Effectiveness of a School-
based Multicomponent Intervention on Children Nutritional Status among Primary Scho
ol Children in Bangkok, Thailand

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ผลของโปรแกรมส่งเสริมสุขภาพต่อภาวะโภชนาการของเด็กในโรงเรียนประถมศึกษา

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ณัฐพนธ์ จาวลา : ผลของโปรแกรมส่งเสริมสุขภาพต่อภาวะโภชนาการของเด็กในโรงเรียน ประถมศึกษา (Effectiveness of a School-based Multicomponent Intervention on Children Nutritional Status among Primary School Children in Bangkok, Thailand) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: นพ. อเลซซิโอ พันซ่า, อ.ที่ปรึกษาวิทยานิพนธ์ ร่วม: ศ. พญ. ชุติมา ศิริกุลชยานนท์, 110 หน้า.

ภาวะโรคอ้วนและน้ำหนักเกินในวัยเด็กได้กลายเป็นปัญหาสุขภาพของโลก โรคอ้วนใน เด็กไทย เพิ่มสูงขึ้นอย่างชัดเจน มีมากกว่าสองเท่าตั้งแต่ปี1960 ผลการศึกษาล่าสุดรายงานว่า โรค อ้วนในประเทศไทยนั้นจัดอยู่ในอันดับที่ 5 ของเอเชีย การวิจัยครั้งนี้เป็นการวิจัยกึ่งทดลอง มี วัตถุประสงค์เพื่อประเมินประสิทธิภาพของ โปรแกรมส่งเสริมสุขภาพต่อภาวะโภชนาการของเด็กใน โรงเรียนประถมศึกษา มีกลุ่มตัวอย่างคือ เด็กนักเรียนทั้งหมด 4 โรงเรียน แบ่งปัน 2โรงเรียน เป็นกลุ่ม ทดลอง และอีก 2โรงเรียนเป็นกลุ่มควบคุม

ผลการศึกษาพบว่า กลุ่มทดลองมีการปรับปรุงอย่างมีนัยสำคัญทางสถิติในการปฏิบัติที่ดีต่อ สุขภาพ (+1.5 ความแตกต่างคะแนนเฉลี่ย, P = 0.048) ในพฤติกรรมการบริโภคอาหารและการออก กำลังกาย พบว่าหลังจากผ่านโปรแกรมส่งเสริมสุขภาพ เด็กนักเรียนมีระดับคอเลสเตอรอลลดลง (- 2.43 ค่าเฉลี่ย P = 0.019)) และ ระดับ HDH เพิ่มขึ้น (+4.06, P = 0.028) เมื่อเทียบกับกลุ่ม ควบคุม การวิจัยครั้งนี้พบว่าจำนวนเด็กอ้วนในกลุ่มทดลอง มีระดับที่ลดลงสูงกว่าเด็กอ้วนในกลุ่ม ควบคุม

ผลการวิจัยชี้ให้เห็นว่าโรคอ้วนในเด็กยังมีอยู่มากในเด็กวัยเรียน การศึกษาครั้งนี้ชี้ให้เห็นว่า โปรแกรมส่งเสริมสุขภาพ (multicomponent) น่าจะมีประสิทธิภาพในการป้องกันภาวะโรคอ้วนและ น้ำหนักเกินในวัยเด็กมากขึ้น การวิจัยในอนาคตโดยใช้โปรแกรมส่งเสริมสุขภาพนี้ ควรมีระยะเวลาใน การปฏิบัติให้นานมากขึ้น เพื่อส่งเสริมสุขภาพที่ดีร่วมกับการพัฒนาสุขภาพอย่างยั่งยืน

สาขาวิชา   สาธารณสุขศาสตร์   ลายมือชื่อนิสิต ....
ปีการศึกษา 2558   ลายมือชื่อ อ.ที่ปรึกษาหลัก ....
                                              ลายมือชื่อ อ.ที่ปรึกษาร่วม ....

5579155653 : MAJOR PUBLIC HEALTH

NATTAPON CHAWLA: Effectiveness of a School-based Multicomponent Intervention on Children Nutritional Status among Primary School Children in Bangkok, Thailand. ADVISOR: ALESSIO PANZA, M.D., CO-ADVISOR: PROF. CHUTIMA SIRIKULCHAYANONTA, M.D., 110 pp.

Childhood obesity has become a major public health issue today. Childhood obesity in Thailand has more than doubled since the 1960s and a recent study reported that overweight and obesity in Thai is the 5th highest in Asia. The present study objective is to evaluate the effectiveness of a multicomponent, school-based intervention on children's nutritional status. A quasi-experimental design was conducted in two-groups (control and intervention schools) on 453 primary school children. The intervention included education, dietary, physical activity, food-environment, school built-environment, and life skills components. Outcomes were measured at baseline and post-treatment measured after 6 months.The intervention group had significant improvements in healthier practice (+1.5 mean difference, $p=0.048$) on dietary habits and physical activity, lowered cholesterol levels (-2.43 mean, $p=0.019$)), and higher HDH levels (+4.06 $p=0.028$) as compared to control. A higher reduction of overweight individuals among the intervention group over the intervention period was observed. Physical activity and consumption of vegetable increased while consumption of high-caloric snacks and fasts food decreased in children after the intervention. Childhood overweight and obesity is a serious public health problem based on its increasing rates and the associated health risks. This study indicated that multidisciplinary approach on school-based interventions is likely most effective to prevent children becoming overweight in long term. More research should be conducted on school-based intervention with longer intervention periods with higher sustainability.

Field of Study: Public Health	Student's Signature ....
Academic Year: 2015	Advisor's Signature ....
	Co-Advisor's Signature ....

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CHAPTER **I**

INTRODUCTION

1.1 BACKGROUND AND RATIONALE

Childhood obesity has become a major public health issue today. Children who are obese are at a major risk for developing serious chronic diseases, including type 2 diabetes (Katz, Daniels et al. 2012), hypertension and stroke, cardiovascular diseases (Dietz 1997, Bastien, Poirier et al. 2014), and certain forms of cancer (WHO 2003) later in life. The health consequences range from increased risk of premature death, to serious chronic conditions that reduce the overall quality of life. Although, the origin of obesity is complex and relates to diet, physical activity, genetics, culture, self-perception and other environment factors, obesity ultimately results from an imbalance of energy intake via diet relative to energy expenditure. (Stevens, Story et al. 1999, Ebbeling, Feldman et al. 2012, Kim, Sharma et al. 2012)

The prevalence of obesity and overweight is increasing in both adult and children. The current data from World Health Organization (WHO) indicates that "there are more than 1 billion overweight adults, and at least 300 million of them clinically obese".(WHO 2011) The International Obesity Taskforce reported that the prevalence of overweight and obesity among school-aged children is about 10%.(Oude Luttikhuis, Baur et al. 2009) However, certain countries and regions have particularly higher rates of childhood obesity: more than 30% in the Americas, around 20% in Europe, and lower in Africa and Asia.(Lobstein, Baur et al. 2004) The prevalence of obesity in Thailand has been doubled in the past two decades with 9.2% overweight males and 33.9% overweight women.(Aekplakorn and Mo-suwan 2009)

A survey conducted in Thailand by the National Health and Nutrition Examination Survey reported that childhood obesity has more than doubled since the 1960s.(Sirikulchayanonta, Ratanopas et al. 2011) A recent study conducted by Thai Health and We Voice Network reported that overweight and obesity in Thai is the 5th highest in Asia, and accounts for 20,000 deaths per year.(Galbally, Fidler et al. 2012) Another report suggested that 20% of primary school children are either overweight

or obese. (Wichai Aekplakorn, Bruce Neal et al. 2004) Health Department, Ministry of Public Health (MOPH) Thailand anticipated that 1 out of 5 preschoolers will be obese in another 10 years due to their diet and lack of exercise.

Studies have shown that obese children tend to become obese adults, and thus, the prevention of overweight in childhood is one means of preventing chronic diseases associated with obesity.

As there is a dramatic increase in childhood obesity, interventions to combat this epidemic are very much needed and must be a priority. In recent years, many intervention programs have been developed and evaluated to reduce childhood obesity. School-based interventions have been identified as "one of the most efficient means" because "school is a critical setting" (Flynn, McNeil et al. 2006, Lissau 2007) and children spend significant amounts of their time in school.(Fein, Plotnikoff et al. 2004, Fox 2004)

The most promising approach for effective interventions focus on modifications in both diet and physical activity.(Baranowski, Baranowski et al. 2003, Swinburn, Caterson et al. 2004, Gortmaker, Swinburn et al. 2011) Increased consumption of fruits and vegetables and reduced intake of dietary fats are beneficial towards health and is associated with lower BMI.(Lin and Morrison 2002, Bazzano, Serdula et al. 2003, Chomitz, McGowan et al. 2010) In addition, physical activity is associated with enhanced health and reduced risk of all-cause morality.(Ortega, Ruiz et al. 2008) Children who engage in regular physical activity have a better mental and physical well-being.(Janz, Burns et al. 2004, Strong, Malina et al. 2005)

In recent years, there has been a growing understanding on how school-based interventions can affect children's physical activity and dietary habits. Several studies place emphasis on activity beyond non-curricular approaches such as using life-skills approaches on school environment and/or other policies. However, the number of available evidence for effectiveness of life skills and school-based interventions is still limited and findings are inconsistent.(Brown and Summerbell 2009) Moreover, to the author's knowledge, a literature search in English language publications has found

no studies in Thailand have examined intervention that combines diet and physical activity with food environment and built environment in schools to reduce childhood obesity. A search on Thai and grey literature may have shown some

The present study aimed to evaluate the effectiveness of a multicomponent, school-based intervention on children's nutritional status. It is hypothesized that after 6 months of intervention, there will be not be an increased in the number of overweight/obese children, or, at best, that there will be a decrease in childhood obesity. Additionally, it is hypothesized that physical activity levels among children would increase and there will be healthier dietary habits.

RESEARCH QUESTIONS

1.2.1 What is the effect of a multicomponent, school-based intervention program on children nutritional status?

RESEARCH OBJECTIVES

1.3.1 GENERAL OBJECTIVE

1.2.1.1 To evaluate the effectiveness of a multicomponent school-based intervention program on children's nutritional status

1.2.2 **Specific Objective**

1.2.2.1 To develop a multicomponent life-skills school-based intervention program. To determine the effectiveness of the intervention program by the changes of variables in and between the intervention and control as the followings:

      I.   Prevalence of obesity among the intervention and control groups.

      II.   Dietary and physical activity behaviors.

      IV.   School-environment

      III.   Blood lipid profiles: TG, TC, LDL-C, HDL-C.

1.4 OPERATIONAL DEFINITIONS

1.4.1 OVERWEIGHT AND OBESITY
The study uses the definition of overweight as having (weight-for-height) BMI-z scores between +2 to 3 SD and obese as having +3 SD set by the Department of Health, Ministry of Public Health and Institute of Nutrition, Mahidol University (INMU) computed using the software INMU-Thai Growth Chart.

1.4.2 DIET
In the study, diet refers to the amount of food and drink a child consumes in a school day.

1.4.3 PHYSICAL ACTIVITY
In the study, physical activity refers to at least moderate to vigorous exercise. An exercise where a child makes an effort in breathing but still can converse in short sentences. For example, exercise such as jogging, running, playing football, basketball, volleyball, or swimming.

1.4.4 LIPID PROFILE (BLOOD TEST)
In the study, the levels of lipid were be classified as desirable, borderline, and high as been done in previous studies.(Sirikulchayanonta, Pavadhgul et al. 2005) The total cholesterol (TC) levels are classified as less than 170 mg/dl as desirable, 170 -199 mg/dl as borderline, and above 200 mg/dL as high. Triglycerdies (TG) is classified as desirable less than 130 mg/dL, 130-149 mg/dL as borderline, and at or above 150 as high.

LDL-C is classified desirable if less than 110 mg/dL, borderline between 110-129 mg/dL, and above 130 mg/dL as high level. HLD-C is classified desirable at or above 35 mg/dL and low level less than 35 mg/dL.

1.4.5 CHILDREN
In the study, children refer to students of both genders attending grade levels 4-5, approximately in the age range 10-12.

1.4.6 AGE
In the study, age refers to the self-reported number of birthday years a child completed at the time of the interview.

1.4.7 EDUCATIONAL LEVEL

In the study, educational level refers to children attending grade levels 4-5. Grade levels 4 and 5 are in primary education referred to as Prathom 4 and Prathom 5 in Thai.

1.4.8 POCKET MONEY

In the study, pocket money refers to the amount of money a child receives from parents/guardians and/or other sources on an average school day.

1.4.9 MULTICOMPONENT

In the study, multicomponent refers to an intervention that combines physical activity, dietary intake, school-environment and food-environment approaches in a school-based setting though a life-skills program.
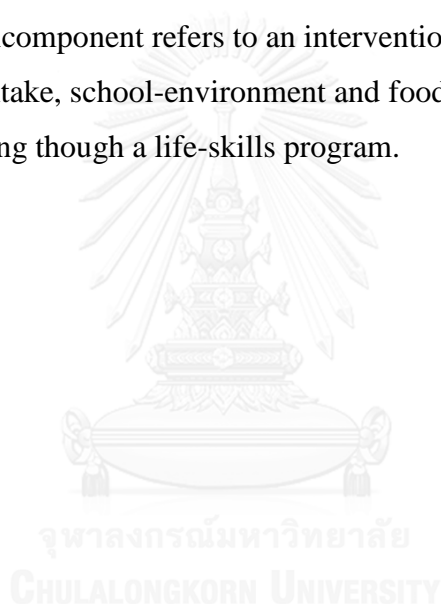
1.5 CONCEPTUAL FRAMEWORK

INDEPENDENT VARIABLE   **DEPENDENT VARIABLE**

Socio Demographic Characteristics
- Age
- Gender
- Educational level
- Pocket money
- Self-perception of obesity.

Multicomponent (life-skills + environment) intervention

Knowledge and Attitude
- Physical activity
- Diet
- Overweight/obesity

Behavior Outcomes
- Levels of physical activity
- Dietary habits

Environmental factors
- School built-environment
- School policies
- School food-environment

Nutritional Status (Weight-height)
- Normal
- Overweigh/obese

Biochemical Indicators
- Cholesterol
- Triglycerides
- LDL
- HDL

CHAPTER 2

LITERATURE

2.1 PREVALENCE OF CHILDHOOD OBESITY WORLDWIDE

Obesity prevalence is increasing worldwide at an alarming rate in both developed and developing countries. (Kantachuvessiri 2005) According to the Oxford Public Health 5th Edition, currently there are an estimated about 1.1 billion overweight and obese adults in the world, with an estimated 10% of all children now being overweight. (Detels, McEwen et al. 2002) Surprisingly, more than half affected are in the middle or low-income countries. (Sakamoto, Wansorn et al. 2001)

While news stories dwell on the alarming trend toward obesity in North American children, the rest of the world appears to be following. More than 1.2 billion people in the world are now officially classified as overweight, according to the World Health Organization.(WHO 2011) Since the publication in the British Medical Journal of new standards for evaluating children's weight, health officials around the world have begun estimating childhood obesity rates. It's alarming that over the last 20 years, the prevalence of overweight and obesity among adults and children had increased dramatically.

The prevalence of obesity has "increased substantially over the last few decades and indications are that this trend will continue."(Pomeranz and Brownell 2011) Children or adults obesity rates that have risen three-fold or more since 1980 in some areas of North America, the United Kingdom, Eastern Europe, the Middle East, the Pacific Islands, Australasia and China. (WHO 2003) WHO reported that "1 in 10 city-dwelling children are now obese in China, obesity in nine-years-old children has tripled in Japan, and approximately 20 per cent of Australian children and adolescents are overweight or obese."(WHO 2011)

Between 1970 and 2004, "the prevalence of overweight and obesity almost tripled among U.S. preschoolers and adolescents and quadrupled among children aged 6 to11 years."(Ogden, Carroll et al. 2006) In 2003-2004, 17.1% of children aged 2 to 19

years were obese (at or above the 95th percentile) of Body Mass Index (BMI) compared to 5-6% in the 1970s, and these percentages are higher in non-Hispanic Blacks and Mexican Americans (20.0% and 19.2%) than in Whites (16%).

Obesity rates are also high among American Indian children with a "prevalence estimate of 22% for boys and 18% for girls."(Caballero, Clay et al. 2003) Currently, about 25 million U.S. children and adolescents are overweight or obese (Braet, Tanghe et al. 2004), and children from families that are of low socio-economic status are disproportionately affected. Due to such increase in obesity rates in the US, "one-third of overweight Americans are at an increased risk of developing chronic diseases such as type 2 diabetes, cardiovascular disease, gallbladder disease, hypertension and certain forms of cancer."(Prentice and Jebb 2001).

China has seen the rise in the prevalence of overweight in urban children rise to 3.3% in 1992 and 6.7% in 1995.(Ko, Chan et al. 1999) Whereas, during 1976 in Singapore, only 2% of schoolchildren (mostly 12-year-olds) were identified as obese, but in 1983, the corresponding rate was 12%.(Ho 1984) Recent data from the Ministry of Health in Singapore shows that the prevalence of obesity among children was 19% for boys and 12% for girls in 1995. In Hong Kong, the prevalence of overweight among a selected group of 1000 adolescents was found to be about 3-4%.(Ko, Chan et al. 1999)

In Japan, in the National Nutrition Survey of 1990-1994 (Yoshiike, Matsumura et al. 1998), "less than 3% of the population had BMI > 30, with approximately 24.3% of men and 20.2% of women being in the range of BMI 25-29.9. In the Second National Health and Morbidity Survey of Malaysia in 1996" (Kantachuvessiri 2005), (16.6% of the population (aged > 18) had BMI 25-30, with 4.4% possessed BMI > 30.It was also proposed that ethnic and cultural variations are factors in the prevalence of obesity across the region.

"Rapid changes in the epidemiology of obesity over the last 20 years may have also altered the previously documented patterns of continuity in childhood obesity."(Ebbeling, Pawlak et al. 2002) According to WHO, the prevalence of

overweight in Indonesia has increased slowly with larger numbers in the urban population. The economy of Vietnam has increased rapidly since 1989, but so has childhood overweight and obesity. Until 1994, overweight and obesity was not a public health problem in Vietnam, but studies since 1996 has showed the prevalence of overweight and obesity in Vietnam increasing over time.

Following the neighboring countries closely, the prevalence of obesity in Thailand has been "doubled in the past two decades. Data from three consecutive National Health examination surveys (NHES) have shown a secular trend, as the prevalence of obesity with body mass index ≥ 25 kg m^{-2} increased from 13.0% in men and 23.2% in women in 1991 to 18.6% and 29.5% in 1997 and 22.4% and 34.3% in 2004 respectively."(Wichai Aekplakorn, Bruce Neal et al. 2004) Obesity prevalence in children, using weight for height criteria, increased from 5.8% in 1997 to 7.9% in 2001 for the 2-5-year-olds and from 5.8% to 6.7% for the 6-12-year-olds.(Aekplakorn and Mo-suwan 2009) This huge increase in obesity has been a huge concern for Thai authorities.

In 1991, the first report on National Health Examination Survey of Thailand was conducted and the report revealed that that 12% of men and 19.5% of women had a BMI of 25-30.(Kantachuvessiri 2005) (Kantachuvessiri, 2005). In accordance, in 1997, the Ministry of Public Health conducted the second report on National Health Examination Survey of Thailand. They reported that there were 19.2% overweight males and 33.9% overweight women. More dramatic was that 3.5% male and 8.8% female were obese. Yet, the results were not surprising as the rates of obesity in the South East Asia region have gradually increased in the past 10 years as mentioned.

Referring to the World Health Organization report, Thailand is an appropriate example for obesity problem. Obesity among Thai children, aged 5 to 12 is 16%, a 4% increase from only a couple of years ago, or at an average of 1 million people.(WHO 2003) This signifies that obesity rate in Thai children grew faster than other countries in Asia. Since, obesity problem has affected Thai children for the past decade, it had become a serious public health problem.

Furthermore, Ladda Mo-suwan, MD, from the Faculty of Medicine Prince Songkla University, conducted a research on 1,373 children in Tessabarn Had Yai School.(Mo-suwan, Pongprapai et al. 1998) She found that the rates of "overweight children are 11.5%". Moreover, this percentage is higher than Japan. Dr. Ladda mentioned the cause of problem to the way of life in urbanization. Children always spend more time watching television, playing video games and computer, and in the same time, they are snacking junk food together. This opinion was also shared by another researcher, Bhonchita Chaiumnuai, a medical doctor at the Faculty of Medicine Phramongkutklao Hospital. She blamed the problem to children and teens having less activity to do in each day.(Wichai Aekplakorn, Bruce Neal et al. 2004) Basically, the lack of exercise is a dominant factor. Dr. Chutima Sirikulchayanon, who's the head of nutrition department at Mahidol University and a forerunner in obesity studies pointed that 78% of young children, on average, in the capital were diagnosed with high cholesterol, and 20% were either overweight or obese.(Sirikulchayanonta, Ratanopas et al. 2011) However, one thing is clear, eating habits, ways of life, and technologies has contributed to obesity problems among Thai children.

2.2 CRITERIA FOR DIAGNOSIS OF OVERWEIGHT AND OBESITY IN CHILDREN

The recent World Health Organization (WHO) agreement on the standardized classification of overweight and obese, based on body mass index (BMI), allows a comparable analysis of prevalence rates worldwide for the first time. In Asia, however, there is a demand for a more limited range for normal BMIs, for instance 18.5 to 22.9 kg/m^2 rather than 18.5 to 24.9 kg/m^2 because of the high prevalence of comorbidities, particularly diabetes and hypertension. In children, the International Obesity Task-Force age-, sex-, and BMI-specific cutoff points are increasingly being used. Hence, the World Health Organization consultation on obesity proposed a system of classification based on BMI. "With the exception of children under 10 years of age due to limitations of energy expenditure data, energy requirements were based on estimates of energy expenditures, rather than energy intakes."(Weisell 2002) The body mass index facilitated the determination of an ideal weight at any given

height. "BMI is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2)."(Prentice and Jebb 2001)

Many past studies used the classifications based on Europoids (Table 1). In these studies the ranges for BMI (underweight, normal, overweight, obese) have been based on mortality outcomes where the confounding influences of cigarette smoking and co-existing chronic disease have been minimized. Hence, there is a WHO recommended different ranges for the Asia-Pacific region based on risk factors and morbidities.

In Asians, the cut-offs for overweight ($\geq$ 23.0 kg/m^2) and obesity ($\geq$ 25.0 kg/m^2) are lower than the WHO criteria. Some support for these cut-offs comes from data on Chinese living in Hong Kong, Chinese in Singapore and Indian Asians living in Mauritius.(Deurenberg-Yap, Yian et al. 1999)

Table 1 Proposed Classification of weight by BMI in adult Asians.

Classification	BMI (kg/m^2)	Risk of co-morbidities
Underweight	< 18.5	Low (but increased risk of other clinical problems)
Normal range	18.5 – 22.9	Average
Overweight:	$\geq$ 23	
At risk	23 - 24.9	Increased
Obese I	35 - 29.9	Moderate
Obese II	$\geq$ 30	Severe

Source: The Asia-Pacific perspective: Redefining obesity and its treatment 2000.

As children are still growing, the adult BMI cut-offs are not considered appropriate for children. Hence, a BMI percentile standards established by the WHO is commonly used to determine childhood obesity (WHO, 2000). Childhood obesity is defined as a BMI > 95th percentile for age and gender, and children were considered to be at risk of obesity if the BMI $\geq$ 85th and $\leq$ 95th percentile.

Table 2 BMI-percentile classification of overweight and obesity in children.

BMI	Classification
Under 5th percentile	Underweight
At 5 – 84.9[th] percentile	Normal
At 85 – 94.9[th] percentile	Overweight
At or above 95th percentile	Obesity

Source: Centers for Disease Control and Prevention. About Child & Teen BMI. CDC, 2015.

Another way to express child growth survey is by using z-scores. The WHO Global Database on Child Growth and Malnutrition indicated that "a major advantage of the z-score system is that a group of z-scores can be subjected to summary statistics such as the mean and standard deviation. The WHO Global Database on Child Growth and Malnutrition uses a z-score cut-off point of <-2 SD to classify low weight-for-age, low height-for-age and low weight-for-height as moderate and severe under nutrition, and <-3 SD to define severe under nutrition. The cut-off point of >+2 SD classifies high weight-for-height as overweight in children."(De Onis and Blössner 2003)

However, the most common classification of overweight and obesity in children in Thailand uses the weight-for-height z-score (น้ำหนัก ส่วนสูง) adapted by the Department of Health, Ministry of Public Health, Thailand as the Thai Growth reference.(Preedy 2012) It is also a standard used by the Institute of Nutrition, Mahidol University (INMU).

