

ASSESSMENT OF CHILDHOOD OBESITY AND OVERWEIGHT IN THAI
CHILDREN GRADE 5-9 IN BMA BILINGUAL SCHOOLS, BANGKOK, THAILAND

MR. NATTAPON CHAWLA

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Public Health Program in Public Health

College of Public Health Sciences

Chulalongkorn University

Academic Year 2011

Copyright of Chulalongkorn University

บทคัดย่อและแฟ้มข้อมูลฉบับเต็มของวิทยานิพนธ์ตั้งแต่ปีการศึกษา 2554 ที่ให้บริการในคลังปัญญาจุฬาฯ (CUIR)
เป็นแฟ้มข้อมูลของนิสิตเจ้าของวิทยานิพนธ์ที่ส่งผ่านทางบัณฑิตวิทยาลัย

The abstract and full text of theses from the academic year 2011 in Chulalongkorn University Intellectual Repository(CUIR)
are the thesis authors' files submitted through the Graduate School.

การประเมินภาวะน้ำหนักเกินและโรคอ้วนในเด็กเกรด ๕-๙ ในโรงเรียนสองภาษา ในสังกัดกทม

นายณัฐพนธ์จาวลา

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

สาขาวิชาสาธารณสุขศาสตร์

วิทยาลัยวิทยาศาสตร์สาธารณสุขจุฬาลงกรณ์มหาวิทยาลัย

ปีการศึกษา 2554

ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

Thesis Title ASSESSMENT OF CHILDHOOD OBESITY AND
OVERWEIGHT IN YOUNG THAI CHILDREN GRADE 5-9
YEARS IN BMA BILINGUAL SCHOOLS, BANGKOK,
THAILAND

By Mr. Nattapon Chawla

Field of Study Public Health

Thesis Advisor Alessio Panza, M.D., M.Com.H., DTMH

Accepted by the College of Public Health Sciences, Chulalongkorn
University in Partial Fulfillment of the Requirements for the Master's Degree

..... Dean of the College of Public Health Sciences
(Professor Surasak Taneepanichskul, M.D.)

THESIS COMMITTEE

..... Chairperson
(Associate Professor SathirakornPongpanich, Ph.D.)

..... Thesis Advisor
(Alessio Panza, M.D., M.Com.H., DTMH.)

..... Examiner
(Assistant Professor Ratana Somrongthong, Ph.D.)

..... External Examiner
(Professor Sirikul Isaranurak, M.D., M.P.H.)

ณัฐพนธ์จาวลา: การประเมินภาวะน้ำหนักเกินและโรคอ้วนในเด็กเกรด ๕-๙ ในโรงเรียนสองภาษา ในสังกัดกทม. (ASSESSMENT OF CHILDHOOD OBESITY AND OVERWEIGHT IN THAI CHILDREN GRADE 5-9 YEARS IN BMA BILINGUAL SCHOOLS, BANGKOK, THAILAND) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: อ.นพ.อเลศชิโอ พันษา, 79 หน้า.

ภาวะโรคอ้วนและน้ำหนักเกินในวัยเด็กได้กลายเป็นปัญหาสำคัญของประเทศไทยวัตถุประสงค์ของการศึกษานี้เพื่อประเมินสถานการณ์ของโรคอ้วนและน้ำหนักเกินในเด็กนักเรียนระดับเกรด 5 – 9 ของโรงเรียนสองภาษาสังกัดกทม. การศึกษานี้เป็นการศึกษาเชิงพรรณนาภาคตัดขวางใช้การสุ่มตัวอย่างแบบมีเจาะจงและการแบ่งระดับชั้นโดยการเลือกกลุ่มนักเรียน 250 คนจากโรงเรียนสองภาษา 6 โรงเรียนในสังกัดกทม. เด็กนักเรียนตอบแบบสอบถามด้วยตนเองการวิเคราะห์ข้อมูลใช้สถิติเชิงบรรยาย (ร้อยละ ค่าเฉลี่ยและส่วนเบี่ยงเบนมาตรฐาน) และสถิติเชิงการถดถอยโลจิสติกเพื่ออธิบายความสัมพันธ์ระหว่างตัวแปรอิสระและตัวแปรตาม

