (77%)
Students participated in the study	267 (15.2%)	273 (15.7%)	233 (14.8%)	279 (16.1%)

Remark: Numerals outside brackets=number of students; numerals inside brackets= percentage of students.

Students' Food Consumption during School Lunch – Results of Weighed School Lunch Survey

Students' Food Consumption

Table 18 showed the results of weighed school lunch consumption of Primary 4 (P.4 (04/05)) and Primary 5 (P.5 f(04/05)) students during the pre-assessment period and that of the Primary 4 (P.4 (06/07)) and Primary 6 (P.6 (06/07)) students during the post-assessment period. Chart 16 illustrated the mean consumption of vegetables of the subjects.

Table 18. Students' food consumption in the two surveys (in grams)

		Grains and cereals	Vegetables	Protein Group [1]
P4(04/05)	Mean ± SD	202.04 ± 120.66	40.69 ± 39.79	67.91 ± 40.63
(n = 267)	95% C. I.	187.50, 216.58	35.89, 45.48	63.01, 72.81
	Range (gram)	0 – 522	0 – 173	0 – 202
P5(04/05)	Mean ± SD	207.01 ± 104.97	46.22 ± 45.05	70.98 ± 44.35
(n = 273)	95% C. I.	194.51, 219.52	40.86, 51.59	65.70, 76.27
	Range (gram)	0 – 537	0 – 283	0 – 213
P4(06/07)	Mean ± SD	144.38 ± 90.90	71.23 ± 55.76	59.11 ± 36.76
(n = 233)	95% C.I.	132.65, 156.11	64.03, 78.43	54.37, 63.86
	Range (gram)	0 – 305	0 – 220	0 – 170
P6(06/07)	Mean ± SD	171.10 ± 94.59	70.54 ± 58.19	67.31 ± 42.08
(n =279)	95% C.I.	159.95, 182.25	63.69, 77.4	62.35, 72.27
	Range (gram)	0 – 468	0 – 246	0 – 171
Recommended quantity [2] (gram)		≥ 200	≥ 90	60 – 100

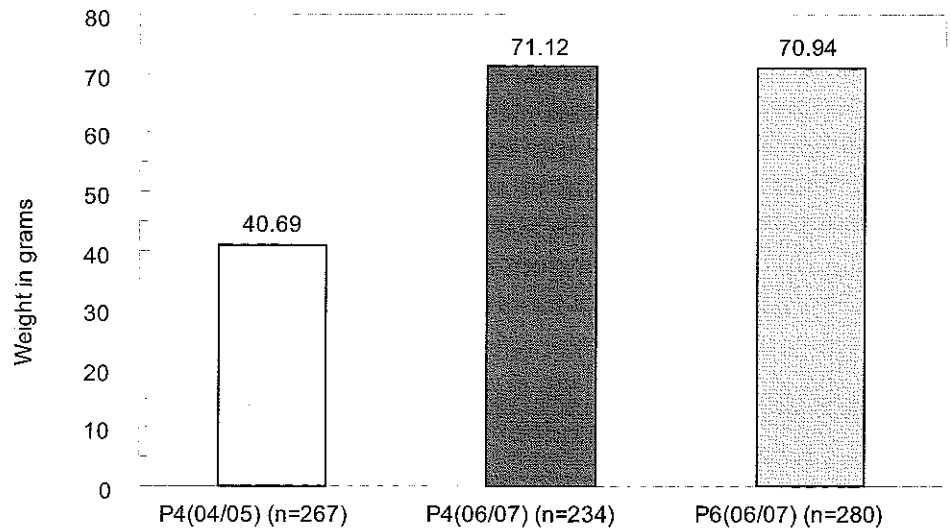
[1] Including meat poultry fish, egg and beans

[2] With reference to the Nutritional Guidelines on School Lunch for Primary School Students published by the Department of Health, The Government of HKSAR[9]

Students' Food Consumption during School Lunch – Results of Weighed School Lunch Survey

Students' Food Consumption

Chart 16. Mean vegetables consumption



To sum up, the weighed school lunch surveys revealed that there wasan overall significant increase of 27.54g (63.3%) in vegetable consumption of the students of the participating schools ($p<0.001$) who participated in the study. The cross-sectional comparison of P.4 students showed that the mean vegetable consumption had a statistically significant increase of 30.43g (74.8%) ($p<0.001$). Meanwhile, the longitudinal comparison among P.4 (04/05) and P.6 students (06/07) showed a statistically significant increase of 30.26g (74.37%) ($p<0.001$).