Table 3 Weight-for-height classification of overweight and obesity in children.

z-scores	Classification
< - 2 SD	Underweight
- 2 SD to + 2 SD	Normal
+ 2-3 SD	Overweight
+ 3 SD	Obesity

Source: INMU, Mahidol University, 2009; Department of Health, MOPH, 2012

2.3 CONSEQUENCES OF OBESITY IN A CHILD

There is growing concern that the prevalence of obesity is increasing in the developed world.(Seidell and Flegal 1997) This shift had created health burdens on diabetes, chronic heart diseases, and certain types of cancer. The frightening fact remains that childhood obesity is positively correlated with eventual adult obesity.(WHO 2011) It is related to many of the same risk factors as adult obesity, most notably cardiovascular and psychosocial factors.(Jonides 1990) "Overweight in adulthood is associated with several adverse health outcomes and cardiovascular disease in particular."(Kushner 1993) Some cohort studies also show an increased mortality risk in the underweight and overweight groups of children. Other studies have examined associations between childhood overweight and adult disease. One study examined the relation between BMI measured in childhood and adult all-cause and cardiovascular mortality in a 57-years follow-up of a cohort study based on the Carnegie (Boyd Orr) Survey of Family Diet and Health in prewar Britain (1937-1939). It reported that "cardiovascular mortality were associated with higher childhood BMI."(Gunnell, Frankel et al. 1998)

Furthermore, medical costs associated with overweight and obesity may involve direct and indirect costs.(Wolf and Colditz 1998) According to the American Cancer Society, obesity cost an estimated $75 billion in 2003. The USA National Institute of

Health, reports that $75-$125 billion is spent on indirect and direct costs due to obesity-related diseases.(Finkelstein, Trogdon et al. 2009)

In children, the development of obesity is associated with the simultaneous deterioration in chronic diseases risk profiles.(Chu 2001) Excess weight in childhood is the leading cause of pediatric hypertension, and overweight children are at a high risk for developing long-term chronic conditions, including adult-onset diabetes mellitus, coronary heart disease, orthopedic disorders and respiratory disease.(Garrow 1988) In fact, there is substantial evidence suggesting that obesity in childhood lays the metabolic groundwork for adult cardiovascular disease.(Del-Rio-Navarro, Velazquez-Monroy et al. 2008) Also, there has been evidence demonstrating that overweight children tend to become overweight adults.(Roberts, Shields et al. 2012) Overall, obesity in childhood appears to increase the risk of subsequent morbidity, whether or not obesity persists into adulthood.

Recent studies have found that the prevalence of overweight/obesity in the older preschool child population has demonstrated the largest increase in the last 20 years.(Summerbell, Waters et al. 2005, Ogden, Carroll et al. 2006) There has been a dramatic increase in the number of overweight and obese children in recent years and studies indicate that children's lives may be shortened as a result of this alarming health problem.(Reither, Olshansky et al. 2011) It is estimated that, for any degree of overweight/obesity, younger adults (20-30 years of age) may have greater years of life lost due to obesity than older adults.(Dixon 2010) This is a concern given that the prevalence of childhood obesity has increased dramatically over the past few years.(De Onis, Blössner et al. 2010, Ng, Fleming et al. 2014)

2.3.1 PHYSICAL CONSEQUENCES

The health risks associated with obesity are numerous. Childhood obesity can have both physical and psychological effects. The medical impact of obesity during childhood is similar to those seen in obese adults.(Stamatakis, Primatesta et al. 2005) Some of the physical effects of childhood obesity include type 2 diabetes, high blood pressure (Sirikulchayanonta, Ratanopas et al. 2011), and sleep apnea. These

conditions have been increasing in children as obesity rates increase. Also, similar to adults, developing these conditions in childhood increases the risk for developing coronary heart disease.(Freedman, Dietz et al. 1999, Sukhonthachit, Aekplakorn et al. 2014) A group of American scientists (Story, Stevens et al. 2003) observed that childhood obesity has become a major health problem in American-Indians. They concluded that if this pattern is not revered, American-Indians populations would be burdened by an increased incidence of chronic diseases.

Another study recorded that childhood overweight and obesity is related to metabolic disorders such hypertension, high LDL-cholesterol, low HDL cholesterol, and high triglyceride levels.(Del-Rio-Navarro, Velazquez-Monroy et al. 2008) Coronary heart diseases (CHD) cause significant morbidity and mortality in adults in various countries, and is one of the first three leading causes of death in Thailand. It has been reported that there are 40% primary school children that have hypercholesterolemia with total cholesterol above 200 mg/dl and high LDL-C. Data from Thai hyperlipidemia study (Sirikulchayanonta, Pavadhgul et al. 2005) reported that Bangkok public primary school children are facing a problem with hyperlipidemia and over 5.4$ had high triglyceride (TG).

2.3.2 SOCIAL AND PSYCHOLOGICAL CONSEQUENCES

Besides the physical effects, there may be psychological effects of childhood obesity. Children and adolescents with obesity face stigmatization and discrimination in many areas of their lives, and it has been assumed that their psychological well-being will be compromised as a result.(Wardle and Cooke 2005) In one study, severely obese children recorded their quality of life with scores as low as children undergoing chemotherapy for cancer. (Schwimmer, Burwinkle et al. 2003)

Obese children and adolescents are subjected to social rejection, discrimination and negative stereotyping.(Puhl and King 2013) Studies have shown that such experiences could be expected to lead to negative consequences in terms of self-image, self-esteem and mood. Self-esteem was defined by William James (1950/1890) in terms of a balance between a person's attainments and their goals or

aspirations. Others emphasize the social aspect of self, such that whether we have high or low self-esteem depends at least partly upon how others regard and treat us. One study among 8-11 years olds found that obese children to be twice as likely to suffer low self-esteem as their normal-weight peers.(Friedlander, Larkin et al. 2003) However, studies that look at the impact of weight loss treatments on self-esteem typically report improvements in some if not all dimensions of self esteem.(Braet, Tanghe et al. 2004)

2.3.3 ECONOMIC CONSEQUENCES

As there are physical, social, and psychological effects of obesity, the economic cost is immense. The medical costs "associated with overweight and obesity may involve direct and indirect costs."(Wolf and Colditz 1998) Obesity is particularly costly because it often results in chronic illnesses that require frequent and continuous use of health care resources. A study in the Netherlands found that obese individuals were 40% more likely to visit physicians than those with healthy weights, and were 2.5 times more likely to take drugs for cardiovascular and circulatory disorders. (Gardner and Halweil 2000) A 1995 Swedish study found that obesity accounted for 7% of lost productivity in that country due to sick leave and disability, and that obese workers were twice as likely to take long-term sick leave as those with healthy weights.(Gorstein and Grosse 1994) According to the American Cancer Society, obesity cost an estimated $75 billion in 2003 (American Cancer Society, 2011). The USA National Institute of Health, reports that $75-$125 billion is spent on indirect and direct costs due to obesity-related diseases.(Finkelstein, Trogdon et al. 2009)

2.4. FACTORS RELATED TO OVERWEIGHT AND OBESITY IN CHILDREN

The causes of obesity are multi-factorial. While these factors are related to this increasing trend towards overweight and obesity, energy imbalance linked with shift in energy sources and total energy intake and physical activity are the most important. According to WHO, the major factors to overweight and obesity are dietary factors, physical activity patterns, socio-economic, and cultural factors influencing energy

intake and physical activity pattern.(WHO 2003) Genetic factors may also be involved. Though, there are some factors that are associated with adult obesity, such as hypertension and metabolic syndrome are very rarely associated in childhood obesity.(Vanhala, Vanhala et al. 1998) Moreover, economic growth, modernization, urbanization and globalization of food markets are just some of the forces thought to underlie the epidemic. Hence, this is a serious public health problem that is to be resolved.

2.4.1 AGE

There are good reasons to consider that year before and after puberty are important for understanding body mass.(McTigue, Garrett et al. 2002) (The growth spurt brings about an increase in fat-free mass in boys and an increase in both fat and fat-free mass in girls.(Patton, Coffey et al. 2011) Hence, age is a factor in understanding childhood obesity. Few decades ago, Dietz suggested that gestation and early infancy, the period of adiposity rebound that occurs between 5 and 7 years of age, and adolescence were critical periods for the development of adiposity.(Dietz 1994) Supporting this claim, the United States National health and Examination Surveys documented in 2004 that nearly 14% of 2-5-year old children and 19% of 6-11-year old children were overweight.(Adair 2008)

2.4.2 GENDER

The dramatic rise in childhood overweight in recent years has sparked numerous research studies that have examined the associations between gender and childhood overweight and obesity. For both males and females, early adolescent changes in body fat distribution elicit emotional and behavioral changes in body fat that have the potential to affect weight.(Patton, Coffey et al. 2011)

However, many studies have reported differently on the prevalence of childhood overweight and obesity in males and females. A 10 year cohort study reported the odd of being overweight or obese were similar in males and females .(Patton, Coffey et al. 2011)Whereas, a study in 1819 children in Mexico City found that males from the 4th to 6th grade had a significantly higher overweight and obesity than their female

counterparts.(Del-Rio-Navarro, Velazquez-Monroy et al. 2008) Yet, another study contradicts earlier findings with rates above 95th percentile higher in girls than boys.(Adair 2008)

A few studies in Thailand have documented similar results in the prevalence of overweight and obesity among boys and girls. One study in adolescents aged 10-17 years living in suburban Bangkok documented that there were more boys than girls who had BMI-for-age percentiles above the 85th percentile.(Pawloski, Ruchiwit et al. 2008) Another study in Saraburi children performed on 406 boys and 405 girls reported similar results for boys and girls, with no significant mean difference in waist circumference, hip circumference, arm circumference, weight-to-height ratio between boys and girls.(Yamborisut, Sakamoto et al. 2010)

2.4.3 ETHNICITY

One of the undeniable truths is that society, culture, and the media send children powerful messages about body weight and shape ideals. For girls, these include the "thin ideal" and an urging to diet and exercise. Messages to boys emphasize a muscular, "buff" body and pressure to body build and perhaps make use of potentially harmful dietary supplements.(McCabe, Fuller-Tyszkiewicz et al. 2012) Yet, the role of ethnicity in determining overweight and obesity is clear. Reasons for racial and ethnic differences in childhood overweight and obesity are not fully known.(Kimbro, Brooks-Gunn et al. 2007)

Many ethnic differences in obesity and overweight studies have emerged from analyses of the National Health and Nutrition Examination Survey in the United States.(Tremblay, Katzmarzyk et al. 2005) In Canada, small regional studies have revealed a higher prevalence of overweight among children and adolescents of First Nations ancestry, compared with those of European ancestry (Tremblay et al., 2005). Other studies in United States reported that Hispanic children were twice as likely as either Black or White children to be overweight or obese.(Kimbro, Brooks-Gunn et al. 2007) Thus, ethnicity is a considerably factor for the study of childhood obesity.

2.4.4 EDUCATIONAL LEVEL

A few studies have been done to examine the frequency of overweight and obesity by education level. A study by the WHO MONICA project reported that "lower education was associated with higher BMI in about half of the male and in almost all of the female populations."(Molarius, Seidell et al. 2000) Another study conducted in children in Spain, reported that in both men and women, the highest odds ratios (ORs) for obesity were observed at lower educational levels.(Gutiérrez-Fisac, Regidor et al. 1996)

In Thailand, formal education consists of at least twelve years of basic education, and higher education. Basic education is divided into six years of primary education and six years of secondary education. Kindergarten up until grade level 6 are considered to be in primary school, whereas, grade levels 7 to 12, which is referred to as Mattayom 1 to 6, are considered as secondary education. Dr. Ladda reported that children in lower secondary, grades 7-9 had higher prevalence of overweight and obesity than upper secondary, grades 10-12.(Mo-suwan, Pongprapai et al. 1998) A recent study also reported similar results, with high prevalence of obesity in the 11-12 year age group compared to 6-10 year age group for both boys and girls.(Sirikulchayanonta, Ratanopas et al. 2011) However, the number of literatures examining the associations of educational levels with overweight and obesity in Thai children is still limited, and more studies will be useful.

2.4.5 POCKET MONEY

Various studies have examined the association between childhood obesity and socioeconomic status (SES). Socioeconomic status (SES) is defined as the amount of income, occupation, and education level of the primary providers of the family. In a review of studies published, Sobal and Stunkard found that there is a consistently a strong inverse relationship between SES and obesity among women in "developed societies."(Stunkard and Sorensen 1993) Among men, studies varied between finding an inverse relationship, a direct relationship, and no relationship. However, most of the studies reviewed was not on the relationship between SES and weight status per se. Data from other studies focused primarily on estimating the prevalence of obesity

in the U.S. showed that the "unadjusted prevalence of obesity tends to be higher within lower categories of education for the population as a whole."(Biro and Wien 2010)

Whereas, recent studies devoted more specifically to examining the relationship between SES and weight status continue to show a strong inverse relationship among women (and often only among white women when race is accounted for) and rather inconsistent findings among men.(Sarlio-Lähteenkorva, Silventoinen et al. 2004) Furthermore, few studies have addressed the question of whether and how such differentials may have changed with time. Yet, it is difficult to measure the income of a child as a student. Therefore, given this difficulty, many studies were conducted linking childhood obesity to pocket money. Hence, a relationship between pocket money to childhood obesity can be determined.

A study in Malaysian primary school children reported that children given more pocket money tended to become overweight and obese.(Zaini, Lim et al. 2005) It has been reported that children who were given more pocket money had larger body weight. Another study conducted among school children in Jordan reported similar results. Children receiving pocket money more than 20 piaster were significantly associated with being overweight.(Khader, Irshaidat et al. 2009) Another research was conducted in 1995 on 663 children aged 7–12 years in a province of southern Thailand suggested that the high prevalence of obesity among elite-school children could be related to the comparatively high socioeconomic status of the children's families.(Hirata, Kuropakornpong et al. 1998) These results imply that pocket money (socioeconomic status) is a factor for overweight and obesity and an appropriate interventions to prevent not only obesity is required.

2.4.6 PARENTAL HISTORY OF OBESITY

Furthermore, parental obesity has been identified as a risk factor for childhood obesity.(Maffeis 2000) (Maffeis, 2000). Children with two obese parents have a higher risk of obesity than those with one or no obese parents.(Maffeis 2000) However, a study conducted in Swedish children suggested that the severity of obesity at age 7 has a positive correlation with maternal BMI, rather than paternal

BMI.(Bralić, Vrdoljak et al. 2005) This has been further complimented by a number of studies that showed a correlation between maternal and child body mass index (BMI), whereas the effect of paternal BMI is less certain, especially among younger children.(Whitaker, Wright et al. 1997, Svensson, Jacobsson et al. 2011) Hence, the influence of parental relative weight primarily affects the severity of childhood obesity. However, since the study uses a school-based survey, it is not possible to validly determine overweight and obesity among parents since we can't calculate their BMI because we cannot measure the parents' weight and height.

2.4.7 PEER PRESSURE

Among other predictors of obesity, such as genetic and environmental factors that underlie the propensity to gain weight, behavioral and psychological are important targets as well. Some studies have report that depressive symptoms are responsible for the development of overweight.(Tanofsky-Kraff, Cohen et al. 2006) Other studies have also reported that depression in childhood or adolescence may predict weight gain.(Pine, Goldstein et al. 2001, Puder and Munsch 2010) Children as well as adults stereotype the obese as "lazy, ugly, and stupid."(Wardle and Cooke 2005) As a result, it has been assumed that obese people, especially children and adolescents, will experience poor psychological health. (Ricciardelli and McCabe 2001)

However, many studiers pointed that a major psychological factor is peer pressure. Studies indicated that peer influence and eating behaviors of friends contributed significantly to the prediction of individual eating habits.(Mueller, Field et al. 1995, Morgan, Yanovski et al. 2002, Hutchinson, Rapee et al. 2010) "Children are more susceptible than adults to peer pressure and this presents additional practical obstacles towards childhood obesity."(Ebbeling, Pawlak et al. 2002)

2.4.8 DIET

In the WHO 2010 publication, WHO clearly points out that unhealthy diet is the key modifiable risk for noncommunicable diseases such as overweight and obesity. Overweight and obesity now ranks as the fifth leading risk for death globally. Today's food environment is quite different to that experienced by previous generations. Globally, an extensive variety of food and drink products are now available in most markets. But at the same time, the wide availability and heavy marketing of many of these products, especially those with a high content of fat, sugar, or salt, challenges efforts to eat healthily and maintain a healthy weight, particularly in children.

Furthermore, WHO stated that "Dietary factors and physical activity patterns have a strong influence on the energy balance equation and can be considered to be the major modifiable factors through which many of the external forces promoting weight gain act." This coincides well with a research conducted at a school in Khon Kaen, Thailand. It reported that obese students with parents whose BMI was more than 25 kg/m^2 tended to consume both significantly higher caloric and fat intakes than the normal students.(Yamborisut, Kittidilokkul et al. 1993) Another research reported that currently, Thai staples and side dishes are being replaced by diets containing higher proportions of fats and animal meat, and less vegetables and fruits. (Kosulwat 2002) This phenomenon is common in the big cities of Thailand, especially among inhabitants with higher incomes and the younger generation.(Popkin 2001) The National Nutrition Survey by the Division of Nutrition, Ministry of Public Health revealed that there is an increase in animal protein and percentage of energy intake from fat in the greater Bangkok population since the 1960.(Sirikulchayanonta, Ratanopas et al. 2011)

2.4.9 PHYSICAL ACTIVITY

Many research suggest that one of the greatest contributors to obesity, and also one of the deadliest is the decrease in physical activity among those of every age group. However, the term "physical activity" has been largely misleading taught of as "exercise". WHO clearly defines exercise as a subcategory of physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or

maintenance of one or more components of physical fitness is the objective. Physical activity includes exercise as well as other activities, which involve bodily movement and are done as part of playing, working, active transportation, house chores and recreational activities. The WHO also recommended at least 30 minutes of regular, moderate-intensity physical activity on most days.

According to Steven Blair, a professor of exercise science and epidemiology at the University of South Carolina's Arnold School of Public Health, there's increasing evidence that our sedentary lives are putting millions of us at increased risk of health problems and even early death. According to the Blair, 25% to 35% of all American adults are inactive, meaning that they have sedentary jobs, no regular physical activity program and are generally inactive around the house or yard.(Anderson 2007, Haskell, Lee et al. 2007)

There are many other studies pointing at the same direction. For instance, a study conducted by Blair in 1999, concluded that physical activity clearly attenuates many of the health risks associated with overweight or obesity. Moreover in his study, physical activity appears to not only attenuate the health risks of overweight and obesity, but active obese individuals actually have lower morbidity and mortality than normal weight individuals who are sedentary. Another literature (Vergara-Castaneda, Castillo-Martínez et al. 2010) reported that an increased risk of childhood overweight has been associated with the increased frequency of inactive leisure time pursuits, such as watching television and using the computer. Furthermore, the increased risk of childhood overweight has been associated with the increased frequency of inactive leisure time pursuits, such as watching television and using the computer.(Anderson 2007)

Globally, obesity and physical inactivity are two health issues affecting young people. In New Zealand, the most current statistics indicate that 33.6% of 11 to 14 year olds, and 27% of 15 to 18 year olds, are considered overweight or obese.(Hohepa, Schofield et al. 2004) Despite these high prevalence levels, New Zealand SPARC reported that only 38% of young people aged 13 to 17 years in New Zealand are considered physically inactive.(Salmon and Timperio 2007)

2.4.10 ENVIRONMENTAL FACTORS

Many research suggest that one of the greatest contributors to obesity beyond diet and physical activity is the environment. Many studies have focused on how the environment affects the increasing consumption of food and physical activity. A major conclusion studies share is that obesity results from a "complex interactions between diet, physical activity, and the environment."(Booth, Pinkston et al. 2005, Feng, Glass et al. 2010)

Moreover, the built-environment, has been suggested to be an important role in influencing obesity by creating a climate that promote increased energy consumption and a reduction in energy expenditure." Built-environment has been defined broadly as "any aspects of a person's surroundings which are man-made or modified which are external to the individual but within their environment."(Chawla and Thamarangsi 2014) Major environmental factors correlating to children physical activity were food availability, walkability, access to recreational facilities, land-use mix, and residential density.(Li, Harmer et al. 2009, Ding, Sallis et al. 2011)

Since children spend significant amount of their time in school, schools are critical settings that effect children.(Fox 2004, Sallis, Cervero et al. 2006) A recent study concluded that facilities and recreational space were significantly associated with high levels of physical activity in youth.(Nielsen, Bugge et al. 2011) While, other studies suggested that sports facilities, play equipment, playground, and zonal markings are important factors to consider in a school-setting to enhance physical activity.(Bower, Hales et al. 2008, Trilk, Ward et al. 2011, Chawla and Thamarangsi 2014) Acknowledging the importance of schools setting and the environment to children, the present study focused on school-based environmental factors that leads to obesity and intervening on the school-built environment as one of the intervention's components.

2.5 THAILAND'S SCHOOL HEALTH PROGRAM

The school setting provides several advantages and opportunities for delivering content and skills on health and development issues among students and teachers as

well as parents. Hence, school is a place where programs can be implemented for the better welfare of health. The Ministry of Public Health in collaboration with the Ministry of Education oversees the implementation of the school health programs.(WHO 2014)

In order to address food and nutrition problems, the Thai government has put an emphasis on participation of families and communities in food and nutrition by promoting food-based strategies to reduce nutritional problems. One of the initiatives the government took was promoting a School Lunch Program (SLP). The program has been implementing in all public primary schools (approximately 30,000 schools), and about 1.8 million primary school children and nearly 700,000 kindergarten children could rely on the School Lunch Program funding annually.(Jumpatong 2006)

The School Lunch Program in Thailand has been implemented for over 30 years (Kai et al., 2008). The main objective of the program is to reduce nutrition problem of students. It is noted that the severe malnutrition rate had been gradually decreasing over fifteen years during 1975-1990 from 36 percent to 18 percent.(Jumpatong 2006) The data taken by the Office of Basic Education Commission in the Ministry of Education showed that the rates have been further declining, with the malnutrition rate at 8.42% in the year 2005.(Council 2007) However, the actual condition of the program is not regularly reviewed by expertise and evaluation study at national level is still underway.(Kai, Pongpanich et al. 2008)

2.6. LIFE SKILLS

In recent years, there is a growing literature recognizing and giving evidence on how life skills are effective interventions for health programs. Life skills are defined as "psychosocial abilities for adaptive and positive behavior that enable individuals to deal effectively with the demands and challenges of everyday life. They are loosely grouped into three broad categories of skills: cognitive skills for analyzing and using information, personal skills for developing personal agency and managing oneself, and inter-personal skills for communicating and interacting effectively with others."(UNICEF. 2010) They are abilities for adaptive and positive behavior that enable individuals to deal effectively with the challenges of every life, which includes decision-making and problem-solving skills, creative thinking, effective communication, interpersonal relationship skills, self-awareness, empathy, coping with emotions, and coping with stress.

Many studies have focused on incorporating life skills into the interventions.(Story, Neumark-Stzainer et al. 2002, Young, Phillips et al. 2006) A recent childhood obesity review on Cochrane suggested that there is a strong evidence and support of the beneficial effects of life skills component on intervention programs on children age 6-12 years old.(Waters, de Silva-Sanigorski et al. 2011) It also recommended that "future research should embed life skills into the health, education, and care systems to achieve long sustainable impacts."(Waters, de Silva-Sanigorski et al. 2011)

Research suggests that life skills area significant factor in the development of adolescents' behavioral changes and considered an essential kind of school health promotion effort.(CDC 2013) One study (Papacharisis, Goudas et al. 2005) proved that by facilitating positive youth development through a life skills educational program combined with environments contributes to positive youth development. Another life skills intervention study (Botvin 1985) conducted in young American adolescents reported that children receiving life skills spent 46.9% of moderate to vigorous activity compared with 30.5% for control class. There was also a decline in television viewing (2 or more hours per day) time in children receiving life skills

intervention. A recent Australian study (Cohen, Morgan et al. 2015) in 460 primary school children reported higher physical activity (mean difference of 12.7 min/day), increased fitness (5.4 laps), and changes in dietary habits in the intervention group that received life-skills training program. These data contributes to the evidence of effectiveness of life-skills program. In this study, life skills were be incorporated into the all aspects of the multicomponent intervention.

2.7. HEALTH BELIEF MODEL

The Health Belief Model (HBM) is a psychological model that attempts to explain and predict health behaviors. This is done by focusing on the attitudes and beliefs of individuals. The HBM was first developed in the 1950s by social psychologists Hochbaum, Rosenstock and Kegels working in the U.S. Public Health Services. (Rosenstock 1990) The model was developed in response to the failure of a free tuberculosis health-screening program.