ผลการศึกษาพบว่าความชุกของภาวะน้ำหนักเกินคือ 10.4% และโรคอ้วน 8.4% ในเด็กไทยเกรด 5-9 ในโรงเรียนสองภาษาสังกัดกทม. การศึกษานี้ยังแสดงให้เห็นว่ามีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติระหว่างลักษณะการรับประทานอาหารของเด็ก (adjusted OR 2.4, 95% CI 0.946-6.103) และลักษณะร่างกาย (adjusted OR 0.09, 95% CI 0.012-0.650) กับน้ำหนักเกินและโรคอ้วนในเด็ก

ผลการวิจัยชี้ให้เห็นว่าโรคอ้วนในเด็กยังมีมากในโรงเรียนสองภาษาสังกัดกทม. ของประเทศไทยที่ภาวะน้ำหนักเกินและโรคอ้วนในเด็กเป็นปัญหาสุขภาพที่ร้ายแรงขึ้นอยู่กับอัตราที่เพิ่มขึ้นและความเสี่ยงต่อสุขภาพ โรคอ้วนเป็นโรคเรื้อรังซึ่งเกิดจากหลายปัจจัยและจากปฏิสัมพันธ์ที่ซับซ้อนระหว่างพันธุกรรมและสภาพแวดล้อมการศึกษาในอนาคตควรคำนึงถึงการดำเนินชีวิตในลักษณะต่างๆ และปัจจัยทางจิตวิทยาในกลุ่มเด็กหลากหลายอายุสุดท้ายในด้านนโยบายเพื่อการปรับปรุงโปรแกรมสุขภาพทางการศึกษาที่เห็นความสำคัญของพฤติกรรมกรบริโภคอาหารและการออกกำลังกายรวมถึงอาหารในบริเวณโรงเรียนเพื่อบทสรุปที่ดีการปรับปรุงโปรแกรมสุขภาพไม่เพียงแต่คำนึงถึงในเด็กวัยเรียนแต่รวมถึงครอบครัวซึ่งควรได้รับการแนะนำเช่นเดียวกัน

สาขาวิชา สาธารณสุขศาสตร์ ลายมือชื่อนิติ
ปีการศึกษา 2554 ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก

5379128553: MAJOR PUBLIC HEALTH

KEYWORDS: BMA/ BILINGUAL SCHOOL/ BMI/ OBESITY/ OVERWEIGHT/
DEPRESSION/ ANXIETY/ PEER PRESSURE

NATTAPON CHAWLA: ASSESSMENT OF CHILDHOOD OBESITY
AND OVERWEIGHT IN YOUNG THAI CHILDREN GRADE 5-9 IN BMA
BILINGUAL SCHOOLS, BANGKOK, THAILAND. ADVISOR: ALESSIO
PANZA, M.D., M.Com.H., DTMH., 79 pp.

Childhood overweight and obesity has become an important public health problem in Thailand. A study was carried to assess the situation of obesity and overweight of Thai children attending grade levels 5-9 in BMA bilingual schools in Bangkok, Thailand. The research was a cross-sectional, analytical study. The study used purposive sampling and stratified random sampling. Two hundred and fifty students were selected as subjects for the study from six different BMA bilingual schools. Data were collected by self-administered questionnaire and analyzed by applying descriptive statistics (percentage, mean, standard deviation) to describe the data, and logistic regression to examine the relationship between independent and dependent variables.