(V) Relationship between School Lunch Supply and Students' Consumption

Results of Pearson Correlation

The data collected at the 2006 weighed school lunch survey was used to investigate the relationship between the amount of different food groups supplied at school lunch and the amount of different food groups consumed by students. Table 19 demonstrated the results of the analysis. It was observed that the more the supply of a food group, the more the corresponding students' consumption. In other words, the amount of vegetable provided at school lunch was positively correlated with the students' vegetable consumption. The result also showed that the amount of cereal and meat, poultry, fish, eggs and beans provided at school lunch were both negatively correlated to vegetable consumption.

Table 19. Relationship between amount of foods supplied in school lunch and students' food consumption (n = 512)

	Total weight of food supplied	Cereal supplied	Vegetables supplied	Meat, poultry, fish, eggs and beans supplied
Cereal consumption	0.552**	0.629**	0.000	0.021
Vegetable consumption	0.165**	-0.152**	0.594**	-0.115**
Meat, poultry, fish, eggs and beans consumption	0.183**	0.032	-0.207**	0.643**

** Pearson Correlation Coefficients with statistical significance at 0.01level

Chapter 4 Overall Feedback from the Participating Schools

A Schools' Feedback Questionnaire was sent to all participating schools and the project coordinating teachers were invited to complete the questionnaire in November 2006. The questionnaire was designed to collect the overall comments from the participating schools towards various components of the current projects and assess for any countable changes in schools healthy eating environment. Data collected from the questionnaires were quantified and reported.

Results

All participating schools returned their questionnaires and the response rate for schools is 100 %.

(I) Parent and student Fruits and Vegetables Ambassadors

All participating schools reported that they had appointed both parent and student ambassadors to convey healthy message to their peers and to assist teachers in carrying out school-based health promotion activities.

(II) School healthy eating policy and environmental changes

All participating schools reported that they had revised and strengthened the healthy eating guideline, strengthened the monitoring of school lunch services and tuck shops management during the project period.

(III) Nutrition education materials

All participating schools had disseminated the nutrition education tool which was provided by the project (Fruits and Vegetables Serving Wheel) to their students for nutrition education purposes. 8 of them have utilized the project teaching kits in the school curriculum or related teaching activities. Out of a total of 10 scores, the schools rated an average of 8.2 for agreeing that the project had provided sufficient resources for nutrition education. 9 of the participating schools stated that they would continue to use the teaching kits for school-based nutrition education in the future.

(IV) Support for teachers

Out of a total of 10 scores, the schools rated an average of 7.8 for agreeing that sufficient training has been provided for teachers, and 7.7 for the various teachers' training activities or workshops as practical.

(V) Others

Table 20. Overall feedback from participating schools

Focus	Average score rated by 10 schools (scores range from 0 to 10)
Schools acquired sufficient support from the project when they organized school-based healthy eating promotion activities.	7.9
Various research reports presented by the project have demonstrated a comprehensive picture on students' eating behaviours and attitudes to the participating schools.	8.0
The project could improve students' knowledge on healthy eating.	8.3
The project could help schools establish a healthy eating environment.	8.4
The schools are now more skillful in organizing school-based nutrition education and related promotion activities when comparing with the past.	8.6
The project helped students improving their eating habits.	8.2