The HBM is based on the understanding that a person will take a health-related action if that person has a positive expectation that by taking a recommended action, he/she will avoid a negative health condition (healthy diet and being physically active will be effective at preventing overweight/obesity), and believes that he/she can successfully take a recommended health action (can be healthy comfortably and with confidence. The model includes four main components: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers.

Perceived susceptibility is a person's perception of the likelihood of getting a disease while perceived severity is that individual's opinion of behaviors change to avoid a consequence. Perceived barrier is an individual's assessment of the influences that facilitate or discourage adoption of the promoted behaviors, while perceived benefits is an individual's assessment of the positive consequences of adopting the behavior. Perceived benefits are the knowledge, attitude or beliefs of various actions that can be taken to reduce risk of the disease or illness.

Since then, the HBM has been adapted to explore a variety of long- and short-term health behaviors, including dietary and physical activity. Many studies have shown that HBM has been proven as an effective tool for intervention programs to reduce obesity (Becker et al., 1977; Atlantis et al., 2006; Andrews et al., 2010). One study (Collins, Okely et al. 2011) concluded a significant reduction in BMI-z score after 24 months of intervention that focused on the HBM on a child-centered and parents-centered diet and physical activity program. The study indicated that for sustainable intervention, both the duration and intervention model are extremely important.

One study (Kim, Ahn et al. 2012) clearly showed that perceived benefit of eating healthy food and perceived barrier for eat healthy food to had significant effects on behavioral intentions and was a valid measurement to use to determine behavioral intentions. These findings can enhance the extant literature on the universal applicability of the health belief model. For these above reasons, this study used the HBM to test the effectiveness of the multicomponent intervention program on children's nutritional status as indicated in the following figure (Figure 1).
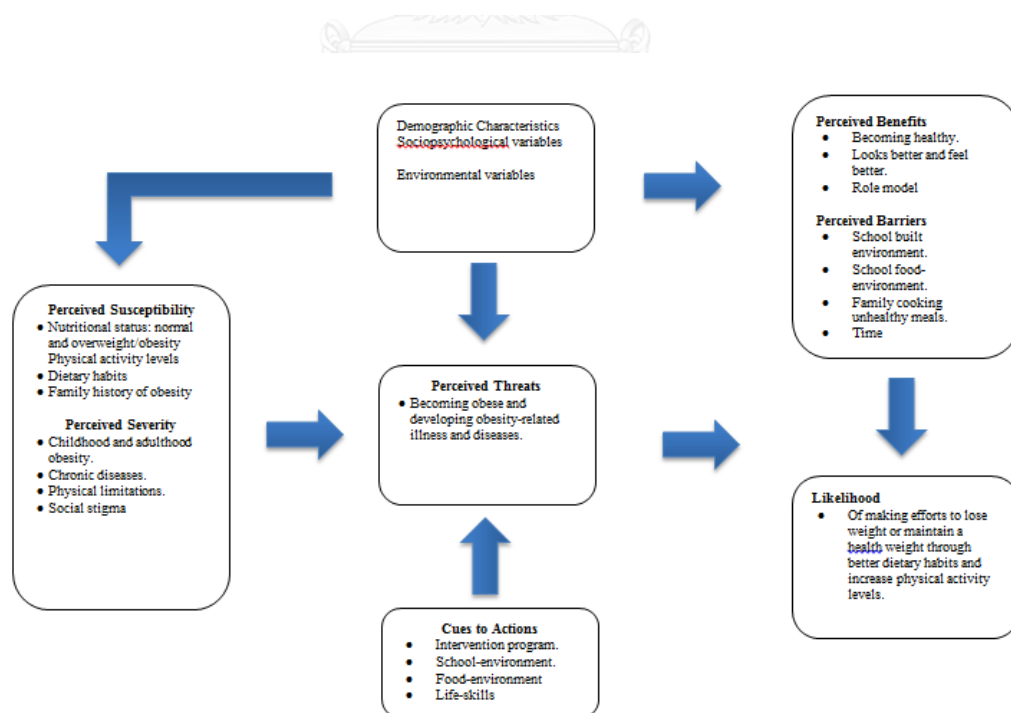
Figure 1 Health Belief Model (Ashford, 1999)

2.8 INTERVENTIONS FOR CHILDHOOD OBESITY

Obesity has become the most common pediatric chronic disease (WHO, 2010). As insufficient physical activity and poor nutrition due to the consumption of calorie-dense foods are acknowledged as primary mechanisms underlying the rise in excess body weight, little has been done to intervene.(Ebbeling, Pawlak et al. 2002) Early prevention and treatment of childhood obesity is necessary. Surprisingly, little has been done. Physical activity and nutrition are therefore the primary foci of health promotion initiatives aimed at preventing or reducing childhood overweight and obesity. A major intervention is to have an effective school programs in regard to preventing overweight and obesity, improving dietary quality, and increasing physical activity.

It is widely accepted that prevention is the best way to control childhood obesity. The preschool age has been recognized as the most effective period to start to care about obesity for the successful prevention of adulthood obesity. The major grounds of this recommendation are the tracking to adulthood obesity and the forming of a lifestyle including a dietary style.(Friedlander, Larkin et al. 2003)   Hence, intervening early in development will yield better results because life style habits are established early in childhood.(Greening, Harrell et al. 2011)

The most effective intervention to date focuses on both diet and physical activity.(Wang, Cai et al. 2015) A study conducted by Veugelers in 2005 on students from schools participating in a coordinated program that incorporated recommendations for school-based healthy eating programs exhibited significantly lower rates of overweight and obesity, had healthier diets, and reported more physical activities than students from schools without nutrition programs.(Veugelers and Fitzgerald 2005, Katz, O'connell et al. 2008) Another study(Nemet, Barkan et al. 2005) demonstrated that there are short and longer-term beneficial effects of a combined dietary behavioral-physical activity intervention among obese children. Multidisciplinary intervention (Gortmaker, Peterson et al. 1999) also resulted in significant positive effects on body weight, BMI, body fat, habitual activity, fitness, and body lipids.

The majority of the research studies on the prevention of childhood obesity have been conducted with children between the ages of 8 and 12 years, an age at which children have begun to determine their own eating habits.(Summerbell, Waters et al. 2005, Oude Luttikhuis, Baur et al. 2009)Therefore, true preventive and early treatment interventions should occur before and during at an age when children's eating patterns may be more easily influenced by parents and by environmental changes. Because parents have great influence over these factors, preventive/early treatment interventions may be most effective if targeted toward parents of those children who may be overweight, children who have a rapidly increasing BMI trajectory, and/or have a parent or first generation relative with obesity or obesity-related comorbidities.

Studies have shown school programs are effective in preventing childhood obesity.(Flynn, McNeil et al. 2006, Lissau 2007) Though, the reduced intake of dietary fat, increased intake of fruits and vegetables, and increase in physical activity are behaviors that have been targeted for population-based interventions among both children and adolescents to reduce obesity.(Stevens, Story et al. 1999, Sahota, Rudolf et al. 2001, Kriemler, Zahner et al. 2010)

In recent years, since the WHO Call for Action, there has been a growing understanding on the role the school-built environment plays in physical activity, and numerous interventions have been carried out. Many studies demonstrated that availability of facilities significantly predicted the level of physical activity and this is effective in increasing PA (Ridgers, Stratton et al. 2007, Griew, Page et al. 2010) Recent study in the USA suggested that active setting (uses of zonal markings) increases the level of children PA.(Bocarro, Kanters et al. 2012) Other studies reported that centers with supportive environments have higher moderate-to-vigorous physical activity, while children in schools with larger campus, buildings, and play areas were associated with increased levels of PA.(Chawla and Thamarangsi 2014)

2.9 Current Interventions in Thailand

In accordance with the WHO recommendations for Southeast Asia Region (SEARO), the Ministry of Public Health, Thailand (MOPH) advocated the health promoting schools under the umbrella of "Healthy Thailand." The objective of a "health promoting school" is to help students, school staff, parents, and the local community to gain knowledge, understanding, and correct health values to help them to participate in minding their own health status and that of those close to them.(WHO 2014) This includes taking care of the health of the environment as a basis for overall good health. The outcomes are assessed on 10 indicators as follow:

1. Establish a health promoting school policy
2. Adapt aspects of school management to allow effective health promotion
3. Conduct health promotion activities with collaboration between the school and the local community
4. Give appropriate attention to the school environment
5. Provide school health services such as physical exams and first aid
6. Provide school-based health education
7. Promote proper nutrition and consumption of safe foods
8. Promote regular physical exercise, sports, and healthy recreational activities
9. Provide counseling and social support for students
10. Support the health status of school staff

They 10 indicators can be concluded as to promote nutrition and consumption of safe foods, regular physical exercise, sports, and health recreational activities, alongside school-health education. However, the ratios for students' overweight/obese using weight-for-height z-scores should not exceed 7% to be considered as a good rating.(Health 2014) Furthermore, health-promoting schools are currently implemented in small scale, the evaluation is complex, and no private schools are involved.

Other interventions in Thailand included campaign by the Sweet Enough Network "Dek Thai Mai Kin Warn", emphasizing more on education program for

children, using health professional nurses and doctors. Their main objective is to reduce dental caries through education on soft drink/soda, and snack intake. The Food for Health "Aharn Phue Sukkha-pawa" pushes for better nutrition among children. They implement research to advocate mother's milk, less sugar consumption, and salt consumption. While the Bureau of Nutrition, MOPH actively works on "Rod Pung Rod Uan", an intervention focusing mainly on education program on food environment and policy advocacy. Another ongoing campaign is by the Food and Nutrition Policy for Health Promotion, by the International Health Policy Program (IHPP) focuses on intervening in the food environment, especially on "soda-free schools." They also push for policy on increase in taxation on soda-drinks. As all the aboved mentioned interventions are great campaign to reduce childhood obesity, there is no one specific intervention that combines a multi-component of diet, physical activity, and school-environment with a focus on life-skills to encourage better health.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 RESEARCH DESIGN

The research was a quasi-experimental design, two-groups, pretest and posttest design.

3.2 STUDY AREA

The study was conducted in 4 primary schools located in Bangkok, Thailand.

3.3 STUDY POPULATION

The study population was children of both sexes who are students studying in grade levels 4-5 (approximately age 10-12 years).

3.4 SAMPLE SIZE

Since the study was a quasi-experimental design, two-groups, pretest posttest design, the sample size calculation used a formula that compares differences between two groups. The sample size formula is

$$N = 2 \times \left(\frac{z_{1-\alpha} + z_{1-\beta}}{\delta_0} \right)^2 \times p \times (1-p)$$

Source: (Cochran 2007)

N= sample size;

$Z_{1-\alpha}$ = 1.96 (from Z table) as type 1 error of 5%;

$Z_{1-\beta}$ = 0.84 (from Z table) at 80% power;

p = pooled prevalence [Prevalence in group (p_1) + prevalence in group (p_2)] / 2;

δ_0 = difference in proportions in two groups ($p_1 - p_2$)

The sample size calculation was based on a previous study conducted in Bangkok, where the prevalence of childhood obesity was 20% (Sukhonthachit, Aekplakorn et al. 2014), and designed to detect a difference of 10% between the two groups. A power of 0.80 and two-sided 0.05 significance level (α=0.05) was used to calculate the

sample size.

$$N = \frac{2 \times (1.96 + 0.84)^2 \times 0.15(1 - 0.15)}{0.1^2} = 199$$

As a result, the sample size required in each group was 199. Assuming the parents refusal rate and the students refusal rate of 10 percent, an extra 20 students were chosen for each group, resulting with 219 per group, an overall sample size of 438 is required for the study.

3.5 SAMPLING TECHNIQUE

Bangkok schools were chosen due to the highest prevalence of childhood obesity prevalence. Recent study points that Bangkok children has the highest prevalence of overweight and obesity in the country.(Sukhonthachit, Aekplakorn et al. 2014) The sampling technique for choosing the schools was convenience on the willingness to participate in the study. Of all the schools willing to participate, four schools were chosen with similar socio demographic characteristics in the following items: school size, number of students, and socioeconomic status. Among all the schools with the above similar socio-demographic characteristics, two schools were randomly selected to receive the intervention program (intervention schools), or no intervention (the control schools).

Since, Thai schools in Bangkok have an average of 40 students per class with an average of 4 classes per grade level. This makes an expected 320 (40 students/class x 4 classes/grade x 2 grade levels) students per group, which makes it sufficient for the study.

Since, there were no significant differences among the participants' characteristics at baseline, no adjustments were made.

3.5.1 INCLUSION CRITERIA:

- Subjects who consent and voluntarily participated in the study.
- Parents consented for children to participate in the study.

- Both male and female children attending grade levels 4-5 studying in a Thai school.

3.5.2 EXCLUSION CRITERION:

- Children who have clinical problems such as, comorbidities (physical disabilities that does not allow them to participate in the research), and/or learning difficulties defined by the teacher.

 If any of the students meets the exclusion criteria, the other student in the list was randomly selected. Likewise for every parent or student that refused to participate, the next student in the list was chosen as replacement.

3.6 INTERVENTION

The intervention was a multicomponent healthy lifestyle program that focuses on the promotion of healthy eating and being physically active. The intervention was based on the principles of nutritional science and health belief model while adapted and focus on life-skills programs as a health promotion strategy. The life skills education intervention aimed to build self-awareness, assertiveness, negotiating skills, communication and decision-making, values clarification, and goal setting through a series of steps with a focus on dietary habits and physical activity. The life skills education intervention was developed with relevant curriculum, teaching materials, classes, and all sessions based on participatory approach.

The life-skills educational component was supported by environmental changes which included: (1) School involvement, (2) School food policy, (3) School environment, and (4) Parental outreach/participatory approach through workshops. The program was implemented over 6 month period in an academic year. Detailed of the lessons can be found in the "Healthy & Happy Life Skills Manual" in the Appendices section of this thesis.

A. Life-skills intervention component

Seven sessions on life-skills were implemented over the intervention period. The seven sessions consisted of knowing your body, healthy eating advice, healthy eating tips in the form of achievable weekly targets, instructions on the reading and understanding of food and drink labels and other simple advice designed to produce gradual changes in dietary habits, and making the right choices. Each session consisted of 50 minutes. Sessions were led out by both the research team and the school teachers. The 7 sessions were covered over seven weeks period as follow:

Session 1: Knowing My Body (Assessing one's nutritional status)
Session 2: Knowing My Body (What are the causes and effects of overweight/obesity on health?)
Session 3: Eating Well (Exploring *My Plate and food groups*)
Session 4: Eating Well (Healthy snacking)
Session 5: Eating Well (Growing healthy food/Gardening & Planting)
Session 6: Making Right Choices (Being physically active and looking good)
Session 7: Making Right Choices (Wise consumer spending)

Furthermore, a handbook and a logbook with the ISBN 978-974-11-07902-2 titled "Dek Thai Kin Dee Doo Dee" were given to each student to enhance the lesson on nutrition and life skills. The book is a child-friendly book which provided information about how many servings are required in each food group and provide quantities and information about type of food for children. For example, one bottle of carbonated drinks contains 8-10 teaspoons of sugar. The book also contains a 7-days log book for a child to fill what they have ate and can be examined by both the teachers and parents. The book has been translated into Thai and validated by ThaiHealth (สำนักงานกองทุนสนับสนุนการสร้างเสริมสุขภาพ).

To enhance physical activity, a multimedia CD titled "Dance Dai Doo Dee" were given to each student in the intervention school. The CD is equipped with 5 dances where students can enjoy dancing through the steps given. Each dance/song is roughly 5 minutes, and students learned the steps to the dance alone away from school.

The life-skills educational method has adopted a highly participatory approach. For details in content, methodology, and duration, attached are the details in Appendix D: Healthy & Happy Life Skills Program.

B. Environmental components

1. School Involvement

Upon the agreement by the school to participate in the study, the researcher and team discussed current obesity problems within school and present ways to help reduce the problem through a school-based and participatory approach program. A publication for the "โครงการพัฒนาศูนย์เรียนรู้เด็กไทยดูดี มีพลานามัย "with ISBN 978-974-11-0756-8 were given to the school as a guideline to understand 7-major topics study were implemented in the school, which includes the following: (see attached manual)

I.   Why should we be healthy?
II.   How do we know our health status?
III.   Ways to help make one another (friends) healthy.
IV.   Skills to be discipline (health conscious).
V.   Knowledge and skills for health.
VI.   Self-sufficient for health.
VII.   Nutritional status

Baseline characteristics of the students and their nutritional status were presented to the school administrators and teachers to undermine further actions during the intervention period.

2. School-Food Policy

In all the intervention schools, all of food sold in schools were monitored and changed to meet the guidelines. Schools were asked not to sell carbonated drinks in the intervention schools. Beverages were requested to be limited to 100% juice, water, and low-fat milk. Intervention schools with vending machines that provide soda,

chips, and candies were asked to be removed. Vendors were asked to provide healthier food choices to children.

3. School Environment

Teachers in the intervention schools were asked to set their classroom to allow more physical activity. Clearer markings and zonal markings were used in the intervention schools. Although, it is not within the school's authority to ask vendors around the school to stop selling unhealthy food, teachers and administrators requested vendors to sell more healthy food, giving students more choices. School staffs and students were given a comic book on "Dek Thai Doo Dee", with games to encourage, enforce, and stimulate healthy choices with the school public. The comic book also has quantity and nutritional values for common food a person eats in order to assess one's diet.

4. Parental Participation

Two times 1-hr workshop was scheduled to meet the family members. Family members were reached through home and school association meetings, report card, parent education meeting, and monthly nutrition/physical activity workshops. The workshops were arranged in schools ground to presents findings of the baseline nutritional status and presents a platform for discussing and education parents about the importance of making healthy food choices. The sessions were led by Dr. Chutima Srikulchayanonta, a pediatrician with the researcher and team presented. Fifteen minutes were given for a presentation on the findings, fifteen for informing parents about the ongoing research and plans. The last 20 minutes were given for Q&A by parents, which addressed by the researcher and team. Each parent were also given a handbook on "Dek Thai Doo Dee Mee Pla Anamai", a publication with ISBN 978-974-11-0756-8. Parents and students were encouraged to purchase healthy snacks, be less sedentary, be more physical active, eat more fruits and vegetables. Parents were discouraged from sending sweets or buying unhealthy snacks for their children.

3.7 DATA COLLECTION

3.7.1 DATA COLLECTION INSTRUMENTS

Standard calibrated weighing scales and stadiometers were used to determine weight, height, to compute nutritionals status through weight-for-height z-scores. Height was measured by Microtoise (standardized portable stadiometer), which measures up to two meters. Height was measured in centimeters to the nearest 0.1 cm, with the children standing straight without shoes, heels together, and child's heals, buttocks, shoulders, and head vertically positioned. A digital standardized weighing scale SECA scale model 750 was used to measure the weight of the child. Weight was measured to the nearest 0.1 kg. Measurements of weight and height strictly followed the CDC Atlanta guidelines for measuring children (see attached Appendix A). In addition, the researcher and team on site observed food availability and food purchasing habits of students during the day of the data collection.

Children nutritional status was assessed by criteria listed in the Institute of Nutrition Research, Mahidol University (INMU) Thai Growth Program as weight for height (WFH) (INMU, 2002). The standard criteria used were that WFH from –2 SD to +2SD as "normal," over 2SD as "overweight" and less than -2SD as "underweight."

Students' socioeconomic status, knowledge, attitude, and practice on overweight/obesity, diet and physical activity, alongside school environment were measured through a self-administered questionnaire. The questionnaire consisted of 75 items classified as the following:

  I.   Socioeconomic: 4 questions
 II.   Knowledge on obesity, diet, and PA: 26 questions
III.   Attitude towards obesity, diet and PA: 6 questions
 IV.   Practice towards obesity, diet, and PA: 33 questions
  V.   School environment: 6 questions

Blood-samples were used for biological markers in the study. Participants were

instructed to fast after 20:00 h. (10-12 hours before the samples were collected), except water. A fasting venous blood sample of 3-5 milliliters from each participant were collected in the morning before breakfast by professionals nurses and technicians. Blood samples were kept in an ice-box (4°C) and sent to the Office of Public Health and Environment Technology Services (OPHETS) laboratory, Faculty of Public Health, Mahidol University for automated analysis of FPG and lipid profiles (TC, TG, LDL-C, HDL-C) by the enzymatic method (Beckman Coulter, AU680).

3.7.2 VALIDITY AND RELIABILITY

The English version of the questionnaire was taken from previous validated studies. Details are as follow:

- Questions on Knowledge, Attitude, and Practice on overweight/obesity were taken from previous study.(Chawla and Panza 2012)

- Questions on Knowledge and Attitude on dietary habits were also taken from the previous study.(Chawla and Panza 2012)

In this section, questions on dietary habit' practices were modified and adjusted from previous Thai study.(Sirikulchayanonta, Ratanopas et al. 2011)

- Knowledge, Attitude, and Practice on physical activity was taken from standardized physical activity questionnaire (GPAQ, WHO) and was also in the previous Thai childhood obesity study.(Chawla and Panza 2012)

-Six questions on school environment were adopted from the Neighborhood Impact on Kids (NIK) and ISCOLE School Environment Questionnaire. The original questions were than modified by Thai experts (Assisstant Professfor Dr. Chantrapa Hudtagosol and Dr. Kitti Sranacharoenpong) to meet the Thai context. The questionnaire included items related to school facilities, health eating and physical activity policies, availability of healthy and unhealthy foods, and promotion of health.

After the content validity of the complete questionnaire, construct validity was conducted by nutritionist (Assisstant Professfor Dr. Chantrapa Hudtagosol) and leading public health researcher (Dr. Kitti Sranacharoenpong) from Mahidol University. The questionnaire was revised and modified (length, vocabulary, and sections) as per their comments.

The validated questionnaire was then translated from English into Thai by a bilingual Thai public health researcher.

A back translation from Thai to English was conducted with input from both Ms. Kherika Mahachinarit (fully bilingual in Thai-English, graduate from Sripathum University, Thailand, and with no knowledge of the original English questionnaire). When there were discrepancies between the original English and back-translated questionnaire, the translators were invited to come to an agreement of the translation. For the few questions that an agreement was not reached, a third translator, Mr. Jiraphat Wongmahachaoroen (fully bilingual in Thai-English with postgraduate from University of Warwick, UK in Science) was called in mediate and agree on the translation.

A pilot study consisting of 34 subjects was conducted in Phayathai School, a public school that shares similar school characteristics (classroom size, number of classes for each grade level, and socioeconomic status) on February 24th, 2015 to test the reliability of the questionnaire. Certain modifications on the section of dietary questions (3 questions on Q.32) and length of the questionnaire were adjusted.

Reliability of the questionnaire was conducted using Cronbach's alpha coefficient for internal consistency. The reliability of the questionnaire (42 items on knowledge and attitude) was tested on 34 participants had a score of 0.82. When the questionnaire was analyzed separately, the reliability on the knowledge questions (43 items) alone was 0.73, while attitude questions (13 items) were 0.55. Though, the internal-consistent reliability of knowledge and attitude questions alone may seem less, the total reliability of the questionnaire was satisfactory.

3.7.3. DATA COLLECTION PROCEDURES

Prior to conducting the study, permission was obtained from the Managing Director and the Principal of the four schools, but subject to ethical approval of the study. Written consents were obtained from participating children's parents for permission. Measurements and data were collected in one academic year. Measures were performed once in the beginning (and after 6 months of the intervention period).

The baseline measures were collected on June 2015. Professional nurses and technicians first collected blood samples in the morning on those who consented to participated in the study. After the completion of blood samples, students were given breakfast. After breakfast, the students' teacher in the presence of the researcher or research assistants administered baseline surveys. The researcher/research assistants were present to minimize bias in the administration of the surveys, and to explain questions asked during the questionnaire filling processing Thai and/or in English. The researcher thoroughly explained the objective of the research and the components of the questionnaire to students before they answered the questionnaire.

After completion of the questionnaire, the researcher and/or research assistant measured height and weight of students, respectively, using the same standard protocols provided by CDC Standard of Measurement in order to reduce inter-observer variability. The measurement was taken upon the completion of the self-administered questionnaire. The researcher only took height and weight measurements and recorded it into the questionnaire. Post-data were collected in the same manner after the completion of the intervention period in December 2015.

3.8 DATA ANALYSIS

Data from the questionnaire and anthropometric measurements were used for analysis. Questions under knowledge section were given "1" for correct answer and "0" for wrong answer. Questions on attitude section were given "3" for Positive, "2" for Neutral/Uncertain and "1" for Negative response. Practice questions on obesity and physical activity were given "1" for good practice and "0" for poor practice. Practice questions on dietary habits had scoring for positive health effects and negative health effects. Scores for positive health effects were 1 for never/rarely, 2 for sometimes (1-2 days/week, 3 for 3-4 days/week, 4 for 5-6 days/week, and 5 for 7 days/week. Scores for negative health effects (unhealthy eating habits) were scored in the reverse direction. Mean scores in each group were analyzed. Sum of score for each categorical (knowledge, attitude, practice) were further computed and tested for associations.