The results revealed that the prevalence of overweight was 10.4% and obesity was 8.4% in Thai children attending grade levels 5-9 in BMA bilingual. The study also showed that there were statistically significant associations between children's diet practice (adjusted OR 2.4, 95% CI 0.946-6.103) and body image (adjusted OR 0.09, 95% CI 0.012-0.650) with childhood overweight and obesity.

The findings indicated that childhood obesity is prevalent in BMA bilingual schools in Bangkok, Thailand. Childhood overweight and obesity is a serious public health problem based on its increasing rates and the associated health risks. Obesity is a multifactorial chronic diseases stemming from complex interactions between genes and environment. Future studies should consider other lifestyle and psychological factors in a larger age group. Finally, policies should improve the health-education program to signify the importance of dietary habits and physical activity. A much directive approach on the food-environment on the school's compound and intervention should be directed not only on school children, but include the whole family are recommended.

Field of Study: Public Health Student's Signature _____

Academic Year: 2011 Advisor's Signature _____

ACKNOWLEDGEMENTS

I deeply express my gratitude and appreciation to my thesis advisor Dr. Alessio Panza for his kindness, support and guidance throughout the course of MPH..

I would like to thank Associate Professor Stahirakorn Pongpanich as chairperson and Prof. Sirikul Isaranurug as external examiner in my Thesis Committee for giving valuable advises to accomplish my study.

I would also like acknowledge Assistant Professor Ratana Somrongthong for her academic guidance, support and encouragement throughout the MPH course. I am grateful to all other professors at the College of Public Health Sciences, Chulalongkorn University who have taught me valuable lessons.

I am profoundly thank the schools that have allowed me to collect my data. Without their help, this thesis would not have been completed.

I also would like to show my appreciation to all of my friends and colleagues who have made MPH course a joyful journey.

My acknowledgement would be incomplete if I fail to thank my family. I would like to express my love and thank my family for the continuous support and encouragement through the whole period of time.

CONTENTS

	Page
ABSTRACT IN THAI.....	iv
ABSTRACT IN ENGLISH.....	v
ACKNOWLEDGEMENTS.....	vi
CONTENTS.....	vii
LIST OF TABLES.....	x
LIST OF ABBREVIATION.....	xi
CHAPTER I INTRODUCTION	
1.1 Background & rationale.....	1
1.2 Statement of problems.....	2
1.3 Research questions.....	2
1.4 Research objectives.....	2
1.5 Operational definition.....	3
1.6 Conceptual framework.....	6
CHAPTER II LITERATURE REVIEW	
2.1 Prevalence of childhoodobesity worldwide.....	7
2.2 Criteria for diagnosis of overweight and obesity in children.....	10
2.3 Effects of obesity in a child.....	13
2.3 Factors leading to overweight and obesity in children.....	14
2.4 Factors leading to overweight and obesity in children.....	16
2.5 Bilingual schools.....	25
2.6 Thailand School Health Program.....	25
2.6Interventions.....	26

	Page
CHAPTER III RESEARCH METHODOLOGY	
3.1 Research design.....	28
3.2 Study area.....	28
3.3 Study population.....	28
3.4 Sample size.....	28
3.5 Sampling Technique.....	29
3.6 Data collection.....	30
3.7 Data analysis.....	32
3.8 Ethical consideration.....	33
3.9 Limitation.....	33
3.10 Benefit of the study.....	34
3.11 Research Timeline.....	34
3.12 Research Budget.....	35
CHAPTER IV RESULTS	
4.1 General characteristics of the population.....	37
4.2 Knowledge on diet and physical activity.....	39
4.3 Attitude on diet and physical activity.....	40
4.4 Practice on diet and physical activity.....	41
4.5 Psychological characteristics.....	42
4.6 Nutritional status among school children.....	44
4.7 Associations between childhood overweight and obesity and independent variables.....	47
CHAPTER V DISCUSSION, CONCLUSION, AND RECOMMENDATION	
5.1 Discussion.....	51
5.2 Conclusion.....	55
5.3 Recommendation.....	56