Chapter 5 Discussion and Conclusion

Discussion

Health Promoting Schools approach as an effective way to promote healths

Chronic diseases are now the major cause of death and disability worldwide and in Hong Kong. The links between dietary habits and health were well established. Diet in childhood is not only an important factor for children's development and learning, it also contributes to their long-term health and well-being. Schools are ideal settings for helping children develop healthy eating habits. The current project is a school healthy eating promotion programme based on the Health Promoting Schools approach to guide the development of a sustainable policy and environmental change at school that promote consumption of fruits and vegetables in students. The concept of Health Promoting Schools was advocated by the World Health Organisation as an effective approach to promote health in schools[11 12]. It is based on a holistic view of health and embodies a coordinated, whole school approach to promote personal and community health in which a broad health education curriculum is supported by the environment and ethos of the school. In Hong Kong, the Centre for Health Education and Health Promotion Of the Chinese University of Hong Kong (CHEP) has pioneered the Health Promoting Schools project, namely the Hong Kong Healthy Schools Award Scheme since 2001. The Scheme is the first territory wide health promoting schools movement that gained recognition from WHO Western Pacific Region for meeting the WHO standard. The Scheme provides a structured framework for the development as well as a system of monitoring progress and recognition of achievement. It aims to promote staff development, parental education, involvement of whole school community, and linkage with different stakeholders so as to improve the health and well-being of the students, parents, staff and the community at large.

The findings from various evaluation methods indicated that the current project was effective in helping school to foster a supportive environment to improve knowledge and support eating behaviour change in school children and also their parents.

Improvement in school eating policy and nutritional quality of school lunch

All schools reported that they have revised and strengthened their policies on healthy eating and more than half of them have strengthened the monitoring measures on school lunch supply and tuck shop management during the Project period. School lunch is an essential element of school' nutrition environment. 5-day school lunch menu review showed an improvement in nutrition quality of school lunch supply in terms of an increase in vegetable supply and limit the fat (especially saturated fat) and salt contents of the lunch boxes. Weighed school lunch survey results indicated that there was a statistically significant increase of 23.6% ($p=0.007$) in the mean weight of vegetable supplied at lunchtime which may be a contributing factor for the significant improvement in students' vegetable consumption. It was observed that efforts have been made by school lunch caterers to increase the supply and also encourage the consumption of vegetables by various methods, such as cutting the vegetables into small pieces and mixed it with the rice.

Changes of students' knowledge, attitude and eating habits

The data analysis of students' questionnaire survey showed a statistically significant improvement in nutrition knowledge (58.7% students got a pass in Knowledge Score at pre assessment vs 73% at the post assessment, p<0.001). Longitudinal comparison showed significantly higher proportions of students reported that they were consuming adequate amount of fruits (18.4% vs 23.1%, P=0.02) and vegetables (24% vs 34.6%, p<0.001). The result was consistent with the findings of weighed lunch survey which showed an overall significant increase of 63.3% (p<0.001) in vegetable consumption at lunchtime. Another benefit of the project on students' eating practice was the consumption of certain high fat and high sugar snacks by students at the longitudinal comparison was reduced. Ice-cream and desserts showed the most significant reduction (-4.6%, p=0.005), followed by instant noodles (-3.7%, p=0.017), confectionaries (-3.5%, p=0.036) and chips (-2.9%, p=0.042). A slight decrease in the consumption of deep fried foods was reported, but it was not statistically significant (-0.9%, p=0.551).

Changes of parents' nutrition knowledge and fruits and vegetables consumption

The data analysis of parents' questionnaire survey showed a statistically significant improvement in parents' nutrition knowledge and their fruits and vegetable consumption. The proportion of parents who got a pass mark for the Knowledge score increased from 25% at the baseline assessment to 35.6% at the post-evaluation (p<0.001). An increase of 8.5% (p<0.0010) of parents consumed sufficient amount of fruits in the evaluation survey and an increase of 4.1% (p=0.041) for vegetable consumption.

Limitation of the Study

There are several limitations of this study need to acknowledge. First, all the participating schools of this project were the member schools of the health promoting schools programme and they have adopted health promoting schools approach for at least 2 years at the time they joined the current project, therefore the findings may not be generalisable to all primary schools. Further studies are recommended to test the model in other schools using nutrition promotion as an entry point for developing health promoting schools. Second, the Health Promoting Schools approach adopted by the current project encouraged school-based actions. School-based approach has the benefits of letting schools have an ownership of the programme and utilise its own strengths and resources to enhance sustainability and effectiveness. On the other hand, the effectiveness and sustainability of the project will rely on the extent to which school itself make a priority of promoting health; the strong leadership, genuine commitment and coordination from school members, especially the school principal and project coordinating teacher. Different schools may proceed at different pace and with varied outcomes. Finally, the nutrition quantity and quality of school lunch was assessed by the weighed lunch survey and 5-day lunch menu review respectively, which has the benefits of being a simple, inexpensive method and can be accurate and precise to give information on the amount of different food groups provided at school lunch when a standard procedure is used. On the other hand, it cannot provide full picture on the energy and nutrient content of the school lunch supply and students' consumption pattern. Also the weighed lunch survey was based on the measurement of one-day school lunch supply and students' consumption may have the limitation of reflecting the eating behaviour.