All anthropometric data were analyzed using Statistical Package for Social Sciences (SPSS version 17). Descriptive statistics of continuous variables was presented as frequencies, percentage distribution, and means ± standard deviation (SD), while median was used to test data with non-normal distribution. Categorical variable was presented as absolute and relative frequencies.

Student t-tests and Chi-square tests for baseline characteristics were used to compare intervention and control groups at baseline and post-treatment. Outcome measures at follow were entered as dependent variables and intervention vs control as independent variables. Student's independent t test were used to evaluate the significance of mean differences after the intervention period between the intervention and control groups. Students' paired t tests were used to evaluate the significant of changes within group at baseline and intervention. Chi-squares tests were used to test for significant differences for categorical data. The means difference between the two groups were used to determine the absolute intervention effect. General linear model were used to analyze nutritional status and blood lipid profiles of the respondents. All analysis used a 95% confidence interval (CI), and a p-value of less than 0.05 to be considered statistically significant.

3.9 ETHICAL CONSIDERATION

The study was reviewed and approved by the Institutional Review Board, Faculty of Public Health, Mahidol University Ethical Code Evidence No. 2014-196. Since the study was conducted in schools, an agreement and consent were obtained from the school authorities, children, and children's parents. A written consent form was sent to parents to seek permission of their child/children to participate in the study. Only those who consent participated in the study. All participants were assured that the information obtained from the questionnaire were utilized purely for this study and confidentiality of the respondents were maintained throughout the study. Children found to be overweight and/or obese were advised to seek medical attention and further observed.

CHAPTER IV

RESEARCH RESULTS

The research was a quasi-experimental study to evaluate the effectiveness of a multicomponent school-based life skills intervention program on children's nutritional status. Four hundred and ninety students were selected as subjects for the study intervention and control groups (see Figure 2). The results of the study are presented in the following orders:

4.1 Life-skills and environmental components of the intervention

4.2 General characteristics of the study populations.

4.3 Knowledge, attitude, and practice on diet, physical activity, and overweight/obesity among the two groups at baseline.

4.3 Distribution of school environmental factors among the two groups at baseline.

4.4 Secondary Outcomes (nutritional status, cholesterol, triglycerides, HDL, and LDL levels) of school children among the two groups at baseline.

4.5 Knowledge, attitude, and practice on diet, physical activity, and overweight/obesity among the two groups after intervention.

4.6 Distribution of school environmental factors among the two groups after intervention.

4.7 Secondary outcomes (Nutritional status, cholesterol, triglycerides, HDL, and LDL levels) among the two groups at baseline of school children among the two groups after intervention.

4.8 Behavioral outcomes changes among the two groups after intervention.

4.9 Secondary outcomes changes among the two groups after intervention.
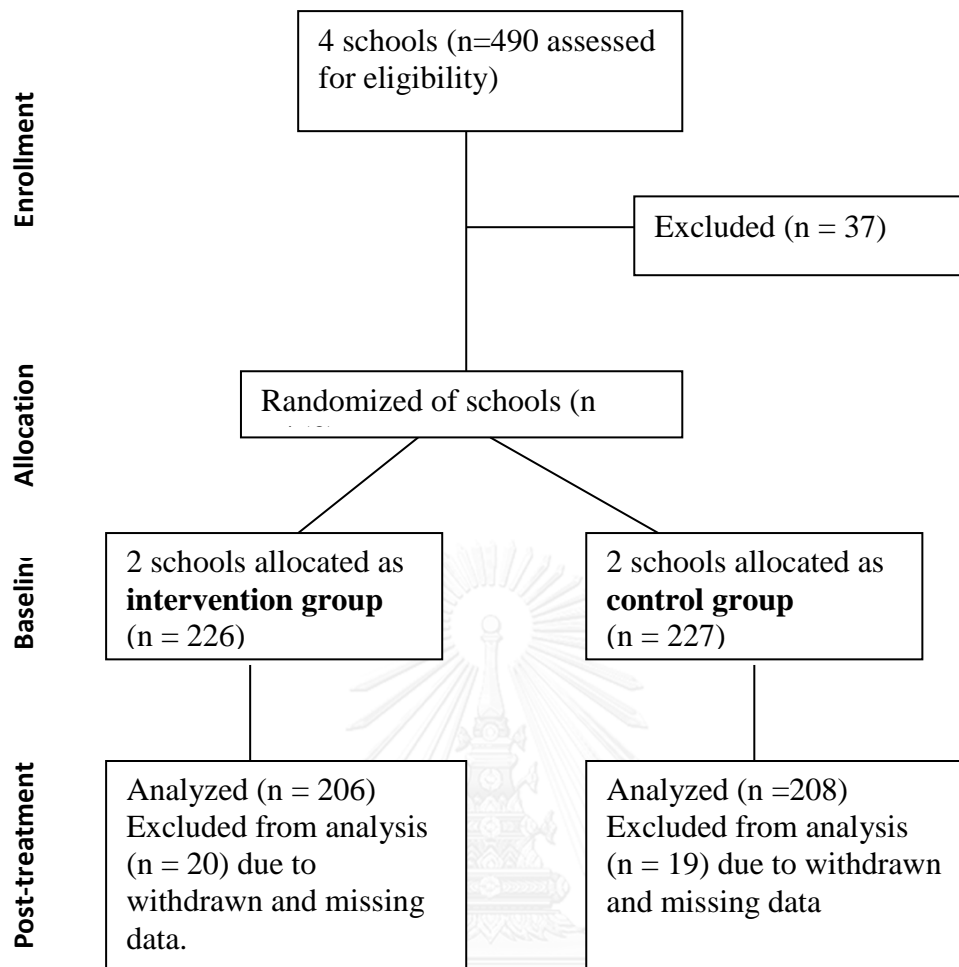
Figure 2 Flow chart of study participants.

4.1 Life skills components of the intervention

Life skills educational intervention included a total of 7 sessions that were conducted in 2 intervention schools. Six classes in grade 4 (4 from Anuban Watnangong and 2 from Anubanwatparinayok) 6 classes in grade 5 ((4 from Anuban Watnangong and 2 from Anubanwatparinayok) joined the sessions. An average of 28 students per class in Grade 4, and 27 students in Grade 5 joined the sessions.

Seven detailed lesson plans were developed to use in the 7 sessions. Three PowerPoint presentations were used, five activities were held, one gardening/planting session, and one gaming session were used throughout the program. Three books and 3 CDs were given as reinforcement. All the sessions were led by the researcher and team, except one session. Session on gardening and planting (Session 5) was led by school teachers after a detailed lesson plan was given due to accessibility to the school facilities and to give school and teachers a more prominent role in the program.

At the end of each the 6 sessions led by the researcher and team, an assessment/activity was given to the students. Scores were given for the right answer. Figure 3 displays the results of the participants in each session categorized in to "Good (above 80%), Moderate (60-80%), and Low (below 60%) scores.
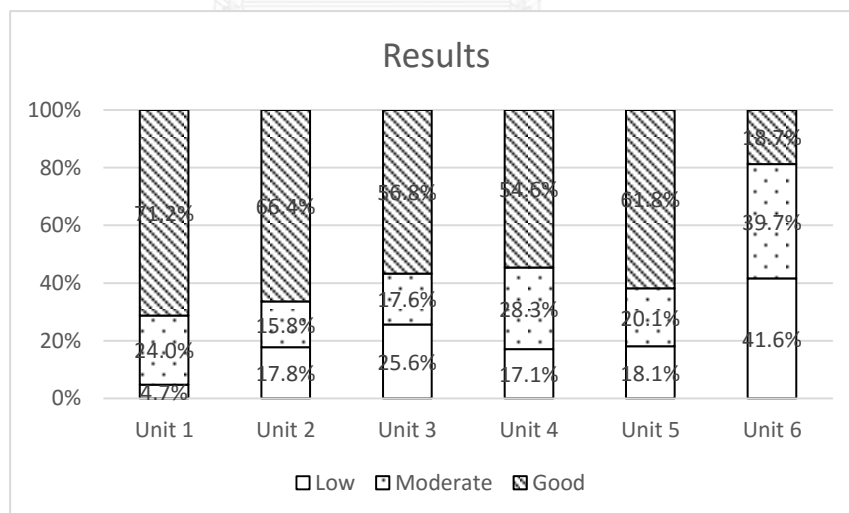
Figure 3. Results of correct score on assessment towards the end of each session.

4.2 General characteristics of the populations

The study included 490 subjects. Two hundred and thirty –six subjects from Wat Parinayok and Wat Nangnong were chosen into the intervention group, while two hundred and fifty-four subjects from Wat Phibulwaet and Wat Samsen were in the control group. General characteristics included gender, age, educational level, pocket money, and self-perception of weight are displayed on Table 4.

Table 4 Comparisons data of the general characteristics at baseline.

Dietary Practice	Intervention (n=236)		Control (n=254)		
	Number	Percent	Number	Percent	*p*-value*
Gender					0.303
Male	117	49.6	111	43.7	
Female	119	50.4	143	56.3	
Age (years)					
8	1	0.4	0	0	
9	85	36	61	24.2	
10	125	53	137	54.4	
11	25	10.6	53	21	
12	0	0.4	1	0.4	
Mean	9.73		10.00		**0.636
Educational level					0.055
Prathom (Grade) 4	106	44.9	92	36.2	
Prathom (Grade) 5	130	55.1	162	63.8	
Daily allowance	n=225		n=227		0.449
<50 baht	138	61.3	129	56.8	
50-100 baht	77	34.2	92	40.5	
101-200 baht	8	3.6	5	2.2	
>200 bath	2	0.9	1	0.4	
					0.704
Self-perception of weight	n=224		n=227		
Underweight	42	18.8	44	19.4	
Normal	116	51.8	109	48	
Overweight	66	29.5	74	32.6	

p-value <0.05 was calculated with Pearson Chi-Square.
** *p*-value of mean age was calculated with independent *t*-test.

Majority of the respondents in the intervention and control groups were 10 years-old, with intervention 53% and control 54.4% respectively. Over 90% of the respondents received a daily allowance of less than 100 baht/day. Distribution of gender among the intervention group was very similar, while there was 12.7% difference in the control group. However, none of the socioeconomic variables were significantly different. The number of respondents for daily allowance and self-perception of weight were fewer due to missing data.

4.3 Knowledge, attitude, and practice on overweight/obesity, diet, and physical activity among intervention and control groups as baseline.

Table 5 displays the results of the children's knowledge on overweight/obesity section from the questionnaire. Series of questions were asked to the respondents on knowledge on overweight/obesity. There were 4 questions on knowledge, with one right answer for each question.

Majority of the questions (3 questions) were answered correctly in both groups. The lowest knowledge score was observed on the daily caloric intakes in both intervention (11.1%) and control (8.4%) groups. Score on knowledge of the effects on obesity were significantly different in both groups, with control scoring 11.1% higher. No other significance differences were observed in other questions.

Table 5 Distribution of knowledge questions on overweight/obesity answered correctly among intervention and control groups at baseline.

	Answer Correctly				
	Intervention (n=226)		**Control** (n=227)		
Knowledge on overweight/obesity	Number	Percent	Number	Percent	*p*-value
Daily 1600-1700 kcal calorie intake.	25	11.1	19	8.4	0.326
Effects of obesity	152	67.3	178	78.4	**0.009**
Causes of obesity	157	69.5	176	77.5	0.052
Ways to prevent obesity	154	68.1	162	71.4	0.455

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 6 displays the results of the children's knowledge on diet section from the questionnaire. Series of questions were asked to the respondents on knowledge on overweight/obesity. There were 22 questions on knowledge, with one right answer for each question.

Table 6 Distribution of knowledge questions on diet answered correctly among the intervention and control groups at baseline.

	Answer Correctly				
	Intervention (n=226)		**Control** (n=227)		
Knowledge on diet	Number	Percent	Number	Percent	*p*-value
Servings of rice (carbohydrates)	133	58.9	136	59.9	0.818
Servings of vegetables	54	23.9	55	24.2	0.933
Servings of meat	154	68.1	168	74.0	0.168
Servings of fruits	38	16.8	23	10.1	0.037
Servings of milk	91	40.3	109	48.0	0.083
Meals per day	204	90.3	216	95.2	0.045
Most important meal of the day	220	97.4	224	98.7	0.309
Benefits of brown rice	104	46.0	124	54.6	0.067
Effects of high fat foods	145	64.2	164	72.3	0.065
Benefits of vegetables and fruits	157	69.5	190	83.7	**0.001**
Healthy type of milk	204	90.3	217	95.6	0.027
Healthy type of drinks	213	94.3	220	96.9	0.167
Effects of soft drinks consumption	143	63.3	173	76.2	**0.003**
Types of healthy snacks	145	64.2	177	77.9	**0.001**
Types of unhealthy snack	176	77.9	191	84.1	0.089
Unhealthy form of oil	160	70.8	193	85.0	**0.001**
Effects of fried food	163	72.1	187	82.4	**0.009**
Daily sugar consumption	130	57.5	142	62.6	0.274
Effects of high salt consumption	207	91.6	215	94.7	0.188
Ways to reduce fats	99	43.8	113	49.8	0.203
Functions of a food label	163	72.1	185	81.5	**0.018**
Interpreting a food label (INT n= 163, CT n=185)	63	38.7	42	22.7	**0.020**

p-value <0.05 was calculated with Pearson Chi-Square.

Seven questions on the knowledge of diet were significantly different among intervention and control groups. The lowest knowledge score was observed on the question on amount of servings of fruits per meal in both intervention (16.8%) and control (10.1%) groups. Over a quarter of participants in the intervention group did not know the functions of a food label as compared to 18.5% in the control group.

Table 7 displays the results of the children's knowledge on physical activity section from the questionnaire. Series of questions were asked to the respondents on knowledge on overweight/obesity. There were 4 questions on knowledge, with one right answer for each question.

Table 7 Distribution of children's correct answer of knowledge on physical activity among intervention and control groups at baseline.

| | Answer Correctly | | | | |
| Knowledge on physical activity | **Intervention** (n=226) | | **Control** (n=227) | | |
	Number	Percent	Number	Percent	*p*-value
PA is essential for health	218	96.5	224	98.7	0.125
Effects of PA on health	156	69.0	194	85.5	**0.001**
Frequency of PA	41	18.1	28	12.3	0.085
Duration of PA per session	23	10.2	40	17.6	**0.023**

*p-value <0.05 was calculated with Pearson Chi-Square.

Majority of participants knew that the importance of PA on health. However, both intervention and control groups scored marginally low on the frequency (18.1%, 12.3%) and duration (10.2%, 17.6%) of PA. Questions on effects and duration of PA were significant different between the groups.

Table 8-10 displays the results of the children's attitude on overweight/obesity, diet, and physical activity among the two groups at baseline. The questionnaire composed of 2 questions that tested the attitude of respondents on each category. Respondents were given 3 choices for each attitude question as follow: Positive, Negative, Neutral/Uncertain.

Attitude towards the question on overweight children are unhealthy were very similar, with intervention and control groups scoring 89.8% and 90.3% respectively. Only one attitude question on overweight were significantly different with intervention group having less positive as compared to control.

No significant differences were observed on question towards attitude on diet between intervention and control groups. Respondents' attitudes were similar for both the dietary questions. Majority of respondents agree that eating fast food will make you overweight and that fast food restaurants should not offer toys.

Table 8 Distribution of children's attitude on overweight/obesity among intervention and control groups at baseline.

Attitude on overweight/obesity	Intervention (n=226)		Control (n=227)		p-value
	Number	Percent	Number	Percent	
Overweight children are less attractive.					**0.001**
Positive	129	57.1	180	79.3	
Negative	37	16.4	32	14.1	
Neutral/Uncertain	60	26.5	15	6.6	
Overweight children are unhealthy.					0.954
Positive	203	89.8	205	90.3	
Negative	13	5.8	12	5.3	
Neutral/Uncertain	10	4.4	10	4.4	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 9 Distribution of children's attitude on diet among intervention and control groups at baseline.

Attitude on diet	Intervention (n=226)		Control (n=227)		p-value
	Number	Percent	Number	Percent	
Fast food restaurants should not offer toys because they encourage kids to eat unhealthy food.					0.072
Positive	163	72.1	183	80.6	
Negative	41	18.1	25	11.0	
Neutral/Uncertain	22	9.7	19	8.4	
Eating too much fast food will make you overweight.					0.139
Positive	195	86.3	209	92.1	
Negative	9	4.0	5	2.2	
Neutral/Uncertain	22	9.7	13	5.7	

*p-value <0.05 was calculated with Pearson Chi-Square.

Majority of respondents from both groups (87.6% and 93.4%) agreed that physical activity can be fun. However, there were more respondents from the intervention group were neutral/uncertain that physical activity can be fun and it will decrease television viewing and playing computer games time.

Table 10 Distribution of children's attitude on physical activity among intervention and control groups at baseline.

Attitude on physical activity	Intervention (n=226)		Control (n=227)		p-value
	Number	Percent	Number	Percent	
Physical activity can be fun.					0.110
Positive	198	87.6	212	93.4	
Negative	9	4.0	5	2.2	
Neutral/Uncertain	19	8.4	10	4.4	
Physical activity will decrease my time to watch television or play computer games					0.419
Positive	25	11.1	22	9.7	
Negative	184	81.4	194	85.5	
Neutral/Uncertain	17	7.5	11	4.8	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 11 displays the results of the children's practice on overweight/obesity. More respondents in the control group were sleeping the recommended amount as compared to the intervention group. However, the differences in the result were not statistically significant.

Table 11 Distribution of children's amount of sleep per night among intervention and control groups at baseline.

Obesity Practice	Intervention (n=226)		Control (n=227)		p-value
	Number	Percent	Number	Percent	
Daily amount of sleep					0.052
< 8 hrs/day	59	26.1	45	19.8	
8-10 hrs/day	144	63.7	168	74.0	
> 10 hrs/day	23	10.2	14	6.2	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 12 Distribution of children's dietary habits on healthy food consumption among intervention and control groups at baseline.

Dietary Practice	Intervention (n=226)		Control (n=227)		
	Number	Percent	Number	Percent	*p*-value
Vegetable consumption					**0.056**
None	26	11.5	19	8.4	
1-2 times/week	63	27.9	64	28.2	
3-4 times/week	51	22.6	58	25.6	
5-6 times/week	35	15.5	53	23.3	
Everyday	51	22.6	33	14.5	
Consumed recommended amount of vegetables per meal.	56	24.8	51	22.5	0.527
Fruit consumption					0.117
None	5	2.2	5	2.2	
1-2 times/week	30	13.3	45	19.8	
3-4 times/week	62	27.4	52	22.9	
5-6 times/week	60	26.5	71	31.3	
Everyday	69	30.5	54	23.8	
Consumed recommended amount of fruit per meal.	108	47.8	106	46.7	0.781
Boiled food consumption					0.159
None	12	5.3	12	5.3	
1-2 times/week	86	38.1	96	42.3	
3-4 times/week	57	25.2	67	29.5	
5-6 times/week	38	16.8	35	15.4	
Everyday	33	14.6	17	7.5	
Consumed recommended 6 glasses of water daily.					**0.001**
None	44	19.5	18	7.9	
1-2 times/week	47	20.8	48	21.1	
3-4 times/week	36	15.9	37	16.3	
5-6 times/week	27	11.9	60	26.4	
Everyday	72	31.9	64	28.2	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 13 Distribution of children's dietary habits on sweetened unhealthy food consumption among intervention and control groups at baseline.

Dietary Practice	Intervention (n=226)		Control (n=227)		
	Number	Percent	Number	Percent	*p*-value
Soft-drinks consumption					**0.031**
None	20	8.8	29	12.8	
1-2 times/week	135	59.7	139	61.2	
3-4 times/week	27	11.9	33	14.5	
5-6 times/week	21	9.3	14	6.2	
Everyday	23	10.2	12	5.3	
Sweetened-milk consumption					**0.026**
None	31	13.7	16	7.0	
1-2 times/week	22	9.7	16	7.0	
3-4 times/week	52	23.0	43	18.9	
5-6 times/week	82	36.3	112	49.3	
Everyday	39	17.3	40	17.6	
Processed sweetened yogurt consumption					
None	13	5.8	13	5.7	**0.034**
1-2 times/week	23	10.2	18	7.98	
3-4 times/week	46	20.4	48	21.1	
5-6 times/week	90	39.8	117	51.5	
Everyday	54	23.9	31	13.7	
Processed fruit juices consumption					**0.007**
None	76	33.6	45	19.8	
1-2 times/week	19	8.4	23	10.1	
3-4 times/week	42	18.6	60	26.4	
5-6 times/week	89	39.4	99	43.6	
Everyday	0	0.0	0	0.0	
Sweetened bakery products consumption					0.254
None	15	6.6	9	4.0	
1-2 times/week	20	8.8	21	9.3	
3-4 times/week	44	19.5	34	15.0	
5-6 times/week	107	47.3	129	56.8	
Everyday	40	17.7	34	15.0	
Chocolate and candies consumption					0.249
None	22	9.7	11	4.8	
1-2 times/week	19	8.4	21	9.3	
3-4 times/week	43	19.0	37	16.3	
5-6 times/week	107	47.3	115	50.7	
Everyday	35	15.5	43	18.9	

SSB consumption					0.136
None	27	11.9	16	7.0	
1-2 times/week	32	14.2	27	11.9	
3-4 times/week	54	23.9	45	19.8	
5-6 times/week	87	38.5	105	46.3	
Everyday	26	11.5	34	15.0	

SSB: sugar sweetened beverages.

*p-value <0.05 was calculated with Pearson Chi Square.

Table 12 displays the results of the children's dietary habits on healthy food consumption among intervention and control groups at baseline. Less than 25% of respondents on both groups consume the recommended amount of vegetables per day, while only 47.8% in the intervention and 46.7% in the control groups consumed the recommended level of fruits. Recommended water consumption of 6 glasses a day were also low among the respondents in both groups.

Contrary, consumption of soft-drinks and sugar sweetened beverages were high in both groups. Results on sweetened unhealthy food consumption are displayed on Table 13. Significantly differences were observed on soft-drinks, sweetened-milk, processed yogurt, and processed fruit juices among the two groups. Very high percentage of respondents in both groups (62.8% intervention and 69.6% control) consumed chocolate and candies more than 4 times/week.

Table 14 displays the results of the children's dietary habits on other unhealthy food consumption at baseline. Fast food (over 50%) and fried food consumption (over 75%) remain high (more than 4 times/week) in both groups. Only 14.2% in the intervention group and 7.9% in the control group did not consume high caloric snacks.

Table 14 Distribution of children's dietary habits on other unhealthy food consumption among intervention and control groups at baseline.

Dietary Practice	Intervention (n=226)		Control (n=227)		p-value
	Number	Percent	Number	Percent	
Stewed pork/steamed chicken rice consumption					0.084
None	24	10.6	16	7.0	
1-2 times/week	21	9.3	16	7.0	
3-4 times/week	48	21.2	40	17.6	
5-6 times/week	107	47.3	137	60.4	
Everyday	26	11.5	18	7.9	
Fried food consumption					0.201
None	30	13.3	17	7.5	
1-2 times/week	33	14.6	27	11.9	
3-4 times/week	59	26.1	72	31.7	
5-6 times/week	93	41.2	97	42.7	
Everyday	11	4.9	14	6.2	
Coconut curried rice consumption					0.358
None	16	7.1	7	3.1	
1-2 times/week	12	5.3	14	6.2	
3-4 times/week	26	11.5	31	13.7	
5-6 times/week	85	37.6	91	40.1	
Everyday	87	38.5	84	37.0	
High caloric snacks consumption					0.318
None	32	14.2	18	7.9	
1-2 times/week	24	10.6	24	10.6	
3-4 times/week	51	22.6	52	22.9	
5-6 times/week	98	43.4	109	48.0	
Everyday	21	9.3	24	10.6	
Fast food consumption					0.155
None	24	10.6	10	4.4	
1-2 times/week	19	8.4	23	10.1	
3-4 times/week	33	14.6	33	14.5	
5-6 times/week	119	52.7	125	55.1	
Everyday	31	13.7	36	15.9	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 15 displays the results of the children's dietary habits on proteins and fats consumption among the intervention and control groups at baseline. Significant differences were observed on the recommended amount of meat consumption per meal and amount of milk per day. Control groups had significantly higher amount of consumption at 55.9% and 49.3% as compared to intervention at 45.1% and 29.6%

respectively.