REFERENCES..... 57

APPENDICES

Appendix A.....68

Appendix B.....77

Appendix C.....78

VITAE..... 79

LIST OF TABLES

	Page
Table 1.1	Classification of weight by BMI in adult Europoids..... 11
Table 1.2	Proposed classification of weight by BMI in adult Asians..... 12
Table 1.2	Classification of overweight and obesity in children..... 12
Table 4.1	Socio-demographic characteristics of respondents..... 38
Table 4.2	Distribution of children's knowledge on diet..... 39
Table 4.3	Distribution of children's knowledge on physical activity..... 39
Table 4.4	Distribution of children's attitude on diet..... 40
Table 4.5	Distribution of children's attitude on physical activity..... 40
Table 4.6	Reported practice on diet..... 41
Table 4.7	Reported practice on physical activity..... 41
Table 4.8	Distribution of physical activities among children..... 42
Table 4.9	Distribution of psychological factors..... 42
Table 4.10	Self-assess of depression between different gender..... 43
Table 4.11	Self-assess of anxiety level..... 43
Table 4.12	Self-assess ability to resist peer-pressure..... 44
Table 4.13	Nutritional status among children..... 44
Table 4.14	Nutritional status among children aged 10-14 in BMA bilingual schools according to socio-demographic and other variables..... 45
Table 4.15	Unadjusted odd ratios (OR) and 95% confidence interval (95% CI) for childhood overweight ($\geq 85^{\text{th}}$ percentile)..... 48
Table 4.16	Adjusted odd ratios (OR) and 95% confidence interval (95% CI) for childhood overweight ($\geq 85^{\text{th}}$ percentile)..... 50

LIST OF ABBREVIATIONS

BMA	Bangkok Metropolitan Administration
BMI	Body Mass Index
CDC	Central for Diseases Control and Prevention
CVD	Cardiovascular Diseases
MOH	Ministry of Health
SPSS	Statistical Package for Social Sciences
SD	Standard Deviation
WHO	World Health Organization

CHAPTER I

INTRODUCTION

1.1 BACKGROUND AND RATIONALE

According to WHO, there are more than 1 billion overweight adults, and at least 300 million of them clinically obese (WHO, 2011). Overweight is an important issue because it leads to obesity. Obesity and overweight pose a major risk for serious diet-related chronic diseases, including type 2 diabetes, hypertension and stroke, cardiovascular diseases, and certain forms of cancer (WHO, 2003). The health consequences range from increased risk of premature death, to serious chronic conditions that reduce the overall quality of life. Yet, many of us fail to realize that, this is a disease that can be prevented, especially by our lifestyle.

The epidemiological shift from “traditional illness” to “modern illness” has resulted with overweight and obesity climbing the “dead ladder.” According to WHO, overweight and obesity is the fifth leading risk for global deaths (WHO, 2011). Furthermore, childhood obesity is positively correlated with eventual adult obesity (Juhola et al., 2011). It is related to many of the same risk factors as adult obesity, most notably cardiovascular and psychosocial factors (Jonides, 1990).

Childhood overweight and obesity have reached epidemic proportions and are major public health problems nationally and globally. A survey conducted in Thailand by the National Health and Nutrition Examination Survey reported that obese childhood obesity has more than doubled since the 1960s (Sirikulchayanota, 2011). Hence, childhood obesity had become an important public health problem in Thailand, especially in big cities such as Bangkok.

1.2 STATEMENT OF PROBLEMS

Many studies have shown that obese children tend to become obese adults, and for this reason the prevention of overweight in childhood is one means of preventing adult diseases associated with obesity. Yet, researches about child obesity in Thailand are still in the early stage, a literature search has found 241 papers only related to this subject. With the prevalence of childhood obesity rising in Thailand, there is no information known regarding the prevalence of overweight and obesity in children in a bilingual school under the Bangkok Metropolitan Administration (BMA) arm and children's knowledge and attitude towards it. Therefore, to conduct this study was beneficial and contribute to the understanding of the situation, development of prevention programs, and/or promoting activities in the future.