Implications of the Study

Overall, the study raised several important implications for policy maker, schools, health professional and other interested bodies trying to improve eating behaviour in school children. The results of current project showed that there was a knowledge-attitude-practice gap on eating behaviour among the students participated in the study. In general the students have good knowledge about healthy eating (73% students got a pass in Knowledge Score at post-assessment) and they also reported a positive attitude toward fruits and vegetables (more than 80% of them reported that they like eating fruits and vegetables). However, this improved knowledge and attitude towards healthy eating did not result in good eating habit, as revealed by the relatively low consumption rate. The finding is consistent with a large-scale survey carried out by the Department of Health, Government of HKSAR[13]. Further study is recommended to explore strategies to reduce the gap and encourage fruits and vegetables intake. The data of this study showed that fruits and vegetables consumption is increased with

- increase in availability: offered fruits as snack and increased vegetables supply at lunch;
- parents' fruits and vegetables consumption;
- perceived positive attitude of peers towards eating vegetables and fruits;

Coordinated Efforts to improve the consumption

Taste of the food was reported to be the top consideration for students in choosing fruits and vegetables, followed by the nutritional value and whether their mother frequently prepare the food. Likewise, parents rated taste and food variety to be the top barriers for sustaining healthy eating habits for their children. The results suggested that healthy eating promotion initiative should not only focus on knowledge acquisition, but also focus on the coordination with school health policies and environment intervention strategies to increase the availability of healthful choices and to make healthful choices competitive and appealing to students. With the increased prevalence of childhood obesity and the changing public health agenda, school lunch nowadays should be a service provided for the children's educational and health benefits , and not merely a commercial service. The Department of Health of HKSAR has published the "Nutritional Guidelines on School Lunch for Primary School Students" in 2006 to guide schools, caterers and parents in providing a nutritionally balance meal to children9. The Pearson Correlation analysis results indicated that the amount of vegetable provided at school lunch was positively correlated with the students' vegetable consumption. On the other hand, the weighed lunch survey indicated that the plate waste accounted for nearly 35% of all food supplied, 45% of vegetable were left unconsumed. The results suggested that by providing more vegetable in school lunch alone may improve the consumption, but will not necessarily solve the problem of inadequate consumption. School lunch should work in coordination with the nutrition message delivered at classroom, to help students develop healthy eating habits and achieve health improvement. Further studies to identify students' food preferences and factors influencing student lunch consumption pattern may help to improve students' food intake and also reduce food wastage. Schools, lunch caterer and parents should work together to identify factors causing students not taking the food and focus on strategies for increasing consumption of vegetables and decreasing overall plate wastes. For example, schools could work with lunch caterer to expand the number and variety of healthy food choices and modified the recipes that are popular with

students, organize taste test to provide students the opportunities to taste and explore different featured vegetable and give feedback on how to make the food more appealing. Health educators could consider incorporating nutrition education strategies with environmental conservation concepts to enhance the education efficacy. Schools could provide experiential learning opportunities, such as getting the students to participate in farming and wastes recycling activities, setting up school edible garden to help students adopt healthy and responsible lifestyles for the well-being of themselves and the earth that we live on.

Parent Education

Apart from school environment, parents are particularly important target to address, in addition to the students, when aiming to change the students' eating habits[14-16]. In the current survey, the major changeable parental factors that correlate with their children's fruits and vegetables consumption were i) parents' understanding of the benefits of fruits and vegetables ii) parents' attitude towards easiness of sustaining healthy eating iii) parents' consumption of fruits and vegetables per se and iv) whether parents constantly offer fruits and vegetables as snacks to their children. This highlighted the role of parents in promotion of fruits and vegetables consumptions. It also affirmed the importance of parent education in the formulation of a comprehensive health promotion strategy to school-aged children. Parents listed "healthy food does not tasted good", "healthy food lacks of variety", "lacks of time to prepare healthy food" and "frequently eat out" as the top barriers for sustaining healthy eating habits. The results suggested that parents should be empowered with skills in how to make healthy food appealing, acceptable and convenience to prepare. Healthy restaurant movement should be encouraged to facilitate healthy food choices.