Table 15 Distribution of children's dietary habits on proteins and fats consumption among intervention and control groups at baseline.

Dietary Practice	Intervention (n=226)		Control (n=227)		p-value
	Number	Percent	Number	Percent	
Meat consumption					0.815
None	4	1.8	1	0.4	
1-2 times/week	39	17.3	42	18.5	
3-4 times/week	49	21.7	51	22.5	
5-6 times/week	52	23.0	54	23.8	
Everyday	82	36.3	79	34.8	
Consumed recommended amount of meat per meal.	102	45.1	127	55.9	**0.024**
Milk consumption					0.257
None	6	2.7	5	2.2	
1-2 times/week	48	21.2	32	14.1	
3-4 times/week	26	11.5	27	11.9	
5-6 times/week	46	20.4	61	26.9	
Everyday	100	44.2	102	44.9	
Consumed recommended amount of milk per day.	67	29.6	112	49.3	**0.001**

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 16 displays the results of the children's dietary habits on carbohydrates consumption among the intervention and control groups at baseline. White rice consumption was high among the two groups, with 55.3% in intervention and 43.7% control. Significantly higher consumption of brown rice was observed in the control group. However, only 50.4% in the intervention and 52% in the control group consumed the recommended amount of rice per meal.

Table 16 Distribution of children's dietary habits on carbohydrates consumption among intervention and control groups at baseline

Dietary Practice	Intervention (n=226)		Control (n=227)		p-value
	Number	Percent	Number	Percent	
Brown rice consumption					**0.013**
None	78	34.5	62	27.3	
1-2 times/week	89	39.4	74	32.6	
3-4 times/week	20	8.8	21	9.3	
5-6 times/week	21	9.3	31	13.7	
Everyday	18	8.0	39	17.2	
White rice consumption					**0.012**
None	8	3.5	2	0.9	
1-2 times/week	32	14.2	40	17.6	
3-4 times/week	12	5.3	18	7.9	
5-6 times/week	49	21.7	70	30.8	
Everyday	125	55.3	97	42.7	
Consumed recommended amount of rice per meal.	114	50.4	119	52.4	0.511
Noodles consumption					0.656
None	14	6.2	14	6.2	
1-2 times/week	25	11.1	20	8.8	
3-4 times/week	41	18.1	51	22.5	
5-6 times/week	120	53.1	122	53.7	
Everyday	26	11.5	20	8.8	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 17 shows that more than 75% of the respondents in intervention and control groups were short of the recommend amount of 6-7 days PA per week. Less than 20% of the children who were physically active practiced the recommended amount of PA minutes/session. Over 58% of respondents in the intervention group watched television over 1 hr/day as compared to 50.2% in the control. Though, there was significantly different amount of time spent playing computer games per day were

observed among the two groups, both groups spent over 1 hour playing computer games per day.

Table 17 Distribution of children's practice on physical activity among intervention and control groups at baseline.

PA Practice	Intervention (n=226)		Control (n=227)		p-value
	Number	Percent	Number	Percent	
Physical activity (days/week)					0.200
< 3days	55	24.3	41	18.1	
3-5 days	126	55.8	131	57.7	
6-7 days	45	19.9	55	24.2	
Physical activity (minutes/session)					0.912
< 30 mins	85	37.6	82	36.1	
30-59 mins	101	44.7	105	46.3	
60 mins or more	43	19.0	40	17.6	
Television viewing per day					0.055
Don't watch	29	12.8	22	9.7	
< 1 hr	65	28.8	91	40.1	
1-2 hrs	81	35.8	77	33.9	
More than 2 hrs	51	22.6	37	16.3	
Playing computer games per day					**0.001**
Don't play	51	22.6	66	29.1	
< 1 hr	89	39.4	68	30.0	
1-2 hrs	45	19.9	75	33.0	
More than 2 hrs	41	18.1	18	7.9	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 18 Distribution of school environmental factors among the two groups at baseline.

	Answer Correctly				
Perception on school environment	Intervention (n=226)		Control (n=227)		p-value
	Number	Percent	Number	Percent	
SE is important for health.					**0.015**
Agree	193	85.4	212	93.4	
Disagree	11	4.9	7	3.1	

Neutral/Uncertain	22	9.7	8	3.5
SE is a major factor for an increase in children PA.				**0.038**
Agree	171	75.7	194	85.5
Disagree	29	12.8	17	7.5
Neutral/Uncertain	26	11.5	16	7.0
My school has enough recreational space.				0.096
Agree	165	73.0	184	81.1
Disagree	35	15.5	29	12.8
Neutral/Uncertain	26	11.5	14	6.2
School food environment is important for health.				0.358
Agree	142	62.8	152	67.0
Disagree	20	8.8	43	18.9
Neutral/Uncertain	44	19.5	32	14.1
Planting/gardening in school will make me consume more vegetables.				**0.038**
Agree	109	48.2	136	59.9
Disagree	64	28.3	45	19.8
Neutral/Uncertain	53	23.5	46	20.3
Implementing a school health program will make my health better.				**0.029**
Agree	178	78.8	201	88.5
Disagree	18	8.0	9	4.0
Neutral/Uncertain	30	13.3	17	7.5

SE: School environment, PA: Physical activity

*p-value <0.05 was calculated with Pearson Chi-Square.

4.4 Distribution of school environmental factors and food environment among the two groups at baseline.

Table 18 displays the results of the distribution of school environmental factors among the two groups at baseline. Of the 6 questions asked about school environment, 4 significance differences were observed among the groups at baseline. Respondents in the control group agreed more that school environment is important to health and plays a major factor for an increase in children's PA as compared to the intervention group. Almost half the respondents on each group (48.2% in intervention, 59.9% in control) agreed that planning plants will make them consume more vegetables. A major difference in opinion was observed on the school food environment. Only 8.8% in the intervention group disagreed that school food

environment is important for health as compared to 18.9% in the control. The difference was statistically significant.

4.5 Nutritional status, cholesterol, triglycerides, HDL, and LDL levels of school children among the two groups at baseline.

Table 19 displays the results of the distribution of nutritional status among the two groups at baseline. No significance in nutritional status was observed at baseline among the two groups. However, there was slightly higher number of underweight and overweight individuals in the control as compared to intervention group at baseline. This difference was however, random and unforeseen before.

Table 19 Distribution of nutritional status among the two groups at baseline.

Dependent variable	Intervention (n=226)		Control (n=227)		
	Number	Percent	Number	Percent	p-value
Nutritional Status					0.356
Underweight	4	1.8	7	3.1	
Normal	179	79.2	171	75.3	
Overweight/Obese	43	19.0	49	21.6	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 20 displays the results of the distribution of the lipid blood profile among the two groups at baseline. Of the 226 participants in the intervention group, 113 consent for blood sampling, while 180 from 227 individuals consent for the test in the control group. No significance differences among the intervention and control groups on lipid blood were observed at baseline. However, intervention and control groups had a very similar data on cholesterol levels. Over 25% of respondents in both groups were at high risk for developing cholesterol in the future. While, very positive results were observed on HDL levels among intervention (100%) and control (99.4%) groups.

Table 20 Distribution of lipid blood profiles among the two groups at baseline.

Lipid blood profile	Intervention (n=113)		Control (n=180)		p-value
	Number	Percent	Number	Percent	
Cholesterol levels					0.974
Desirable (< 170 mg/dl)	35	31.0	58	32.2	
Borderline (170-199 mg/dl)	47	41.6	73	40.6	
High risk (≥ 200 mg/dl)	31	27.4	49	27.2	
Triglycerides levels					0.587
Desirable (< 130 mg/dl)	100	88.5	153	85.0	
Borderline (130-150 mg/dl)	4	3.5	11	6.1	
High risk (≥ 150 mg/dl)	9	8.0	16	8.9	
LDL levels					0.347
Desirable (< 110 mg/dl)	64	56.6	107	59.4	
Borderline (110-129 mg/dl)	29	25.7	34	18.9	
High risk (≥ 130 mg/dl)	20	17.7	39	21.7	
HDL levels					0.427
Desirable	113	100.0	179	99.4	
Low	0	0.0	1	0.6	

LDL: Low-density lipoproteins, HDL: High-density lipoprotein

*p-value <0.05 was calculated with Pearson Chi-Square.

4.7 Knowledge, attitude, and practice on overweight/obesity, and physical activity among the two groups after intervention.

Table 21 displays the results of the children's knowledge on overweight/obesity after the intervention period among the two groups. There were significant different knowledge on the daily caloric intake and causes of obesity between the two groups. Participants in the intervention group scored above 50% in all 4 questions as compared to control. Highest knowledge was observed on the question on causes of obesity among the two groups.

Table 21 Distribution of knowledge questions on overweight/obesity answered correctly among intervention and control groups after intervention period.

| Knowledge on overweight/obesity | Answer Correctly | | | | |
| | Intervention (n=206) | | Control (n=208) | | |
	Number	Percent	Number	Percent	*p*-value
Daily 1600-1700 kcal calorie intake.	111	53.9	23	11.1	**0.001**
Effects of obesity	170	75.2	179	86.1	0.267
Causes of obesity	171	75.7	187	89.9	**0.04**
Ways to prevent obesity	169	74.8	166	79.8	0.564

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 22 displays the results of the children's knowledge on diet after the intervention period. Twelve of the 22 questions asked were significantly different among intervention and control groups. Intervention group scored above 50% on all items except serving of fruits (33.98%) as compared to control groups with 2 items scoring less than 50%. The highest knowledge scored in both groups was on the most important meal of the day (96.6% and 98.8% respectively). The highest difference of (20.54%) in knowledge was observed on question asking about serving of rice (carbohydrates) where intervention group scored 85.92% and control group scored 65.38%.

Table 22 Distribution of knowledge questions on diet answered correctly among intervention and control groups after intervention period.

| Knowledge on diet | Answer Correctly | | | | |
| | Intervention (n=206) | | Control (n=208) | | |
	Number	Percent	Number	Percent	*p*-value
Servings of rice (carbohydrates)	177	85.92	136	65.38	**0.001**
Servings of vegetables	67	32.52	50	24.04	0.051
Servings of meat	171	83.01	164	78.85	0.315
Servings of fruits	70	33.98	24	11.54	**0.001**
Servings of milk	103	50.00	86	41.35	**0.069**
Meals per day	189	91.75	199	95.67	**0.062**

	Number	Percent	Number	Percent	p-value
Most important meal of the day	199	96.60	204	98.08	0.351
Benefits of brown rice	118	57.28	143	68.75	0.016
Effects of high fat foods	126	61.17	153	73.56	**0.007**
Benefits of vegetables and fruits	161	78.16	185	88.94	**0.003**
Healthy type of milk	188	91.26	198	95.19	0.066
Healthy type of drinks	196	95.15	202	97.12	0.321
Effects of soft drinks consumption	160	77.67	178	85.58	**0.042**
Types of healthy snacks	130	63.11	160	76.92	**0.002**
Types of unhealthy snack	174	84.47	194	93.27	**0.001**
Unhealthy form of oil	161	78.16	184	88.46	**0.006**
Effects of fried food	169	82.04	185	88.94	0.051
Daily sugar consumption	137	66.50	128	61.54	0.292
Effects of high salt consumption	169	82.04	194	93.27	**0.001**
Ways to reduce fats	120	58.25	127	61.06	0.521
Functions of a food label	172	83.50	141	67.79	**0.001**
Interpreting food label (INT n=172, CT n=141)	103	59.88	82	58.16	0.306

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 23 displays the results of the children's knowledge on physical activity after the intervention period. All 4 questions were significantly different among the intervention and control groups. Almost a perfect score (99.5%) was observed in the control group addressing the question, "Is PA essential for health?" Intervention group scored higher on the frequency and duration of the PA as compared to control groups.

Table 23 Distribution of knowledge questions on physical activity answered correctly among intervention and control groups after intervention period.

	Answer Correctly				
Knowledge on physical activity	**Intervention** (n=206)		**Control** (n=208)		
	Number	Percent	Number	Percent	p-value
PA is essential for health	195	94.7	207	99.5	**0.010**

Effects of PA on health	154	74.8	181	87.0	**0.002**
Frequency of PA	55	26.7	25	12.0	**0.001**
Duration of PA per session	64	31.1	35	16.8	**0.001**

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 24-26 displays the results of the children's attitude on overweight/obesity, diet, and physical activity after the intervention period. Attitude towards the question on overweight children are unhealthy remained very similar, with intervention and control groups scoring 90.8% and 88.5% respectively. No significance difference were observed on questions related to attitude towards overweight/obesity.

No significant differences were observed on question towards attitude on diet between intervention and control groups. Almost identical (87.9% intervention and 88.0% control) attitude were observed on question related to eating fast food will make you overweight.

Attitude towards physical activity remained high on both the questions. Over 90% in both groups agreed that physical activity can be fun. Although the percentage of neutral/uncertain increased in both groups increased, (7.8% and 8.2%) no significant differences were observed.

Table 24 Distribution of children's attitude on overweight/obesity among intervention and control groups after intervention period.

Attitude on overweight/obesity	Intervention (n=206)		Control (n=208)		
	Number	Percent	Number	Percent	p-value
Overweight children are less attractive.					0.244
Positive	151	73.3	152	73.1	
Negative	17	8.3	26	12.5	
Neutral/Uncertain	38	18.4	30	14.4	
Overweight children are unhealthy.					0.885
Positive	187	90.8	184	88.5	
Negative	12	5.8	14	6.7	
Neutral/Uncertain	7	3.4	10	4.8	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 25 Distribution of children's attitude on diet among intervention and control groups after intervention period.

Attitude on diet	Intervention (n=206)		Control (n=208)		
	Number	Percent	Number	Percent	p-value
Fast food restaurants should not offer toys because they encourage kids to eat unhealthy food.					0.206
Positive	160	77.7	169	81.3	
Negative	28	13.6	17	8.2	
Neutral/Uncertain	18	8.7	22	10.6	
Eating too much fast food will make you overweight.					0.804
Positive	181	87.9	183	88.0	
Negative	12	5.8	12	5.8	
Neutral/Uncertain	13	6.3	13	6.3	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 26 Distribution of children's attitude on physical activity among intervention and control groups after intervention period.

Attitude on diet	Intervention (n=206)		Control (n=208)		
	Number	Percent	Number	Percent	p-value
Physical activity can be fun.					0.887
Positive	194	94.2	198	95.1	
Negative	4	1.9	3	1.4	
Neutral/Uncertain	8	3.9	7	3.4	
Physical activity will decrease my time to watch television or play computer games.					0.543
Positive	38	18.4	30	14.4	
Negative	152	73.8	161	77.4	
Neutral/Uncertain	16	7.8	17	8.2	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 27 displays the results of the children's practice on overweight/obesity after the intervention period. More respondents in the intervention group slept the recommended amount of 8-10 hrs/day as compared to the control. A decrease in respondents sleeping over 10hrs/day were also observed in both groups as compared to baseline. However, the differences in the result were not statistically significant.

Table 27Distribution of children's amount of sleep per night among intervention and control groups after intervention period.

Obesity Practice	Intervention (n=206)		Control (n=208)		
	Number	Percent	Number	Percent	p-value
Daily amount of sleep					0.995
< 8 hrs/day	48	23.3	49	23.6	
8-10 hrs/day	146	70.9	145	69.7	
> 10 hrs/day	12	5.8	12	5.8	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 28 Distribution of children's dietary habits on healthy food consumption among intervention and control groups after intervention period.

Dietary Practice	Intervention (n=206)		Control (n=208)		
	Number	Percent	Number	Percent	p-value
Vegetable consumption					0.552
None	14	6.8	13	6.3	
1-2 times/week	66	32.0	68	32.7	
3-4 times/week	55	26.7	54	26.0	
5-6 times/week	47	22.8	38	18.3	
Everyday	24	11.7	35	16.8	
Consumed recommended amount of vegetables per meal.	47	22.8	36	17.3	0.184
Fruit consumption					0.735
None	5	2.4	6	2.9	
1-2 times/week	39	18.9	47	22.6	

3-4 times/week	66	32.0	56	26.9	
5-6 times/week	44	21.4	37	17.8	
Everyday	52	25.2	47	22.6	
Consumed recommended amount of fruit per meal.	107	51.9	94	45.2	0.216
Boiled food consumption					0.725
None	11	5.3	10	4.8	
1-2 times/week	82	39.8	91	43.8	
3-4 times/week	49	23.8	55	26.4	
5-6 times/week	39	18.9	31	14.9	
Everyday	25	12.1	21	10.1	
Consumed recommended 6 glasses of water daily.					0.417
None	25	12.1	18	8.7	
1-2 times/week	53	25.7	43	20.7	
3-4 times/week	41	19.9	46	22.1	
5-6 times/week	43	20.9	46	22.1	
Everyday	44	21.4	55	26.4	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 29 Distribution of children's dietary habits on sweetened unhealthy food consumption among intervention and control groups after intervention period.

Dietary Practice	Intervention (n=206)		Control (n=208)		
	Number	Percent	Number	Percent	p-value
Soft-drinks consumption					0.724
None	12	5.8	9	4.3	
1-2 times/week	10	4.9	12	5.8	
3-4 times/week	32	15.5	32	15.4	
5-6 times/week	126	61.2	121	58.2	
Everyday	26	12.6	34	16.3	
Sweetened-milk consumption					0.939
None	20	9.7	16	7.7	
1-2 times/week	16	7.8	17	8.2	
3-4 times/week	38	18.4	39	18.8	
5-6 times/week	98	47.6	104	50.0	
Everyday	34	16.5	32	15.4	
Processed-sweetened					0.386

yogurt consumption					
None	13	6.3	12	5.8	
1-2 times/week	16	7.8	15	7.2	
3-4 times/week	39	18.9	38	18.3	
5-6 times/week	99	48.1	117	56.3	
Everyday	39	18.9	26	12.5	
Processed fruit juices consumption					0.073
None	13	6.3	13	6.3	
1-2 times/week	31	15.0	29	13.9	
3-4 times/week	29	14.1	40	19.2	
5-6 times/week	87	42.2	100	48.1	
Everyday	46	22.3	26	12.5	
Sweetened bakery products consumption					0.575
None	12	5.8	12	5.8	
1-2 times/week	21	10.2	18	8.7	
3-4 times/week	43	20.9	32	15.4	
5-6 times/week	103	50.0	110	52.9	
Everyday	29	14.1	36	17.3	
Chocolate and candies consumption					**0.020**
None	15	7.3	10	4.8	
1-2 times/week	22	10.7	17	8.2	
3-4 times/week	39	18.9	40	19.2	
5-6 times/week	111	53.9	98	47.1	
Everyday	19	9.2	43	20.7	
SSB consumption					0.266
None	21	10.2	13	6.3	
1-2 times/week	19	9.2	20	9.6	
3-4 times/week	54	26.2	42	20.2	
5-6 times/week	90	43.7	106	51.0	
Everyday	22	10.7	27	13.0	

SSB: sugar sweetened beverages.

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 28 displays the results of the children's dietary habits on healthy food consumption among intervention and control groups after intervention. Significant higher amount of recommended consumption of vegetables were observed in

intervention as compared to control. Intervention group also had a higher percentage of fruit and boiled food consumption. However, the increase was not statistically different.

Table 29 displays the results of the children's dietary habits on sweetened unhealthy food consumption. Intervention group had a lower consumption of bakery products, chocolates and candies, and SSB beverages as compared to control. Consumption of fast food, chocolate and candies were statistically different among the two groups.

Table 30 displays the results of the children's dietary habits on other unhealthy food consumption after intervention. Fast food consumption was significantly different among the two groups. Although the differences were not statistically significant, fried food and high caloric snacks consumption decreased marginally in the intervention as compared to control.

Table 30 Distribution of children's dietary habits on other unhealthy food consumption among intervention and control groups after intervention period.

Dietary Practice	Intervention (n=206)		Control (n=208)		
	Number	Percent	Number	Percent	*p*-value
Stewed pork leg with rice/steamed chicken rice consumption					0.252
None	24	11.7	18	8.7	
1-2 times/week	23	11.2	12	5.8	
3-4 times/week	33	16.0	41	19.7	
5-6 times/week	104	50.5	113	54.3	
Everyday	22	10.7	24	11.5	
Fried food consumption					0.456
None	19	9.2	15	7.2	
1-2 times/week	33	16.0	28	13.5	
3-4 times/week	47	22.8	51	24.5	
5-6 times/week	87	42.2	101	48.6	
Everyday	20	9.7	13	6.3	
Coconut curried rice consumption					0.614
None	12	5.8	7	3.4	
1-2 times/week	13	6.3	12	5.8	

3-4 times/week	34	16.5	31	14.9	
5-6 times/week	81	39.3	95	45.7	
Everyday	66	32.0	63	30.3	
High caloric snacks consumption					0.146
None	23	11.2	17	8.2	
1-2 times/week	37	18.0	23	11.1	
3-4 times/week	47	22.8	46	22.1	
5-6 times/week	81	39.3	101	48.6	
Everyday	18	8.7	21	10.1	
Fast food consumption					**0.002**
None	15	7.3	13	6.3	
1-2 times/week	20	9.7	14	6.7	
3-4 times/week	41	19.9	15	7.2	
5-6 times/week	98	47.6	126	60.6	
Everyday	32	15.5	40	19.2	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 31displays the results of the children's dietary habits on proteins and fats consumption among the intervention and control groups after intervention. No significant differences were observed any of the questions. Respondents from both groups consumed similar amount of meat and milk. However, data from table revealed that the control group consumed more milk as compared to intervention.

Table 31 Distribution of children's dietary habits on proteins and fats consumption among intervention and control groups after intervention period.

Dietary Practice	Intervention (n=206)		Control (n=209)		
	Number	Percent	Number	Percent	p-value
Meat consumption					0.567
None	2	1.0	1	0.5	
1-2 times/week	37	18.0	30	14.4	
3-4 times/week	60	29.1	66	31.7	
5-6 times/week	45	21.8	59	28.4	
Everyday	62	30.1	52	25.0	
Consumed recommended amount of meat per meal.	121	58.7	122	58.7	0.967
Milk consumption					0.152
None	5	2.4	2	1.0	

Dietary Practice	Number	Percent	Number	Percent	
1-2 times/week	48	23.3	36	17.3	
3-4 times/week	37	18.0	31	14.9	
5-6 times/week	48	23.3	55	26.4	
Everyday	68	33.0	84	40.4	
Consumed recommended amount of milk per day.	89	43.2	90	43.3	0.920

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 32 displays the results of the children's dietary habits on carbohydrates consumption among the intervention and control groups after intervention. White rice consumption were lower and more consumption of brown rice were reported in the intervention as compared to control. There were significantly different consumption of brown rice in the two groups. More respondents in the intervention (64.1%) group consumed the recommended amount of rice per meal as compared to control (57.7%).

Table 32 Distribution of children's dietary habits on carbohydrates consumption among intervention and control groups after intervention period.

Dietary Practice	Intervention (n=206)		Control (n=208)		
	Number	Percent	Number	Percent	p-value
Brown rice consumption					**0.013**
None	56	27.2	41	19.7	
1-2 times/week	89	43.2	94	45.2	
3-4 times/week	22	10.7	34	16.3	
5-6 times/week	20	9.7	22	10.6	
Everyday	19	9.2	17	8.2	
White rice consumption					0.148
None	3	1.5	0	0.0	
1-2 times/week	33	16.0	25	12.0	

3-4 times/week	28	13.6	23	11.1	
5-6 times/week	62	30.1	57	27.4	
Everyday	80	38.8	101	48.6	
Consumed recommended amount of rice per meal.	132	64.1	120	57.7	0.225
Noodles consumption					0.218
None	18	8.7	11	5.3	
1-2 times/week	17	8.3	19	9.1	
3-4 times/week	44	21.4	43	20.7	
5-6 times/week	94	45.6	113	54.3	
Everyday	33	16.0	22	10.6	

*p-value <0.05 was calculated with Pearson Chi-Square.

Table 33 displays the children's practice on physical activity among intervention and control groups after intervention period. It is observed that respondents in the intervention group had higher frequency and duration of physical activity as compared to control group. The differences is however, not significant. Nevertheless, data revealed an increase of PA from baseline, and a decrease in screen time in the intervention group.

Table 33 Distribution of children's practice on physical activity among intervention and control groups after intervention period.