1.3 RESEARCH QUESTIONS

- 1.3.1 What is the prevalence of obesity and overweight in Thai children attending grade levels 5-9 in BMA bilingual schools?
- 1.3.2 What is the knowledge, attitude, and practice of Thai children attending grade levels 5-9 in BMA bilingual schools towards obesity and overweight?

1.4 RESEARCH OBJECTIVES

1.4.1 General Objective

- 1.4.1.1 To assess the situation of obesity and overweight of Thai children attending grade levels 5-9 in BMA bilingual schools

1.4.2 Specific Objective

1.4.2.1 To determine the prevalence of obesity and overweight among Thai children attending grade levels 5-9 in BMA bilingual schools.

1.4.2.2 To assess the knowledge, attitude and behavior on obesity and overweight among Thai children attending grade levels 5-9 in BMA bilingual schools.

1.4.2.3 To identify the risk factors of overweight and obesity among Thai children attending grade levels 5-9 in BMA bilingual schools.

1.5 OPERATIONAL DEFINITIONS

1.5.1 Overweight and Obesity

The study uses the WHO Asia-Pacific definition of overweight as having 85th to 94.9th percentile and obesity as having a percentile of 95th and above.

1.5.2 Risk Factors

The study focused on risk factors such as diet, physical activity, and psychological factors like body image, depression, and anxiety. Due to technical difficulties and insufficient resources, the study excludes the risk factors measured by laboratory tests (triglycerides, cholesterol level, etc.).

1.5.3 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.

1.5.4 Educational level

In the study, educational level refers to children attending grade levels 5 - 9. Grade levels 5 and 6 are in primary education, whereas grades 7, 8, and 9 have finished primary education and currently in secondary education.

1.5.5 Ethnicity

In the study, ethnicity refers to children belonging to a social group that has a common national or cultural tradition. The ethnic groups in the study included Thai, Chinese, Indian, Thai-Chinese, Thai-Indian, or mixed of others.

1.5.6 Diet

In the study, diet refers to the amount of food and drink a child consumes in a day. Attitude on diet in this study refers to attitude on fast food only.

1.5.7 Physical activity

In the study, exercise refers to at least moderate exercise, an exercise where a child makes an effort in breathing but still can converse in short sentences.

1.5.8 Body Image (Body Dissatisfaction)

In the study, body image refers to the perception the child has on his/her body regardless of the actual body mass index. Body dissatisfaction refers to the child's dissatisfaction on his/her body.

1.5.9 Depression

In the study, depression refers to a mental condition involving feelings of sadness, loneliness, irritability, worthlessness, hopelessness, agitation, and guilt that may be accompanied by an array of physical symptoms including child's eating habits, physical exercise and perception of oneself.