Possible Success Factors

The possible factors that contributed to the project's success may include:

- An integrated approach, entailing improved school eating policies and eating environment at school, empowerment of teachers and parents, involvement of family and community, along with a comprehensive nutrition education programme and the active participation of students was adopted;
- A collaborative approach in project development and execution was emphasized. Teachers were valued as working partners of the project and sharing of information and experiences with the project team and between schools were actively encouraged;
- A comprehensive need assessment was carried out to establish the needs and key nutrition issues for the participating schools. The data obtained from the assessment was a powerful information to feedback to school principals, teachers and parents to generate enthusiasm to drive the program forward;
- Adequate orientation and trainings of teachers, parents and peer student leaders were provided to empower them with necessary skills to create change at school and to take up the health promoting roles;
- Good quality of nutrition education resources were developed to support teachers in conducting skill-based nutrition education activities. The majority of the participating schools have utilized the education resources provided by the project to carry out a variety of school-based activities;

Implications of the Study

- Adequate attention to related strategies that maximize success, such as link with community resources and health promotion programme;
- Strong leadership, genuine commitment and coordination of school personnel especially the coordinating teachers;
- All of the participating schools supplemented their nutrition education initiatives with improvement in school health policies and the overall nutrition environment, such as introducing more healthy choices to tuckshops, working with school lunch caterer to increase vegetable supply;
- Using interactive approaches and encouraging active involvement of students and making use of positive peer influence. All participating schools have appointed student ambassadors to assist teachers in conveying healthy eating message through a wide range of communication channels at school;
- Full involvement and maintenance of close ties with parents.

Establishing nutrition and health education as a regular element of the school curriculum

Nutrition and health training for both students and school staff has to compete for time with many other important academic and professional development topics. Due to competing priorities and limited resources, maintaining health promotion as a priority in schools over a long period is difficult. Therefore, establishing nutrition and health education as a regular element of the school curriculum and incorporating health promoting school framework into school development remains an important objective for the education and health benefits of students.

Conclusion

The current project affirmed that the Health Promoting Schools model is an effective way to integrate a broad range of strategies that complimented each other to foster a supportive environment to improve knowledge and support eating behaviour change in school children and also their parents. School is an ideal setting for health promotion to help alleviate the increasing health care cost and reduced productivity due to unhealthy lifestyles. The Hong Kong Healthy Schools Award Scheme administered by the Centre for Health Education and Health Promotion of the Chinese University of Hong Kong since 2001 has successfully laid the foundation of health promoting schools in more than 200 kindergartens, primary and secondary schools in Hong Kong. The Department of Health of HKSAR has launched a territory wide healthy eating promotion campaign in primary schools in 2006 and nutritional guidelines on school lunch and healthy snack has been published. Built on this foundation, we can further make use of the strong network among schools, government sectors, academic institutions and organizations as well as the commercial partners to strengthen the partnership in promoting better health for the students.

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A total of ten local primary schools from different districts of Hong Kong participated in the project. A list of the participating schools is as follows (in alphabetical order):

Baptist Sha Tin Wai Lui Ming Choi Primary School
HHCKLA Buddhist Wong Cho Sum School
Hong Kong Student Aid Society Primary School
Lok Wah Catholic Primary School
Ma On Shan Lutheran Primary School
Ma On Shan Methodist Primary School
Pentecostal Yu Leung Fat Primary School
Po Leung Kuk Fong Wong Kam Chuen Primary School
Tin Shui Wai Catholic Primary School
Yuen Long Public Middle School Alumni Assn. Ying Yip Primary School

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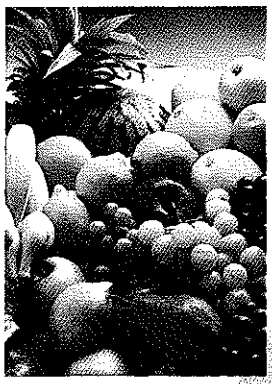

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