PA Practice	Intervention (n=206)		Control (n=208)		
	Number	Percent	Number	Percent	p-value
Physical activity (days/week)					0.187
< 3days	47	22.8	46	22.1	
3-5 days	110	53.4	127	61.1	
6-7 days	49	23.8	35	16.8	
Physical activity (minutes/session)					0.389
< 30 mins	70	34.0	73	35.1	
30-59 mins	92	44.7	99	47.6	
60 mins or more	44	21.4	33	15.9	
Television viewing per day					0.700
Don't watch	16	7.8	13	6.3	
< 1 hr	63	30.6	63	30.3	

1-2 hrs	83	40.3	94	45.2
More than 2 hrs	44	21.4	38	18.3
Playing computer games per day				
Don't play	31	15.0	40	19.2
< 1 hr	67	32.5	73	35.1
1-2 hrs	71	34.5	66	31.7
More than 2 hrs	37	18.0	29	13.9

p-value <0.05 was calculated with Pearson Chi-Square.

Table 34 Distribution of school environmental factors among the two groups at after intervention period.

	Answer Correctly				
Perception on school environment	**Intervention** (n=206)		**Control** (n=208)		*p*-value
	Number	Percent	Number	Percent	
SE is important for health.					**0.004**
Agree	175	85.0	196	94.2	
Disagree	3	1.5	3	1.4	
Neutral/Uncertain	28	13.6	9	4.3	
SE is a major factor for an increase in children PA.					**0.015**
Agree	158	76.7	181	87.0	
Disagree	27	13.1	13	6.3	
Neutral/Uncertain	21	10.2	14	6.7	
My school has enough recreational space.					0.872
Agree	140	68.0	141	67.8	
Disagree	33	16.0	36	17.3	
Neutral/Uncertain	33	16.0	30	14.4	
School food environment is important for health.					0.270
Agree	124	60.2	129	62.0	
Disagree	32	15.5	40	19.2	
Neutral/Uncertain	50	24.3	38	18.3	
Planting/gardening in school will make me consume more					0.200

vegetables.					
Agree	127	61.7	124	59.6	
Disagree	27	13.1	40	19.2	
Neutral/Uncertain	52	25.2	44	21.2	
Implementing a school health program will make my health better.					**0.015**
Agree	157	76.2	180	86.5	
Disagree	22	10.7	9	4.3	
Neutral/Uncertain	27	13.1	19	9.1	

SE: School environment, PA: Physical activity

p-value <0.05 was calculated with Pearson Chi-Square.

4.7 Distribution of school environmental factors among the two groups after intervention.

Table 34 displays the results of the distribution of school environmental factors among the two groups after intervention. Significance differences were observed for 3 variables. Majority of the respondents from both groups (85.0% in intervention and 94.2% in control) still agree that school environment is important for health. A huge increase in intervention from 48.2% (see Table 4.15) at baseline to 61.7% after intervention and significantly different between groups were observed on question related to planting/gardening in school. Only 10.7% in intervention and 4.3% in control groups disagreed that implementing a school health program will make their health better.

Changes towards the school environment to facilitate more physical activity were also observed. Clearer zonal markings, repainting of grounds, and more sports equipment were observed in the interventions schools. The school initiated 10 minutes aerobic dance twice a week after morning assembly. The aerobic session were led by students. Three students from each grade level took turns to lead the program. The school PE instructor also organized internal sports competition to encourage more physical activity. The sports included rope skipping, running, and basketball.

There were changes made towards the food environment as well. Children were served fruits during lunch. Teachers reminded students to eat their meal with fruits. It was also observed that vendors in the intervention school started to serve more healthy food. Fruits were being sold during lunch and after school. Though, fried

foods and ice cream were still being sold after the schools, children were given more healthy food choices.

4.8 **Nutritional status, cholesterol, triglycerides, HDL, and LDL levels of school children among the two groups after intervention.**

Table 35 displays the results of the distribution of nutritional status among the two groups at baseline. There was a higher reduction in the prevalence of overweight/obese children in the intervention at baseline (see Table 4.16) as compared to control group. A decrease in the prevalence of underweight in the intervention group, from 1.8% to 1.3% and an increase from 3.1% to 3.5% in the control group were also observed. However, none of the differences were significant.

Table 35 Distribution of children's nutritional status (WFH) among the two groups after intervention period.

Dependent variables	Intervention (n=223)		Control (n=228)		
	Number	Percent	Number	Percent	*p*-value
Nutritional Status					0.204
Underweight	3	1.3	8	3.5	
Normal	183	82.1	175	76.8	
Overweight/Obese	37	16.6	45	19.7	

*p-value <0.05 was calculated with Pearson Chi-Square.
WFH: weight-for-height

Table 36 Analysis of children's knowledge, attitude, and practice among the intervention and control groups.

	Intervention			Control			p-value*	p-value**
	N	Mean	Std. Deviation	N	Mean	Std. Deviation		
Obesity Knowledge Score								
Pre	226	2.16	1.06	227	2.34	0.99	0.298	0.065
Post	206	3.01	1.04	208	2.67	0.79946	0.026	**0.001**
Difference	20	0.85	1.05	19	0.33	1.02	0.622	**0.001**
Diet Knowledge Score								
Pre	226	14.01	2.89	227	15.13	2.96	0.224	**0.000**
Post	206	15.92	3.23	208	15.99	2.41342	0.002	0.848
Difference	20	1.91	2.78	19	0.86	2.82	0.303	**0.001**
PA Knowledge Score								
Pre	226	0.96	0.19	227	0.98	0.15	0.083	0.386
Post	206	2.31	0.92	208	2.16	0.63	0.001	0.054
Difference	20	1.35	0.93	19	1.18	0.64	0.001	**0.040**
Overall Knowledge Score								
Pre	226	17.13	3.91	227	18.45	3.77	0.026	**0.001**
Post	206	21.24	4.13	208	20.81	2.85	0.001	0.059
Difference	20	4.11	3.44	19	2.36	3.23	0.183	**0.001**

*p-value <0.05 was calculated with test of homogeneity of variances.

**p-value <0.05 was calculated with independent sample t-test.

	Intervention			Control			p-value*	p-value**
	N	Mean	Std. Deviation	N	Mean	Std. Deviation		
Obesity Attitude Score								
Pre	226	5.25	0.93	227	5.49	0.91	0.382	**0.005**
Post	206	5.37	0.92	208	5.29	0.95	0.255	0.396
Difference	20	0.12	1.18	19	-0.20	1.16	0.976	**0.004**
Diet Attitude Score								
Pre	226	5.38	1.02	227	5.53	0.84	0.002	0.083
Post	206	5.33	0.94	208	5.41	0.95	0.405	0.376
Difference	20	-0.05	1.24	19	-0.12	1.23	0.865	0.525
PA Attitude Score								
Pre	226	4.14	0.79	227	4.10	0.74	0.235	0.608
Post	206	4.34	0.80	208	4.29	0.77	0.266	0.439
Difference	20	0.20	0.96	19	0.19	0.89	0.146	0.817
Overall Attitude Score								
Pre	226	14.77	1.87	227	15.12	1.67	0.24	0.032
Post	206	16.03	2.46	208	16.11	2.49	0.828	0.722
Difference	20	1.27	2.58	19	0.99	2.76	0.755	0.275

*p-value <0.05 was calculated with test of homogeneity of variances.

**p-value <0.05 was calculated with independent sample t-test.

	Intervention			Control			p-value*	p-value**
	N	Mean	Std. Deviation	N	Mean	Std. Deviation		
Obesity Practice Score								
Pre	226	1.84	0.58	227	1.86	0.49	0.005	0.654
Post	206	1.82	0.52	208	1.82	0.51	0.893	0.959
Difference	20	-0.02	0.68	19	-0.04	0.66	0.558	0.656
Diet Practice Score								
Pre	226	32.86	6.54	227	34.12	6.09	0.369	**0.040**
Post	206	32.71	6.63	208	32.85	6.88	0.608	0.846
Difference	20	0.07	7.22	19	-1.27	7.66	0.288	0.087
PA Practice Score								
Pre	226	4.72	2.05	227	5.07	1.93	0.23	0.056
Post	206	4.15	2.17	208	4.12	2.22	0.387	0.891
Difference	20	-0.57	2.40	19	-0.96	2.37	0.751	0.085
Overall Practice Score								
Pre	226	39.45	6.92	227	41.06	6.39	0.186	**0.013**
Post	206	38.68	6.96	208	38.79	7.16	0.707	0.760
Difference	20	-0.77	7.58	19	-2.27	7.85	0.423	**0.048**

*p-value <0.05 was calculated with test of homogeneity of variances.

**p-value <0.05 was calculated with independent sample t-test.

4.9 **Difference in changes on primary and secondary outcomes among the intervention and control groups.**

Table 36 displays the children's knowledge, attitude, and practice among intervention and control groups. It is observed that there were significantly differences in the overall knowledge, attitude, and practice of overweight/obesity, diet, and PA as baseline within intervention and control groups. Summary of the knowledge, attitude, and practice are further summarized and analyzed in Table 37. Data indicated that indicated that the overall mean scores on knowledge, attitude, and practice in overweight/obesity, diet, and PA were higher in the intervention group as compared to control. Significantly differences were observed for overall attitude at baseline, but no different at post-treatment. There were also significant different of differences in changes between baseline and post treatment on overall knowledge and practice between the intervention and control groups. Intervention group had a mean increase of knowledge of 4.11 as compared to an increase of 2.36 in the control.

Physical activity among the intervention group increased after the intervention, while there was a decreased in the control group. More decrease in screen time was also observed in the intervention group at post treatment as compared to control. The data revealed that the both the intervention and baseline groups fell short of the recommended 8-10 hours of sleep per day.

Table 38 displays the secondary outcomes after the intervention and the mean difference in change between the intervention and control groups. Due to very less number of underweight individuals and the changes in underweight for both the intervention and control groups were 1 individual, data of underweight was grouped with normal nutritional status.

Data observed in the table reported an increase in percentage of normal nutritional status from baseline by 2.71% in the intervention group and 2.16% in the control

group. The difference in changes were however not statistically significant. Number of overweight individuals in intervention group decreased more than control group. Statistically different decreased in cholesterol levels and increase in HDL levels were observed in the intervention as compared to control. The data indicated a positive change in the intervention group for all variables as compared to control.

Table 37 Primary outcomes among intervention and control groups after intervention.

Variable	Intervention	Control	Changes	*p*-value*
Overall Knowledge				
Baseline	17.13 (3.91)	18.45 (3.77)		**0.001**
After 6 months	21.24 (4.13)	20.81 (2.85)		0.059
Difference	4.11	2.36	1.75	**0.001**
Overall Attitude				
Baseline	14.77 (1.87)	15.12(1.67)		**0.032**
After 6 months	16.03 (2.46)	16.11 (2.49)		0.722
Difference	2.58	2.76	-0.18	0.275
Overall Practice				
Baseline	39.45 (6.92)	41.06 (6.39)		**0.013**
After 6 months	38.68 (6.96)	38.79 (7.16)		0.760
Difference	-0.77	-2.27	1.50	**0.048**
Physical activity (hrs/wk)				
Baseline	2.94 (1.62)	3.01 (1.43)		0.644
After 6 months	3.00 (1.63)	2.68 (1.55)		0.175
Difference	0.06	-0.33	0.39	0.124
Screen time (hrs/day)				
Baseline	2.93 (1.59)	3.22 (1.55)		**0.050**
After 6 months	2.42 (1.62)	2.56 (1.64)		0.383
Difference	-0.51	-0.65	0.14	0.368
Sleep (hrs/day)				
Baseline	7.36 (2.33)	7.44 (1.97)		0.654
After 6 months	7.28 (2.06)	7.28 (2.05)		0.959
Difference	-0.08	-0.16	0.08	0.355

*p-value <0.05 was calculated with independent sample t-test.

Table 38 Secondary outcomes among intervention and control groups after intervention.

Variable	Baseline	After 6 months	Changes after the INT	Diff in changes	p-value
Normal NS					
Intervention	80.70%	83.41%	2.71%	0.55	0.321
Control	78.10%	80.26%	2.16%		
Overweight/Obese NS					
Intervention	19.28%	16.59%	-2.69%	0.51	0.822
Control	21.92%	19.74%	-2.18%		
Cholesterol levels (mean)					
Intervention	182.27 (29.40)	179.84 (30.89)	-2.43 (15.70)	3.84	**0.019
Control	184.01 (30.60)	185.42 (34.91)	1.41 (17.61)		
Triglycerides levels (mean)					
Intervention	81.58 (39.02)	74.86 (37.29)	-6.72 (40.85)	4.55	**0.476
Control	94.21 (45.83)	92.04 (41.86)	-2.17 (36.17)		
LDL levels (mean)					
Intervention	108.48 (27.47)	107.22 (29.74)	-1.26 (14.55)	2.64	**0.068
Control	103.29 (25.74)	99.39 (24.81)	-3.9 (14.31)		
HDL levels (mean)					
Intervention	59.27 (13.13)	63.33 (13.06)	4.06 (8.59)	2.23	**0.028
Control	60.18 (14.48)	62.01(15.92)	1.83 (7.88)		

*p-value <0.05 was calculated with independent sample t test.

**p-value <0.05 was calculated with chi-square test.

CHAPTER V

DISCUSSION, CONCLUSION, AND RECOMMENDATION

5.1 Discussion

Discussion on development and process of life-skills intervention

This study used a multicomponent life-skills intervention. The multicomponent was developed after a systematic review was conducted on the effectiveness of a school-based intervention studies on child obesity. Evidence from the review suggested that multidisciplinary approach school-based interventions are effective in reducing childhood obesity. Review suggested that interventions aimed solely to modify diet and physical activity through education alone were largely ineffective. An effective intervention should include external factors and participation from the school, parents, and community.

For the above reasons and in accordance with the health belief model (see Figure 1), a multicomponent life-skills intervention was developed. The multicomponent included life skills educational component on dietary and physical activity, supplemented with school environment and food environment. Due to limited resources and time, participatory approach included school staffs, teachers, parents, and not other sectors of the community, while the intervention was limited to 6 months.

The life skills intervention was well accepted by the school administrators, teachers, children, and parents. Children seemed to really enjoy the sessions, especially Session 4 and Session 7. We observed that earlier in the program, children were not as willing to participate with the team. However, by session 3, children were asking the team to spend more time on the session, as they really enjoyed learning

through participation. We received positive response from both the school and parents.

There were some challenges faced throughout the program as well. One of the difficulties and challenges faced was the consistency in delivering the life-skills program. Of the seven sessions, one session had to be postponed. For that reason, the planned 7 consecutive weekly lessons were not achieved, due to a school function that was not foreseen. The session that was scheduled for the week was therefore postpone by one additional week resulting in 7 sessions being completed over an 8 week period.

Another aspect that may have affected the outcome was the absence of certain students during the sessions. As the session was held once a week for each class, any student who failed to be present on the school day did not receive the session. No make-up sessions were arranged due to limited time and resources.

Discussion on Findings

Childhood overweight and obesity has become an important public health problem worldwide, including Thailand. The study suggested a possible effectiveness of a 6-month multicomponent life-skills intervention for reducing overweight and increasing physical activity and diet-related behavior in young adolescents. The findings showed a significantly healthier practice on dietary habits and physical activity, lowered cholesterol levels, and higher HDL levels in the intervention group.

The findings of this study represented 4 primary schools in Bangkok under the Office of the Basic Education Commission (OBEC), Ministry of Education. The schools were chosen by convenience sampling because schools voluntarily wanted to participate in the study. The 4 schools were coeducational, with similar demographics for gender, number of students, and number of classes per grade level, family socioeconomic status (low to middle class), parental support, and school environment. The participants' characteristics in the four schools were statistically tested for differences and no significance differences were reported at baseline. Data from the OBEC (OBEC, 2009) showed that other schools in Bangkok under OBEC share similar characteristics. Similar characteristics included number of students (30-40 students/class), socioeconomic status (low to middle), and size of the school. For that reason, the data may be assumed representative of other MOE schools in Bangkok.

Our study reported a greater reduction in the prevalence of overweight/obesity in the intervention group (-2.71%, p=0.55) as compared to control group (-2.16%). Although the reduction is not significant, these results were consistent with other similar studies.(Sahota, Rudolf et al. 2001, Ebbeling, Feldman et al. 2012, Wang, Cai et al. 2015) Sahota et al. multicomponent intervention study was conducted in primary school children aged 7-11 years in Leeds, England and reported a lowered weighted mean (-0.07, p=0.08) in the intervention group. A similar study by Ebelling et al. reported a difference (-0.30 BMI, p=0.46) between intervention and control group in a study conducted in urban Boston American pupils. Similarly, Wang et al. reported a non-significant reduction in BMI (-0.24, p=0.80) in the intervention group among urban Beijing Chinese primary school children.

The non-significance reduction in overweight in this study may be due to the short intervention period. A recent Italian study (Ermetici, Zelaschi et al. 2016), which also has a similar multicomponent school-based intervention on education, diet, PA, and school environment conducting in young adolescents, reported a significant reduction in overweight (-0.18 BMI z-score, p=0.01) children with an intervention period of 2 years. Another multicomponent (education, social marketing, training, and parental outreach) study (Foster et al., 2013) with a similar intervention period of 2 years conducted in Philadelphia (USA) primary school children reported a significant reduction in the prevalence and incidence of overweight in the intervention group. Few other multicomponent intervention studies with intervention period of at least 1 academic year also reported significant reduction in adiposity measures, including BMI z-scores (McFarlin, Johnston et al. 2013, Meng, Xu et al. 2013), BMI (da Silva, Fisberg et al. 2013), and body fat (Rush, Reed et al. 2012).

Physical activity and sedentary behaviors are an essential focus for a successful obesity intervention. In our study, that has given great importance to physical activity and reduction of sedentary behaviors. The study findings after the intervention, reported that children in the intervention group were more physically active (+0.06 hr/week) and reduced sedentary behavior (0.51hr/week). These beneficial changes are most likely linked to the significantly decreased cholesterol levels (-2.43±15.70) and increased HDL (4.06±8.59) in the intervention group. As shown in two other studies (Nemet, Barkan et al. 2005, Blüher and Schwarz 2014) reported significant increase

in children's PA and reduction in cholesterol and LDL levels, while Bluher et al. reported significant reduction in both BMI and blood lipid. Contrary to our findings, physical activity intervention study by Wang et al. has shown significant changes in adiposity and glucose, but not in blood lipids (Wang, Cai et al. 2015).

The reported significantly improved in overall mean practice of 1.34 between intervention and control group is likely due to the significant increase in overall knowledge score in the intervention group. Although, the knowledge at baseline in the two groups was significantly different (intervention group mean score of 17.13, control group mean score of 18.45), there was a significant higher increase in the intervention (+4.11 mean score) group as compared to the control (+3.23 mean score). For this reason, it is assumable the increase is due to the intervention.

Furthermore, the significant increase in recommended vegetable consumption and reduction in high caloric snacks and fast foods in the intervention group compared to control were observed in three other multicomponent lifestyle interventions for childhood obesity.(Jiang, Xia et al. 2007, Shah, Misra et al. 2010, Viggiano, Viggiano et al. 2015) A decrease in daily white rice consumption (55.3% to 38.8%) and increase in daily brown rice consumption (8.0% to 9.2%) among the intervention group were also observed in the study. In contrast, the control did not decrease the consumption of white rice.

Surprisingly, the control school has a higher consumption of brown rice as compared to the intervention. This may be due to chance, as data at baseline indicated that brown rice consumption were significant different between the two groups. There was higher consumption of brown rice (consume everyday) in the control group (17%) as compared to 8% in the intervention group at baseline. The significance difference of almost double prevalence of brown rice consumption in the control group compared to the intervention at baseline may have contributed to the non-effect on the brown rice consumption between the intervention and control at post treatment.

Though, there was a decrease (significant and non-significant) in many of the sweetened unhealthy food consumption, soft drinks and SSB consumption still remained high in both groups. A major cause of concern is over 70% of both intervention and control groups consuming soft drinks at least 5 times a week. This data corresponded well with report from the Thailand National Health Examination

Survey (2009), indicating that over 30% of adolescents aged 6–14 years consumed SSBs almost every day or more often, a relative increases of 50% and 100% since the previous survey in 2003.(Lim, Banwell et al. 2014) Another concerning data were on the consumption of fast foods. Although, consumption of fast foods (5 times or more/week) was significantly lower in the intervention (63.1%) as compared to control group (79.8%), they remained high in both groups. It is observed that children's attitude in both group towards fast foods did not significantly change after the intervention, and thus maybe a reason for the high consumption of fast foods.

School children have considerable purchasing power and several food options to choose from. However, not all have the natural ability to choose a nutritious diet. Therefore, it was essential to intervene at a young age through series of life-skills approach. As reported, the knowledge at baseline among the schools was relatively low. Many did not understand the concept of nutritional value, recommended servings per day, and dietary components. Children were not aware of key topics such as energy, protein, carbohydrates, fats, and fiber. Furthermore, it was observed that the accessibility to healthy food in and around schools were limited. Many vendors around the school were selling high caloric food including fried food and sugar sweetened beverages and ice cream. Another contributor could have been the preference of sweet taste in children. Many studies (Liem, Mars et al. 2004, Lissner, Lanfer et al. 2012) have shown that children have a preference for high concentrations of sucrose in foods. This preference of taste has been positively related to high consumption of sucrose containing foods. It is questionable if all these factors may have contributed to lowered knowledge, and subsequently, high intake of unhealthy food and sweetened beverages.

The study provided evidence that there is an association between the levels of knowledge and levels of overall practice of diet and PA (difference of 1.5 mean score between the intervention and control groups). In this study, the intervention group had a significantly (p=0.001) higher mean knowledge score after the intervention (4.11 ± 3.44) as compared to control (2.36±3.23) and that may be one of the contributor to a significant increase in the level of practice for both diet and PA. However, the significant changes in the behavioral outcomes did not significantly change the nutritionals status. This corresponds well with another study that reported school-

based education interventions may have significantly increased PA and improved dietary habits, but there were still conflicting results on the changes in BMI (Hollar, 2010). It is reported that changes towards the nutritional status may take a longer period of time.(Greening, Harrell et al. 2011, Levy, Ruán et al. 2012)

Many studies have demonstrated that elevated cholesterol levels are relatively common among obese children.(Sirikulchayanonta, Pavadhgul et al. 2005, Reinehr 2015) It is documented that elevated cholesterol levels during childhood are associated with hypercholesterolemia in adult life.(Belay, Belamarich et al. 2004) Moreover, lipid abnormalities among children are related to higher risk of insulin resistance and development of heart disease later in life. Therefore, one of the important findings of this study was the significant decrease in cholesterol level and increase in HDL levels among the intervention group. This highlights the importance of multicomponent intervention for childhood obesity, not only for reduction in overweight/obesity but also improvement of lipid profiles and reduction of risk factors for heart diseases.

Discussion on the Intervention

The study used a successful multicomponent intervention. The findings of the study are in line with many other combined intervention studies (Brown and Summerbell 2009, Hollar, Lombardo et al. 2010, Kriemler, Zahner et al. 2010, Rush, Reed et al. 2012) that provided more significant changes than a single intervention program (Shah, Misra et al. 2010). For example, the reported increase in healthy food consumption, decrease in unhealthy food (fast food, chocolate and candies consumption, SSB) and increase in physical activity levels are consistent with other studies that provided both short and longer-term beneficial effects multidisciplinary interventions.(Nemet, Barkan et al. 2005, Gonzalez-Suarez C1 2009) Multicomponent interventions targeting behavioral changes to promote negative energy balance for changes in adiposity measures use common strategies. This study focused specifically on decreasing consumption of sugar sweetened beverages, increase physical activity levels, and building awareness on childhood obesity through an education-behavioral life-skills approach. Therefore, data from this study indicates that it is possible to reduce childhood obesity through school-based multicomponent interventions that impact students at school and home settings.

We believed that a major factor to the success of the intervention was the involvement of schools and parents through the participatory approach. Based on evidence on the effectiveness of community-based participatory approach (Chomitz, McGowan et al. 2010), the study included school staffs, teachers, and parents. Two workshops were held for teachers and parents to gain knowledge on current health status of their students and children with emphasis given on health promotion with their potential role as a caretaker. Activities included singing, dancing and games stimulated the children to adopt positive behavior throughout the intervention period. Awards were handed to positively reinforce behavioral change. Indeed during the workshops, parents reported that they changed their cooking ways, purchasing habits of snacks and food for their children, and gave positive reinforcements to adopt a healthy diet. In addition to some evidence from other studies that have given a greater importance to the parents participatory approach, Foster et al. reported significant reduction in incidence and prevalence of overweight in intervention groups as compared to control.

Another key component of our intervention is that it was focused on changes in school environment as well as individual behavior. Though, there was no significant increase in positive mean increase in the school environment in the intervention group as compared to control, some changes were made within the school. Intervention school had a clearer marking and prepared more recreational space. The school administrators implemented policy to promote healthier eating and high physical activity. Vendors were approached by the schools to prepare healthier meals. We observed that more fruits and healthy foods were visible for children to buy during lunch break and after school. However, after an agreement from the school administrators prior to the study to completely modify the food environment within school, we were unable to completely change the food environment. Ice cream stalls and high caloric snacks were still being sold during lunch break and after school. Explanation from the school included loss of revenue and certain vendors still had a valid contract to sell food within the school. It is assumable that changes to the school food environment may take longer than 6 months period.