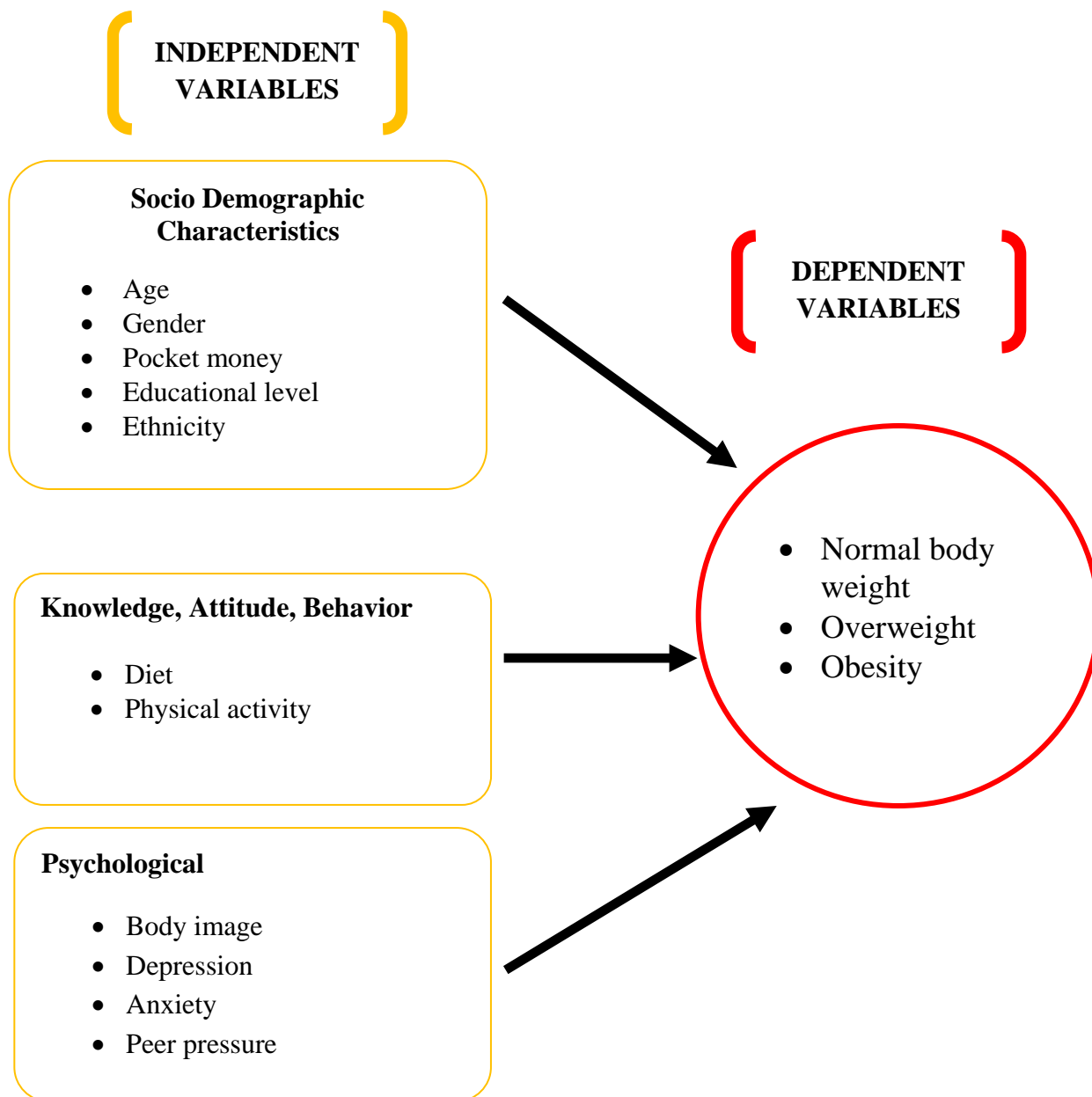
1.5.10 Peer pressure

In the study, peer pressure refers to influence exerted by friends in encouraging a child to make unhealthy food choices.

1.5.11 Bilingual School

This study refers to a bilingual school (using English and Thai as the medium of instruction) located in Bangkok, under the administration of Bangkok Metropolitan Administration (BMA).

1.6 CONCEPTUAL FRAMEWORK



CHAPTER 2

LITERATURE REVIEW

2.1 PREVALENCE OF CHILDHOOD OBESITY WORLDWIDE

Obesity prevalence is increasing worldwide at an alarming rate in both developed and developing countries (Kantachuversiri, 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 et al., 2011). Surprisingly, more than half affected are in the middle or low-income countries (Sakamoto 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, 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 to 11 years (Ogden 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%) (Ogden et al., 2006).