Many studies reported that school environment is an essential factor that may lead to the shifts in children BMI.(Demetriou and Höner 2012, Groffik, Sigmund et al.

2012) Based on the consistent positive associations between the schools environment and PA levels of children, it is fair to say interventions in the future should include a school-environment component to be more effective in stimulating student physical activity. It is recommended that interventions should seek to incorporate individual behavior change strategies with policy and environmental changes in order to make a substantial and sustainable impact on children's physical activity.

A positive response from school, teachers, and parents to promote healthy eating in school was considered a significant improvement. We suggest that the easy availability of healthy foods and beverages in school will help children make healthier choices. Educational posters, school lessons, textbooks, and messages focused strongly on encouraging healthier eating and physical activity may contribute further to positive behavioral changes.

Discussion on Methodologies

This study had a quasi-experimental design and randomizations were not conducted at all levels. Though, it is true that well-designed methodologically RCTs is still the highest standard of evidence available in public health research (Torgerson 2002), quasi-experimental design may be the most practical option for conduction outcomes evaluation in social context.

In this study, nutritional status was measured by weight-for-height and further classified into 3 categories "Underweight, normal, and overweight" as supposed to the use of BMI. There were a few reasons for it. First, the BMI is a reliable measurement but could not be expected to change significantly over such a short time. Second, the majority of childhood obesity studies conducted in Thailand used weigh-for-height classification, and therefore, would have been easier for this study to compare the results. These standards WFH references "INMU Thai Growth Program for Nutritional Assessment" were developed by the Institute of Nutrition Research, Mahidol University, from a Thai National nutrition survey, Department of Health, Ministry of Public Health in 2002, and it is routinely used for Thai children.

Our findings addressed an importance of a multicomponent/combined intervention programs for the treatment of childhood obesity. However, questions remained on which aspect of the multicomponent attributed to the change. This may have to be

further explored. Additional research with a multiple arm intervention study is required to understand which component of the intervention has significance on the outcome variables.

5.2 Limitations

The study has some limitations as well. There was no random selection of participants. Schools voluntarily enrolled in the study and randomization was in choosing the intervention and control schools. Randomization and not voluntary participation of schools is necessary in order to generalize the findings to all MOE schools in Bangkok. For this reasons, the data from this study may not be generalized for all primary school children in Bangkok.

The use of a self-administered questionnaire may have some bias and limitations. There is no certainty as to where self-reported changes corresponded to real behavior changes. For instance, to accurately measure children's physical activity levels, the use of an accelerometer would be more reliable. However, due to limited resources, children's PA was relied on a self-administered questionnaire. Another limitation on the questionnaire is the sensitivity on the dietary habits questions. A weekly frequency questionnaire was used to represent the data as to the use of a daily-report. A last limitation of the questionnaire was the low score of reliability on attitude questions.

Another area of consideration is the long-term sustainability of the changes in nutritional status and lipid profiles. The data from this study did not allow the analysis of long-term impacts of the program. Subsequent studies should be planned to track children's behavior and nutritional status and blood profile over longer periods of time, with additional measurement and follow-ups.

Furthermore, the study design cannot identify which of the intervention component contributed to the effectiveness of the intervention and the magnitude of the effect of each component.

5.3 Strengths

A major strength of this study is the use of lipid blood profile as a biological marker with high number of participants. Cholesterol, triglycerides, LDL, and HDL levels with 293 participants at baseline and 271 participants in post treatment were analyzed.

Another strength of the study is the high responsive rate of over 90% participants providing the study with a rather large sample. The large sample size allowed for more analysis and breakdown of consumption patterns among the children.

A final strength of the study is the development of the intervention. The intervention was based on an extensive literature review and identification of reported successful components of behavioral changes in dietary habits, PA, and nutritional changes including the adaptation for all the above components to meet the Thai context.

5.4 Conclusion

Childhood overweight and obesity is a serious public health problem based on its increasing rates and the associated health risks. This study suggested that Thai children are facing problems with overweight and obesity. Obesity is a multifactorial chronic diseases stemming from complex interactions between genes and environment. However, dietary and physical activities are behavioral risk factors that are modifiable. This study indicated that multicomponent school-based intervention including school environment is likely to be the most effective way to reducing overweight/obesity and improving some physical activity and diet-related behaviors in young adolescents.

5.5 Recommendation

Research Recommendation

1. More research and priority should be given unto childhood overweight and obesity, as it's an alarming public health problem. There should be cohort studies to follow the nutritional status of children.

2. Future research should use a multi-arm randomized trial in order to clarify the extent to which and how each intervention component influences children's behavior.

3. Future research should use more reliable tools (pedometer or accelerometer) to assess children's physical activity as to the use of self-administered questionnaire.

4. It recommended reviewing the questions on attitude due to the low Cronbach's alpha coefficient for internal consistency.

5. Future school-based intervention programs should have a longer intervention period and should seek to incorporate individual behavior change strategies with policy and environmental changes in order to make a substantial and sustainable impact on children's health.

Policy Recommendation

1. It is recommended a revised health-education program which signifies the importance of dietary habits, the recommended amount of consumption, and the importance of physical activity be implemented in primary schools.

2. Development of a healthy school program. A program, which aims to improve children's perception of one's body image, eating habits, and physical activities. Children should be educated on how to calculate their body mass in

order to have positive attitude on control of one's weight. Interventions strategies should be directed not only at children, but should include the whole family.

3. Specific school policies (eg. reduction of SSB in school) should be developed and implemented in order to enhance and improve the school environment for healthy dietary habits and increase in physical activity levels.

4. Initiate health campaign. There should be more mass media health campaign to build awareness, since the prevalence of childhood obesity is arguably high in primary schools. Literature review has shown that childhood overweight tends to lead to adult overweight.

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APPENDIX

APPENDIX A

CDC MEASURING HEIGHT AND WEIGHT GUIDELINES

Measuring Height Accurately

To measure height accurately at home to calculate BMI-for-age:

1. Remove the child's shoes, bulky clothing, and hair ornaments, and unbraid hair that interferes with the measurement.
2. Take the height measurement on flooring that is not carpeted and against a flat surface such as a wall with no molding.
3. Have the child stand with feet flat, together, and against the wall. Make sure legs are straight, arms are at sides, and shoulders are level.
4. Make sure the child is looking straight ahead and that the line of sight is parallel with the floor.
5. Take the measurement while the child stands with head, shoulders, buttocks, and heels touching the flat surface (wall). (See illustration.) Depending on the overall body shape of the child, all points may not touch the wall.
6. Use a flat headpiece to form a right angle with the wall and lower the headpiece until it firmly touches the crown of the head.
7. Make sure the measurer's eyes are at the same level as the headpiece.
8. Lightly mark where the bottom of the headpiece meets the wall. Then, use a metal tape to measure from the base on the floor to the marked measurement on the wall to get the height measurement.
9. Accurately record the height to the nearest 1/8th inch or 0.1 centimeter.

Measuring Weight Accurately

To measure weight accurately at home to calculate BMI-for-age:

1. Use a digital scale. Avoid using bathroom scales that are spring-loaded. Place the scale on firm flooring (such as tile or wood) rather than carpet.
2. Have the child or teen remove shoes and heavy clothing, such as sweaters.
3. Have the child or teen stand with both feet in the center of the scale.
4. Record the weight to the nearest decimal fraction (for example, 55.5 pounds or 25.1 kilograms).

APPENDIX B: QUESTIONNAIRE FOR CHILDREN

Grade _____	**CODE:** _____	**Survey Date** _____

PART I. Socio-demographic Characteristics

1. A. Please fill in your birthday (day/month/year): ___/___/___

    B. Please put a (√) next to your gender: ☐ Male ☐ Female

2. What is your pocket money per day?
    A. Less than 50 baht.
    B. 50 – 100 baht.
    C. 101 – 200 baht.
    D. More than 200 baht.

3. How do you spend your pocket money?
    A. Beverages
    B. Toys
    C. Snacks (eg. bakery, fried chicken/meat balls, ice cream)
    D. Fruit
    E. Saving
    F. Others (Please specify: _____)

4. What would you describe your own weight?
    A. Normal
    B. Overweight
    C. Underweight

Part II. Knowledge and attitude on overweight and obesity.
The following questions are about knowledge (Question 1-4) and attitude (Question 5-6) towards overweight and obesity. Please choose the best answer only.

1. How do you describe your weight?
    ☐ Normal   ☐ Overweight   ☐ Underweight

2. What is the recommended daily caloric intake for children?
    ☐1300   ☐1400   ☐1700-1600   ☐ Don't know

3. What are the effects of overweight to health?
    A. High blood pressure
    B. Diabetes
    C. High cholesterol
    D. All of the above

   .4What are factors leading to overeight?
    A. Eating high caloric food.
    B. Eating too frequently.
    C. Lack of physical activity.
    D. All of the above

5-6. Please put a (√) under AGREE if you totally agree with the statement or (√) under DISAGREE if you absolutely disagree with the statement. Ii you cannot decide or refused to answer, put a (√) under Don't Know/Refused

STATEMENT	Agree	Disagree	Uncertain/ Neutral
5. Overweight children and teens are unhealthy.			
6. Overweight people have less stamina compared to normal-weight people.			

7. On an average night, how many hours of sleep do you get?
    ☐ < 8 hrs   ☐1 8-10 hrs   ☐ > 10 hrs

Part III. KNOWLEDGE, ATTITUDE, and BEHAVIOR
The following sections are divided into two parts: Part A is about Diet, Part B is about Physical Activity.

A. DIET The following questions are about your eating habits. Please choose the best answer only.

1. 1. What is the recommend amount of serving per meal?

Rice (ladle(	☐1	☐3-2	☐4
Vegetable) table spoon(	☐2	☐3	☐4
Meat (table spoon)	☐3-2	☐4	☐5
Fruit (serving)	☐1	☐2	☐3
Serving of milk per day) glass(	☐1	☐2	☐3

2. How many meals do you have per day?
   A. 2 meals
   B. 3 meals
   C. 4 meals

1. Which is the most important meal of the day?
   A. Breakfast
   B. Lunch
   C. Dinner
   D. Late night meals

2. Brown rice is good for health beacuse
   A. High minerals and vitamins
   B. Fiber
   C. Makes you full longer than white rice
   D. All of the above
3. Which type of meal has the least amount of fats?
   A. Pork
   B. Fish
   C. Shrimp
   D. Squid

4. What are the benefits of consuming vegetables and fruits?
   A. Improves health and immunity
   B. Prevents constipation
   C. Stronger bones
   D. All of the above

5. Which type (flavor) of milk is healthiest?
   A. Chocolate milk
   B. Unflavored milk
   C. Strawberry milk
   D. Sweetened milk

6. Which type of beverage/drinks is healthy for you?
   A. Soft drinks
   B. Pure water
   C. Smoothies
   D. Green tea
7. What are the effects of carbonated (soft) drinks on health?
   A. Overweight and dental caries
   B. Stomach acidity

      C. Stimulants causing lack of sleep

      D. All of the above

8. Which type of the following snack is the healthiest?
   - A. Yogurt
   - B. Tuna sandwich
   - C. Crisp snacks
   - D. Chocolate

9. Crispy snacks usually contain _____.
   - A. Starch and sugar
   - B. Fats
   - C. Salt
   - D. All of the above

10. Fried food usually used cooked oil, which type of oil should you avoid?
    - A. Cooking oil black in color
    - B. Cooking oil burning smell
    - C. A lot of smoke while cooking
    - D. All of the above

11. What are the effects of consuming fried food?
    - E. Cancer
    - F. High cholesterol
    - G. Overweight
    - H. All of the above

12. What is the recommended amount sugar intake per day
    - A. 4 tablespoon
    - B. 6tablespoon
    - C. 8tablespoon
    - D. 10tablespoon

13. What are the effects of eating too salty food?
    - A. High blood pressure
    - B. Lack of concentration
    - C. Fresher mind
    - D. Better digestion

14. Ways to reduce fats in cooking include _____.
    - A. Boil
    - B. Steamed
    - C. Grilled
    - D. All of the above

15. Do you know what is a food label?
    - ☐Yes   ☐No)Skip to Q. 17

16. Do you understand the meaning of "one serving"?

           Serving size: 1/2 pack (30 กรัม)

           Serving per container: 2

Example: You bought a snack for 20 THB and the food label states:

What do you understand from the above label?
A. You can eat all at once
B. Should be divided and eaten twice.
C. May be shared with another person.
D. B and C are correct

17-18. Please put a (√) under *AGREE* if you think the statement is true or (√) under *DISAGREE* if you think the statement is false. Ii you cannot decide, you may answer Don't Know.

STATEMENT	AGREE	DISAGREE	Don't Know/ refused
17. Fast food restaurants should not offer toys because they encourage children to eat more.			
18. Eating from fast food restaurants regularly will make me overweight.			

19. If you have a choice to go shopping for food with parents, how would you choose?
A. Value for money
B. Compare the food labels for the most nutritious food.
C. All of the above

20. If you were given the chance to purchase a type of food, what factor will you consider the most before buying? **Tick ✓ the choice you agree the most**
☐ Flavor ☐ Benefits ☐ Advertisement
☐ Amount ☐ Color ☐ Free toys
☐ Packaging ☐ Price ☐ Others (Please specify.......................)

21. **Dietary practice.** Please put a (√) under right answer/practice.

Item	Never	1-2 times/week	3-4 times/week	5-6 times/week	Daily or more than once/day
Brown rice consumption					
White rice consumption					
Amount of consumption ☐ Less than 2 ladle ☐ 2-3 ladles ☐ More than 2 ladles					
Meat consumption					
Amount of consumption ☐ Less than 2 table spoon ☐-2 3 table spoons ☐ More than 3 table spoons					
Vegetable consumption					
Amount of consumption					

☐ Less than 2 table spoon ☐ -2 3 table spoons ☐ More than 3 table spoons					
Fruit consumption					
Amount of consumption ☐ Less than 1 serving ☐ 1 serving ☐ More than 1 serving					
Unflavored milk consumption					
Amount of consumption ☐ 1 glass ☐ 2 glasses ☐ More than 2 glasses					
Sweetened-milk consumption					
Consumed at least 6 glasses of water per day.					
Sweetened-milk consumption					
Processed-sweetened yogurt consumption					
Processed fruit juices consumption					
Sugar sweetened beverages					
Noodles consumption					
Stewed pork leg with rice/steamed chicken rice consumption					
Fried food consumption					
Coconut curried rice consumption					
Boiled food consumption					
High caloric snacks consumption					
Sweetened bakery products consumption					
Chocolate and candies consumption					
Fast food consumption					

Physical Activities The following questions are about your physical activity. Please remember to answer about moderate exercise only. (KNOWLEDGE Questions 1-4, ATTITUDE Questions 5-6, PRACTICE Questions 7-10)

1. Are physical activities good for health? (Please put a (√) next to correct answer)   ☐ Yes   ☐ No

2. How often should a person exercise in a week?

       A. Less than 3 times
       B. 4-5 times
       C. 6-7 times

3. On average, how many minutes should a person spend exercising per time?

      A. Less than 30 minutes
      B. 31-59 minutes
      C. At least 60 minutes

4. How important is exercise for health?

      A. Very important
      B. Moderately important
      C. Not important

5-6. Please put a (√) under AGREE if you totally agree with the statement or (√) under DISAGREE if you absolutely disagree with the statement. Ii you cannot decide or refused to answer, put a (√) under Don't Know/Refused.

STATEMENT	AGREE	DISAGREE	Don't Know/ refused
5. Taking part in physical activities can help reduce stress.			
6. Physical activities reduces the time to play games.			

7. How many times do you exercise in a week?

      A. Less than 3 times
      B. 4-5 times
      C. 6-7 times

8. On average, how many minutes do you spend exercising per time?

      A. Less than 30 minutes
      B. 31-59 minutes
      C. At least 60 minutes

9. On a typical SCHOOL DAY, how many hours do you usually spend watching television or videos? (Include DVD and video movies. Do not count video or computer games)

      A. None
      B. Less than 1 hour
      C. 1-2 hours
      D. More than 2 hours

10. On a typical SCHOOL DAY, how many hours do you usually spend playing video or computer games?

    A. None
    B. Less than 1 hour
    C. 1-2 hours
    D. More than 2 hours

School Environment. The following are some general questions about the school-environment. Please choose the best answer only. **Please put a (√) under *AGREE* if you think the statement is true or (√) under *DISAGREE* if you think the statement is false. Ii you cannot decide, you may answer Don't Know.**

STATEMENT	AGREE	DISAGREE	Don't Know/ refused
1. School environment is very important to promote physical activity.			
2. My school environment is not ideal for physical activity.			
3. School environment is very important to promote healthy eating.			
4. Food served in my school has too much fats, salts, and/or sugar.			
5. Growing edible plants in my school will make me eat healthier.			
6. If my school promotes good health, I will be healthier.			

Thank you for your participation and cooperation in this research.
Please return the questionnaire to the researcher, and kindly allow him to measure your weight and height.

APPENDIX C: QUESTIONNAIRE (THAI)

☐ ด.ช. ☐ ด.ญ ....เลขประจำตัว .อายุปี   ชั้น ป.........................ห้อง............**โรงเรียน**......................

<u>**ข้อมูลพื้นฐานและการประเมินตนเอง**</u>

1. ข้อมูลวันเดือนปีเกิดของน้อง วัน)/เดือน /ปี (:_____/_____/_____

2. ในแต่ละวันน้องได้เงินมาโรงเรียนกี่บาท
   a. น้อยกว่า 50 บาท
   b. 50-100 บาท
   c. 101-200 บาท
   d. มากกว่า 200 บาท

3. จากข้อ 2 เงินที่น้องได้รับในแต่ละวัน น้องใช้จ่ายอะไรบ้าง สามารถตอบได้มากกว่า 1 ข้อ **ใส่เครื่องหมาย)**
   ✔ **หน้าข้อความ(**

☐ เครื่องดื่ม (นม เป็นต้น ,น้ำอัดลม ,น้ำหวาน ,เช่น น้ำปั่น)

☐ ของเล่น

☐ อาหารว่าง (ไอศกรีม เป็นต้น ,ไก่ทอด ,ลูกชิ้นทอด ,เบเกอรี่ ,เช่น ขนมกรุบกรอบ)

☐ ผลไม้

☐ หยอดกระปุกออมสิน บาท.......

☐ อื่นๆ ระบุ.....................................

4. น้องคิดว่ารูปร่างของตัวเองในปัจจุบันเป็นอย่างไร **ใส่เครื่องหมาย)**✔ หน้าข้อความ(

☐ สมส่วน   ☐ อ้วน   ☐ ผอม

   ขอให้น้องใส่เครื่องหมายวงกลมหน้าคำตอบที่น้องคิดว่าถูกที่สุด

5. น้องทราบหรือไม่ว่าใน วัน น้องประถมปลายต้องการพลังงานจากอาหารกี่กิโลแคลอรี 1
   a. 1300   ข.1400 .   ค .1600 -1700   ง ไม่ทราบ.

6. เด็กที่อ้วน ในอนาคตมีโอกาสเสี่ยงจะเป็นโรคใดบ้าง
   a. โรคความดันโลหิตสูง
   b. โรคเบาหวาน
   c. โรคไขมันในเลือดสูง
   d. ถูกทุกข้อ

7. โรคอ้วน มีสาเหตุมาจากอะไร
   a. กินอาหารที่มีพลังงานสูง เช่น ไก่ทอด ลูกชิ้นทอด ขนมกรุบกรอบ เค้ก มากเกินไป
   b. กินอาหารจุบจิบในปริมาณมาก
   c. ไม่ออกกำลังกาย
   d. ถูกทุกข้อ

8. น้องควรจะทำอย่างไร ให้ห่างไกลจากโรคอ้วน
   a. กินขนมขณะ ดูทีวี
   b. ช่วยพ่อแม่ทำงานบ้าน
   c. กินข้าวมากกว่า 3 มื้อ
   d. ดื่มนมแทนน้ำ

9. **ใส่เครื่องหมาย)**✔ใน (ช่องที่น้อง เห็นด้วย หรือไม่เห็นด้วย หรือ ไม่ทราบ/ไม่เข้าใจ

ข้อความ	เห็นด้วย	ไม่เห็นด้วย	ไม่ทราบ/ไม่แน่ใจ
เด็กและวัยรุ่นที่อ้วนจะดูไม่ดีเมื่อเปรียบเทียบกับเด็กที่รูปร่างสมส่วนในวัยเดียวกัน			
เด็กอ้วนมักมีสุขภาพไม่ดี			

10. น้องนอนคืนละกี่ชั่วโมง

      ก.   น้อยกว่า ชั่วโมง 8

      ข.   10-8 ชั่วโมง

      ค.   มากกว่า 10 ชั่วโมง

การประเมินด้านอาหารและโภชนาการ

11. น้องทราบหรือไม่ว่าในวัยของน้องควรกินอาหารเป็นสัดส่วนเท่าใดในแต่ละมื้อ

ข้าว (ทัพพี)	☐1	☐3-2	☐4
ผัก (ช้อนโต๊ะ)	☐2	☐3	☐4
เนื้อสัตว์ (ช้อนโต๊ะ)	☐3-2	☐4	☐5
ผลไม้ (ส่วน)	☐1	☐2	☐3
น้องควรดื่มนมวันละ (กล่อง/แก้ว)	☐1	☐2	☐3

ขอให้น้องใส่เครื่องหมายวงกลมหน้าคำตอบที่น้องคิดว่าถูกที่สุด

12. น้องควรกินข้าววันละกี่มื้อ

      a.   (มื้อเย็น-มื้อกลางวัน) มื้อ 2

      b.   (มื้อเย็น-มื้อกลางวัน-มื้อเช้า) มื้อ 3

      c.   (มื้อดึก-มื้อเย็น-มื้อกลางวัน-มื้อเช้า) มื้อ 4

13. อาหารมื้อไหนสำคัญที่สุด

      a.   มื้อเช้า

      b.   มื้อกลางวัน

      c.   มื้อเย็น

      d.   มื้อดึก

14. ข้าวกล้อง ดีต่อสุขภาพเพราะ

      a.   มีวิตามินและแร่ธาตุสูง

      b.   มีกากใยสูง

      c.   อิ่มนานกว่าข้าวขาว ทำให้ไม่หิวเร็ว

      d.   ถูกทุกข้อ

15. เนื้อสัตว์ประเภทใดต่อไปนี้ที่มีไขมันต่ำ

      a.   หมูสามชั้น

      b.   ปลา

      c.   กุ้ง

      d.   ปลาหมึก

16. การกินผักและผลไม้เป็นประจำมีประโยชน์ อย่างไร

      a.   ทำให้ร่างกายแข็งแรง ไม่เป็นหวัดง่าย

      b.   ช่วยให้ท้องไม่ผูก

      c.   ช่วยเสริมสร้างกระดูกและฟันให้แข็งแรง

    d.   ถูกทุกข้อ

17. น้องควรดื่มนมชนิดใด จึงจะมีประโยชน์ต่อร่างกายมากที่สุด

    a.   นมรสช็อคโกแลต

    b.   นมสดรสจืดหรือนมพร่องมันเนย

    c.   นมรสสตรอเบอรี่

    d.   นมรสหวาน

18. น้ำดื่มชนิดใดที่ดีต่อสุขภาพและน้องควรดื่ม

    a.   น้ำอัดลม

    b.   น้ำเปล่า

    c.   น้ำปั่น

    d.   ชาเขียว

19. ผลของน้ำอัดลมต่อสุขภาพคือ

    a.   มีน้ำตาลสูง ทำให้เป็นโรคอ้วนและฟันผุ

    b.   กรดในน้ำอัดลมทำให้ปวดท้อง

    c.   คาเฟอีนกระตุ้นประสาททำให้นอนไม่หลับ

    d.   ถูกทุกข้อ

20. อาหารว่างต่อไปนี้ที่มีประโยชน์มากกว่า คือ

    a.   นมเปรี้ยว

    b.   แซนวิชไส้ทูน่า

    c.   ขนมกรุบกรอบ

    d.   ช็อคโกแลต

21. ขนมกรุบกรอบประกอบด้วย

    a.   แป้งและน้ำตาล

    b.   ไขมัน

    c.   เกลือและผงชูรส

    d.   ถูกทุกข้อ

22. ของทอดมักใช้น้ำมันทอดซ้ำ น้ำมันลักษณะใดที่น้องควรหลีกเลี่ยง

    a.   น้ำมันมีสีดำคล้ำ

    b.   มีกลิ่นไหม้

    c.   มีควันมากขณะทอด

    d.   ถูกทุกข้อ

23. การกินอาหารทอดบ่อยๆ จะเกิดผลเสียอย่างไรต่อร่างกาย

    a.   น้ำมันทอดซ้ำๆ สีดำ มีสารก่อมะเร็ง

    b.   เสี่ยงต่อภาวะไขมันในเลือดสูง

    c.   ทำให้อ้วน

    d.   ถูกทุกข้อ

24. เพื่อสุขภาพที่ดี น้องไม่ควรกินน้ำตาลเกินวันละกี่ช้อนชา

    a.   ช้อนชา 4

    b.   ช้อนชา 6

    c.   ช้อนชา 8

    d.   ช้อนชา 10

25.   การกินอาหารที่มีรสเค็มจัดเป็นประจำ จะส่งผลอย่างไรต่อสุขภาพ

    a.   เสี่ยงต่อโรคความดันโลหิตสูง

    b.   สมองปลอดโปร่ง มีสมาธิในการเรียนหนังสือ

    c.   ร่างกายสดชื่น กระปรี้กระเปร่า

    d.   เจริญอาหารมากขึ้น ทำให้ร่างกายได้รับสารอาหารเพียงพอ

26.   วิธีปรุงอาหารที่จะลดไขมันได้

    a.   การต้ม เช่น แกงจืด

    b.   การนึ่ง เช่น ปลานึ่ง

    c.   การอบ เช่น ไก่อบ

    d.   ถูกทุกข้อ

27.   น้องรู้จักฉลากโภชนาการหรือไม่

    ☐รู้จัก   ☐ไม่รู้จัก (29 ข้ามไปข้อ)

28.   น้องทราบความหมายของคำว่า "หนึ่งหน่วยบริโภค" หรือไม่

    ตัวอย่าง   น้องซื้อขนมมันฝรั่งทอดกรอบจากร้านสะดวกซื้อมา 1 ซองราคา 20 บาท ฉลากโภชนาการระบุว่า

หนึ่งหน่วยบริโภค   1/2 ซอง (30 กรัม)

จำนวนหน่วยบริโภคต่อซอง: ประมาณ 2

    น้องเข้าใจคำพูดนี้ว่าอย่างไร

    a.   น้องสามารถกินมันฝรั่งทอดกรอบหมดภายในครั้งเดียว

    b.   น้องควรแบ่งขนมมันฝรั่งทอดกรอบกิน 2 ครั้ง

    c.   น้องควรแบ่งขนมมันฝรั่งทอดกรอบกินกับเพื่อน

    d.   ข้อ ข. และข้อ ค.