Obesity rates are also high among American Indian children with a prevalence estimate of 22% for boys and 18% for girls (Caballero et al., 2003). Currently, about 25 million U.S. children and adolescents are overweight or obese (Braet, 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, 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 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 et al., 1985). 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 et al., 1999).

In Japan, in the National Nutrition Survey of 1990-1994 (Yoshiike et al., 1999), 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 (Ebell, 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 $\geq 25 \text{ kg m}^{-2}$ 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 (Aekplakorn, 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, 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). 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 (Aekplakorn, 2004). 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 Morhsuwan, MD, from the Faculty of Medicine Prince Songkla University, conducted a research on 1,373 children in Tessabarn Had Yai School (Morhsuwan et al., 1998). She found that the rates of overweight children are 11.5%. Moreover, this percentage is higher than Japan. 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 Phramongkutklo Hospital. She blamed the problem to children and teens having less activity to do in each day (Aekplakorn et al., 2009). Basically, the lack of exercise is a dominant factor. 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/m² rather than 18.5 to 24.9 kg/m² 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 (WHO, 1998) 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, 2003). 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) (Prentince, 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.

Table 1. Classification of Weight by BMI in adult Europoids (WHO 1998)

Classification	BMI (kg/m^2)	Risk of co-morbidities
Underweight	< 18.5	Low (but increased risk of other clinical problems)
Normal range	18.5 – 24.9	Average
Overweight:	≥ 25	
Pre-obese	25 - 29.9	Increased
Obese I	30 - 34.9	Moderate
Obese II	35 – 39.9	Severe
Obese III	≥ 40	Very severe

Source: WHO 1998.

In Asians, the cut-offs for overweight (≥ 23.0 kg/m²) and obesity (≥ 25.0 kg/m²) are lower than the WHO criteria. Some support for these cut-offs comes from data on Chinese living in Hong Kong (Ko et al., 1999), Chinese in Singapore (Deurenberg-Yap et al., 1999) and Indian Asians living in Mauritius.

Table 2. Proposed Classification of weight by BMI in adult Asians.

Classification	BMI (kg/m²)	Risk of co-morbidities
Underweight	< 18.5	Low (but increased risk of other clinical problems)
Normal range	18.5 – 22.9	Average
Overweight:	≥ 23	
At risk	23 - 24.9	Increased
Obese I	35 - 29.9	Moderate
Obese II	≥ 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 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 $\geq 85^{\text{th}}$ and $\leq 95^{\text{th}}$ percentile.

Table 3. Classification of overweight and obesity in children.

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

2.3 EFFECTS OF OBESITY IN A CHILD

There is growing concern that the prevalence of obesity is increasing in the developed world (Seidell et al., 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, 2000). 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 et al, 1998).

Furthermore, medical costs associated with overweight and obesity may involve direct and indirect costs (Wolf, 1998). 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 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, 1998). In fact, there is substantial evidence suggesting that obesity in childhood lays the metabolic groundwork for adult cardiovascular disease (Del-rio-Navarro, 2007). Also, there have

been reports demonstrating that overweight children tend to become overweight adults (Pitton et al. 2011). 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 et al., 2005; Lyznicki et al., 2001; Ogden et al., 2002). There has been a dramatic increase in the number of overweight and obese children in recent years (World Health Organization, 1997) and studies indicate that children's lives may be shortened as a result of this alarming health problem (American Academy of Pediatrics, 2003; Olshansky et al., 2005). 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 (Fontaine et al., 2003). This is a concern given that approximately 30% of children (ages 6 -11) are overweight/obese with a Body Mass Index (BMI) percentile of 85th percentile or greater (Lyznicki et al., 2001; Ogden et al., 2002).

2.3.1 PHYSICAL EFFECTS

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 et al., 2005). Some of the physical effects of childhood obesity include type 2 diabetes, high blood pressure, 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 et al., 1999). A group of American scientists (Story et al. 2003) observed that childhood obesity has become a major health problem in American-Indians. They concluded that if this pattern is not reversed, 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 et al., 2006).