29. ใส่เครื่องหมาย (✓ "ในข้อความที่น้อง (เห็นด้วย" หรือ "ไม่เห็นด้วย" หรือ "ไม่ทราบ/ไม่แน่ใจ"

ข้อความ	เห็นด้วย	ไม่เห็นด้วย	ไม่ทราบ/ไม่แน่ใจ
ร้านอาหารฟาสต์ฟู้ดไม่ควรแถมของเล่น เพราะจะ สนับสนุนให้เด็กๆ กินอาหารที่ไม่ดีต่อสุขภาพ			
น้องคิดว่าการกินอาหารฟาสต์ฟู้ดบ่อยๆ จะทำให้อ้วน			

30. ถ้าน้องมีโอกาสไปซื้ออาหารกับผู้ปกครอง น้องจะมีวิธีในการเลือกซื้ออาหารอย่างไร

        a. เลือกซื้ออาหารที่ราคาไม่แพง ปริมาณคุ้มค่ากับราคา

        b. อ่านฉลากโภชนาการก่อนซื้อ เปรียบเทียบดูหลายๆ ยี่ห้อ แล้วเลือกยี่ห้อที่มีคุณค่าทางโภชนาการสูงสุด

        c. ถูกทุกข้อ

31. ถ้าน้องสามารถเลือกอาหารได้ 1 ชนิด น้องจะตัดสินใจเลือกอาหารชนิดนั้นโดยคำนึงถึงสิ่งใดเป็นอันดับแรก

ใส่เครื่องหมาย(✓ หน้าข้อความ)

    ☐ รสชาติอร่อย ☐ มีประโยชน์   ☐ ตามสื่อโฆษณา

    ☐ ปริมาณ   ☐ สีสัน   ☐ ของแถม

    ☐ บรรจุภัณฑ์ ☐ ราคา   ☐ อื่นๆ ระบุ......................

32 .พฤติกรรมการบริโภคอาหารของน้องใน 1 สัปดาห์ที่ผ่านมา) ให้น้องทำเครื่องหมาย ✓ ในช่องที่น้องได้ปฏิบัติตาม(

รายการ	ไม่เคย	1-2 ครั้ง/ สัปดาห์	3-4 ครั้ง/ สัปดาห์	5-6 ครั้ง/ สัปดาห์	1 ครั้ง/วัน หรือ มากกว่า 1 ครั้ง/วัน
น้องกินข้าวกล้อง					
น้องกินข้าวสวย					
ในวันที่กินข้าว น้องกินข้าวเฉลี่ยมื้อละ ☐ น้อยกว่า 2 ทัพพี ☐ 2-3 ทัพพี ☐ มากกว่า 3 ทัพพี					
น้องกินเนื้อสัตว์(ปลา /ไก่/ หมู)					
ในวันที่กิน น้องกินเนื้อสัตว์เฉลี่ยมื้อละ ☐ น้อยกว่า 2 ช้อนกินข้าว ☐ -2 3 ช้อนกินข้าว ☐ มากกว่า 3 ช้อนกินข้าว					

รายการ	ไม่เคย	1-2 ครั้ง/สัปดาห์	3-4 ครั้ง/สัปดาห์	5-6 ครั้ง/สัปดาห์	1 ครั้ง/วัน หรือ มากกว่า 1 ครั้ง/วัน
น้องกินผัก เช่น ผักกาดขาว ผักบุ้ง คะน้า					
ในวันที่กิน น้องกินผักเฉลี่ยมื้อละ ☐ น้อยกว่า 2 ช้อนกินข้าว ☐ 2-3 ช้อนกินข้าว ☐ 4 ช้อนกินข้าว หรือมากกว่า					
น้องกินผลไม้					
ในวันที่กิน น้องกินผลไม้เฉลี่ยมื้อละ 1)ส่วน=แอปเปิล 1 ผล /กล้วย 1 ผลมะละกอ/ลูก 4 เงาะ/ 6-8 ชิ้นคำ ฝรั่ง /½ ผล / (ผล 3-2 ชมพู่ ☐ น้อยกว่า 1 ส่วน ☐ 1 ส่วน ☐ มากกว่า 1 ส่วน					
น้องดื่มนมจืด					
น้องดื่มนมวันละกี่แก้ว กล่อง)) ☐ 1 แก้ว)1 แก้ว =1 กล่อง 200 มล(./วัน ☐ 2 แก้ว/วัน ☐ มากกว่า 2 แก้ว/วัน					
น้องดื่มน้ำอัดลม					
น้องดื่มน้ำอย่างน้อยวันละ 6 แก้ว					
น้องดื่มนมปรุงแต่งรส เช่น นมรสช็อคโกแลต นมรสหวาน					
น้องดื่มนมเปรี้ยวหรือโยเกิร์ตปรุงแต่งรส					
น้องดื่มน้ำผลไม้สำเร็จรูป					
น้องดื่มเครื่องดื่มรสหวาน เช่น ชาเขียว นมเย็น โกโก้					
น้องกินก๋วยเตี๋ยวผัดผัดซีอิ๊ว/ผัดไท					
น้องกินข้าวมัน ไก่ข้าวขาหมู/					
น้องกินอาหารทอด เช่น ไส้กรอกทอดลูกชิ้นทอด//ไก่ทอด					
น้องกินแกงกะทิ เช่น แกงไก่ มัสมั่น					
น้องกินอาหารต้ม เช่น แกงจืด แกงส้ม ต้มยำ					
น้องกินขนมกรุบกรอบ เช่น มันฝรั่งทอด					
น้องกินเบเกอรี่ครัวซองก์/โดนัท/					
น้องกินช็อคโกแลตลูกกวาด/ลูกอม/					
น้องกินอาหารฟาสฟู้ด เช่น แฮมเบอเกอร์ พิซซ่า					

การออกกำลังกาย

คำถามเกี่ยวกับกิจกรรมการออกกำลังกาย ขอให้น้องวงกลมหน้าข้อที่น้องคิดว่าถูกที่สุด

33. กิจกรรมการออกกำลังกายดีต่อสุขภาพใช่หรือไม่

ก ใช่ .   ข ไม่ใช่ .

34. การออกกำลังกายสม่ำเสมอ มีผลดีต่อร่างกายคือ

     ก.   รูปร่างดูดี

     ข.   กล้ามเนื้อแข็งแรง

     ค.   เพิ่มภูมิต้านทานโรค

     ง.   ถูกทุกข้อ

35. วัยเด็กควรออกกำลังกาย**สัปดาห์ละกี่ครั้ง**(วัน(

     ก.   น้อยกว่า ครั้ง 3

     ข.   3-5 ครั้ง

     ค.   ครั้ง 7-6

36. เด็กๆ ควรออกกำลังกายวันละเท่าไร

     ก.   น้อยกว่า นาที 30

     ข.   5-309 นาที

     ค.   นาทีหรือมากกว่า 60

37. ใส่เครื่องหมาย) ✓ (ในข้อความที่น้อง "เห็นด้วย" หรือ "ไม่เห็นด้วย" หรือ "ไม่ทราบ/ไม่เข้าใจ"

ข้อความ	เห็นด้วย	ไม่เห็นด้วย	ไม่ทราบ/ไม่แน่ใจ
น้องคิดว่าการออกกำลังกายจะช่วยให้สนุก และมีความสุข			
น้องคิดว่าการออกกำลังกายทำให้เสียเวลาในการเล่นเกม			

38. น้องทำกิจกรรมทางกาย เช่น วิ่งเล่น ทำงานบ้าน เล่นกีฬา สัปดาห์ละกี่ครั้ง

     ก.   น้อยกว่า ครั้ง 3

     ข.   3 5-ครั้ง

     ค.   ครั้ง 7-6

39. น้องทำกิจกรรมทางกายเช่น วิ่งเล่น ทำงานบ้าน เล่นกีฬา วันละเท่าไร

     ก.   น้อยกว่า นาที 30

     ข.   5-309 นาที

     ค.   นาทีหรือมากกว่า 60

40. น้องใช้เวลาเท่าไรในการดูทีวีดีวีดี , หรือวีดีโอหลังกลับจากโรงเรียน

     ก.   ไม่ดูเลย

     ข.   น้อยกว่า 1 ชั่วโมง

     ค.   1-2 ชั่วโมง

     ง.   มากกว่า 2 ชั่วโมง

41. น้องใช้เวลาเท่าไรในการเล่นวีดีโอเกมส์หรือเกมส์คอมพิวเตอร์หลังกลับจากโรงเรียน

     ก.   ไม่เล่นเลย

     ข.   น้อยกว่า 1 ชั่วโมง

     ค.   1-2 ชั่วโมง

     ง.   มากกว่า 2 ชั่วโมง

42. ใส่เครื่องหมาย)✓ ในข้อความที่น้อง "เห็นด้วย" หรือ "ไม่เห็นด้วย" หรือ "ไม่ทราบ/ไม่เข้าใจ"

ข้อความ	เห็นด้วย	ไม่เห็นด้วย	ไม่ทราบ/ไม่แน่ใจ
น้องคิดว่าสิ่งแวดล้อมในโรงเรียนมีความสำคัญต่อสุขภาพ			
สิ่งแวดล้อมในโรงเรียนเป็นปัจจัยสำคัญต่อการได้วิ่งเล่น ออกกำลังกาย			
โรงเรียนของน้องมีที่ออกกำลังกายเพียงพอ			
การจัดและขายอาหารในโรงเรียนมีความสำคัญต่อสุขภาพเด็ก			
ถ้าน้องปลูกผักสวนครัวในโรงเรียนจะทำให้น้องชอบกินผักมากขึ้น			
ถ้าโรงเรียนเรามีโปรแกรมส่งเสริมสุขภาพน้องจะมีสุขภาพดีขึ้น			

ขอขอบคุณน้องๆ ทุกคนที่ให้เวลาในการตอบแบบสอบถาม

APPENDIX D

HEALTHY & HAPPY LIFE SKILLS PROGRAM

GRADE 4-5 LESSON PLANS

HEALTHY & HAPPY LIFE SKILLS PROGRAM

Healthy & Happy Life Skills Program is designed for children in Grade 4 and 5. The manual is a curriculum-based tool that is divided into sections that promote healthy living. The purpose of this manual is to promote and teach a healthy lifestyle.

Learning to be a responsible consumer is important. Learning to make healthy food selections and being physically active while young can impact a long-term health. Preparing and tasting simple foods that promote good health is also an important step in making informed choices about nutrition. These choices can then continue into these students' adult lives.

There are seven major components to this manual. Instructional time will focus on the functional skills that are necessary to build a healthy and strong body. The components, objectives, and essential questions to be asked are listen bellow as follow:

1. KNOWING MY BODY
Specific Content: Nutritional Status
Objectives:
1. Understand the importance of nutritional status.
2. Trace weight-to-height on a graph to determine their nutritional status.
3. Explain the differences between underweight, normal, overweight, and obese.

2. IS OBESITY A DISEASE?
Specific Content: Effects of Overweight/Obesity on Health
Objectives:
1. State how obesity affects health.
2. Know the consequence of being overweight/obese.
3. List factors causing overweight/obesity.
4. State ways to prevent or reduce overweight/obesity.

3. EATING WELL
Specific Content: Exploring My Plate
Objectives:
1. Develop an understanding of good nutrition.
2. States components of a well-balanced diet

4. EATING WELL
Specific Content: Healthy Snacking
Objectives:
1. Differentiate between healthy and unhealthy snacks.

2. Make healthier decision for snack choices.

3. Recall the importance of eating fruits and vegetables.
4. Understand and comprehend the use of food label.

5. PLANTING
Specific Content: Growing Healthy Foods
Objectives:
1. Enjoy planting food that can be eaten.
2. Develop an appreciation for the process of cultivation and harvesting.

6. MAKING RIGHT CHOICES
Specific Content: How Right Choices Make You Look Good/Physically Active
Objectives:
1. Identify various ways of making decision and examine their results.
2. Practice making difficult decisions.
3. Learn about effective decision-making and their consequences.

7. MAKING RIGHT CHOICES
Specific Content: Wise Consumer Spending
Objectives:
1. Recognize the influence that advertising has on our lives and our eating habits.
2. Realize the importance of money and spend money wisely.
3. Build awareness about food marketing.
4. Save money and spend wisely.

ESSENTIAL QUESTIONS
- Why do we eat what we eat?

- Why does it matter?

- What are factors that cause obesity?

- What has led to the rise in obesity and what are the affects of it?

- How do we keep ourselves healthy?

- What are ways to become a more effective decision maker?

- How to become a better healthy consumer?

LESSON 1: Knowing My Body

SPECIFIC SUBJECT MATTER FOR THE LESSON: Nutritional Status

OBJECTIVES

Students will be able to:

1. Understand the importance of nutritional status.
2. Trace weight-for-height on a graph to determine their nutritional status.
3. Explain the differences between underweight, normal, overweight, and obese.

Integration Subject	Materials or Reference	Contents	Methodologies / Strategies/Activities	Student Evaluation
- Health Education	- Computer to show PowerPoint Presentation title "Nutritional Status" - Colored pencils/crayons - Weight-for-height graphs to determine nutritional status. Can be obtained from http://nutrition.anamai.moph.go.th	1. Weight-for-height graphs for children 2. Nutritional status: Normal, Overweight, Obese, Underweight	- Students will be asked on how do we know if our weight is normal or not? **Q & A 10 mins** - Students will be presented with a PowerPoint presentation on what is body composition and how to calculate our nutritional status **Presentation 15 mins** - Students will measure their height and weight and trace upon the colors of the graph displayed/given to students to determine their nutritional status. (Purple = overweight; Green = normal; Orange = underweight). They will record their data on a scorecard **Activity 15 mins** - Revision of lesson **Revision 10 mins**	Questions & Answers Calculation of nutritional status. Take home essay determining why you think your have a particular nutritional status. If you are over the normal amount, explain why. If you are under the normal amount, explain why?

LESSON 2: Is Obesity a Disease?

SPECIFIC SUBJECT MATTER FOR THE LESSON: What are the Causes and Effects of Overweight/Obesity on Health?

OBJECTIVES

Students will be able to:

1. State how obesity affects health.
2. Know the consequence of being overweight/obese.
3. State ways to prevent or reduce overweight/obesity.

Integration Subject	Materials or References	Contents	Methodologies / Strategies/Activities	Student Evaluation
- Health Education	- PowerPoint Presentation on Obesity and Overweight. - หนังสือคู่มือการสร้างเสริมสุขภาพ - หนังสือการ์ตูนเด็กไทยอุดี ศอน	1. Factors of Overweight: Diet 2. Effects of Overweight/Obesity: Tiredness, cholesterol, heart diseases, hypertension, diabetes, black spots, allergies, arthritis, cancer 3. Prevention	- Engage students in a discussion about what causes overweight and obesity? **Q & A 10 mins** - Display pictures of obese people with adverse health effects **Display 10 mins** - Presentation on Obesity and Overweight **Presentation 15 mins** - Students to list down in their notebook what are some causes of overweight and how to prevent them from happening to us? **Classwork 10 mins** - Revision of lesson and distribution of books **Revision 5 mins**	Discussion on obesity through Q & A. Classwork Students to watch a movie Super Size Me (พากย์ไทย) during a club time in the school's auditorium from free accessible website: www.clipmass.com/movie/4130 02913134392

LESSON 3: Eating Well

SPECIFIC SUBJECT MATTER FOR THE LESSON: Exploring My Plate

OBJECTIVES

Students will be able to:

1. Develop an understanding of good nutritional.
2. States components of a well-balanced diet.

Integration Subject	Materials or References	Contents	Methodologies / Strategies/Activities	Student Evaluation
- Health Education	- MyPlate poster (available online at www.learningzoneexpress.com) - Real food, different types. (Mixture of healthy and unhealthy) - Food Model	1. Three Meals 2. Importance of Breakfast 3. Eating Discipline: Eating on time, Avoid over snacking, eating too late, understanding types of food. 4. Proportion amount per meal.	- Follow up question from previous class regarding overweight and obesity. Question students about three of health problems Spurlock faced in his 30 days marathon of fast food (Super Size Me)? **Follow-up 10 mins.** - Introduce students to importance of meals, breakfast, eating discipline, and proportion of food. **Discussion 10 mins.** - My Plate, healthy food choices by inquiring/focusing questions on characteristics of healthy foods? What are the five food groups and how are they important to a well-balanced diet? Ask students what the different food groups represents and why are they different in sizes. Let students identify a food from each of the food group. **Discussion 15 mins.** - Student fill up a My Plate exercise individually and color and/or place cutout pictures of food in. **Classwork 10 mins.** - After completion, students can orally review the concept of My Plate as a group. Each student can present their work while teacher reinforces concepts of food groups, type of foods, and healthy choices. **Revision 5 mins.**	Assignment on My Plate. Classwork

LESSON 4: Eating Well

SPECIFIC SUBJECT MATTER FOR THE LESSON: Healthy Snacking

OBJECTIVES

Students will be able to:

1. Differentiate between healthy and unhealthy snacks.
2. Make healthier decision for snack choices.
3. Recall the importance of eating fruits and vegetables.

Integration Subject	Materials or References	Contents	Methodologies / Strategies/Activities	Student Evaluation
- Health Education - Science	- Variety of healthy snacks (fruits, nuts) and unhealthy snacks (soft drinks, chips, biscuits, cakes, candies, chocolate) - CD "Dek Thai Doo Dee" - Video การ์ตูน Dr. Smart พิชิต โรคอ้วน (https://www.youtube.com/watch?v=WYeLHgSwUtI)	1. Health Snacks – fruits Benefits of fruits: Vitamins, minerals, fibre, increase immunity. 2. Ingredients of unhealthy snacks: flour/sugar, fats – causes overweight, salts causes hypertension 3. Soft drinks: ingredients include sugar causes overweight, tooth decay, stomach ache, caffeine – stimulates heart beat, MSG	- Inquiring question on some examples of healthy and unhealthy snacks. **Q & A 10 mins.** - Display of snacks and allow students vote on their preferable snacks **Activity 10 mins.** - Class activity by discussing about snacks and categorize snacks "healthy vs unhealthy" **Activity 15 mins.** - Tasting Healthy snacks. **Tasting 5 mins.** - Give students CD to take home, watch cartoon to reinforce lesson. **Revision 10 mins.**	Activity

LESSON 5: Planting

SPECIFIC SUBJECT MATTER FOR THE LESSON: Growing Healthy Foods

OBJECTIVES

Students will be able to:

1. Enjoy planting food that can be eaten.
2. Develop an appreciation for the process of cultivation and harvesting.

Integration Subject	Materials or References	Contents	Methodologies / Strategies/Activities	Student Evaluation
- Careers	- Seeds, soil, pots, rulers, notebook. - Gardening tools - Water - Markers - Journal or notebook - "Dek Thai Kin Dee Doo Dee" booklet	1. Preparation of Soil 2. Plantation and Gardening	- Teacher will describe the resources required to grow a plant and explain on how to effectively grow a plant including preparation of soil, cultivating and harvesting **Display 15 mins** - Students will be given a clear plastic glove with their name written on it, cotton balls, and small bowl of water. Each student will be given 3-5 seeds of the same plant. Students will water the plants **Planting 20 mins** - Students will record the data and observation daily into a journal/notebook and record on Dek Thai Doo Dee Kin Dee booklet. **Observation and Recording 15 mins**	Gardening. Record the observation. Logbook Dek Thai Doo Dee Kin Dee

LESSON 6: HOW TO LOOK GOOD

SPECIFIC SUBJECT MATTER FOR THE LESSON: How Right Choices Make You Look Good

OBJECTIVES

Students will be able to:

1. Identify various ways of making decision and examine their results.
2. Practice making difficult decisions.
3. Learn about effective decision-making and managing time correctly.

Integration Subject	Materials or References	Contents	Methodologies / Strategies/Activities	Student Evaluation
- PE	- CD เพลงรูปแบบที่ได้ฟิต - CD เพลงรูปแบบไทยฟิต - PowerPoint presentation showing healthy good looking people making right choices for health VS unhealthy people with sedentary lifestyle.	1. Time management: Revision of studies, physical activity. 2. How to look good everyday: Running, skipping, aerobics, hula-hoop, housework: at least 1 hour everyday. 3. Warm-up, aerobics, cool-down 4. Television viewing and gaming not over 2 hours/day 5. Sleeping 8-10 hrs/day	- Discussion about time management and physical activity **Discussion 10 mins** - Point out importance and benefits of physical activity. Negative effects of too much television viewing and playing games. State how sleeping 8-10 hrs a day is healthy. **Presentation 15 mins** - Show pictures on how sedentary lifestyle can lead to bad health. (Sedentary lifestyle now exceeding 2 hrs a day, watching TV and playing games) **Display 10 mins** - Give CD to children enjoy dancing for being fit. **Dancing 10 mins** - **Revision 5 mins**	Q & A. Ask student to collect and keep one food or snack they ate in the week and bring the "food label" for the following class.

LESSON 7: Making Right Choices

SPECIFIC SUBJECT MATTER FOR THE LESSON: Wise Consumer Spending

OBJECTIVES

Students will be able to:

1. Recognize the influence that advertising has on our lives and our eating habits.
2. Realize the importance of money and spend money wisely.
3. Build awareness about food marketing.
4. Save money and spend wisely.

Integration Subject	Materials or References	Contents	Methodologies / Strategies/Activities	Student Evaluation
- Health Education/ Careers	- Food labels (from students' collection) - Price tags - Variety of food and snacks with proper labeling (food label). - THAI HEALTH Social Marketing TV SPOT	1. Choosing Snacks: 3 ป; Healthy, Safety, Saving 2. What is food label? What do they tell us? How to understanding the reading? 3. Wise consumer spending tips: As appropriately required, saving money.	- Have a class discussion about the influence of advertising in our lives and brainstorm a list of influences of food choice and group them by common themes. **Q & A 10 mins.** - Ask the class how marketing and advertising techniques and strategies affect what we buy, what we eat, and how we spend our money? How to save money? How to become wise consumer? **Discussion 30 mins** - Spend few minutes on SOCIAL MARKETING TV SPOT to realize how easy it is to over spend and importance of spending wisely on healthy food and drinks. **Video 10 mins.**	Discussion of importance of making the right choices. Group activity Monopoly Game. Q & A

VITA

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Asia Pacific International University