2.3.2 SOCIAL AND PSYCHOLOGICAL EFFECTS

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, 2005). In one study, severely obese children recorded their quality of life with scores as low as children undergoing chemotherapy for cancer (Schwimmer et al., 2003).

Obese children and adolescents are subjected to social rejection, discrimination and negative stereotyping (Puhl et al., 2001). 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 (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, 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 et al., 2004)

2.3.3 ECONOMIC EFFECTS

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 et al., 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 et al., 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 et al., 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 et al., 2009).

2.4. FACTORS LEADING 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 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 years before and after puberty are important for understanding body mass (McTigue 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 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, 2007).

Another research was conducted on the association of nutrition status of 663 children aged 7–12 years with socioeconomic factors in a province of southern Thailand in 1995. They 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 et al., 1998). Another study showed that children in the provinces were as a whole considerably leaner than children in the big cities of Thailand (Sirilulchayanota et al., 2011). These results imply a need for appropriate interventions, which cannot only prevent obesity, but also improve the malnutrition of school children in the rural provinces of southern Thailand.

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 et al., 2010).

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, et al., 2010). 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 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, 2006). 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 et al., 2010).

2.4.3 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, 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 (Mokdad et al., 2001).

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 (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 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 et al., 2008).

2.4.4 EDUCATIONAL LEVEL

A few studies have been done to examine the frequency of overweight and obesity by education level. While a study by the WHO MONICA projected reported that lower education was associated with higher BMI in about half of the male and in almost all of the female populations (Molarius 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 (Fisac 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. Base on this education base line, Ladda Mo-Suwan reported that children in lower secondary, grades 7-9 had higher prevalence of overweight and obesity than upper secondary, grades 10-12 (Mo-suwan et al., 1998). However, there are still few studies examining the associations of educational levels with overweight and obesity.

2.4.4 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 (Riccaridelli, 2002). 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 (Kimbrow 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 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 (Kimbrow et al., 2007).

2.4.5 PARENTAL HISTORY OF OBESITY

Furthermore, parental obesity has been identified as a risk factor for childhood obesity (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 (Bralic 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 (Svenson et. al, 2011; Whitaker et al., 1997). 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.

2.4.6 DIETARY

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/m² tended to consume both significantly higher caloric and fat intakes than the normal students (Kittidilokkul, 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 (Kasulwat, 2002).

2.4.7 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 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.

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 (Castaneda 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 et al., 1998).

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 (Hohema, 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 J & Timperio A, 2007).

2.4.8 PSYCHOLOGICAL

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 (Kraff et al., 2011). Other studies have also reported that depression in childhood or adolescence may predict weight gain (Goodman et al., 2002), with Pine reporting children and adolescents with major depression had a twofold increased relative risk of overweight (Pine et al., 2001).

Furthermore, children as well as adults stereotype the obese as “lazy, ugly, and stupid” (Wardle et al., 2005). As a result, it has been assumed that obese people, especially children and adolescents, will experience poor psychological health. This has led to extensive literature on body image in children. In one of the review published in 2001, Ricciardelli and McCabe concluded that there are consistent findings of a relationship between body mass index (BMI) and body dissatisfaction in children, particularly in girls (Ricciardelli et al., 2001).

Other studies have pointed out that adolescents who were concerned about over-eating scores higher on the depression scale. (Mueller et al., 1995) Another study showed that overweight children had higher anxiety, more depressive symptoms and more body

dissatisfaction (Morgan et al., 2002). While a study conducted on large community of girls in early adolescents showed that there is a relationship between body dissatisfaction and bulimic behaviors. Though, it also pointed that peer influence and eating behaviors of friends contributed significantly to the prediction of individual eating habits (Hutchinson, 2009). Children are more susceptible than adults to peer pressure and this presents additional practical obstacles towards childhood obesity (Ebell et al., 2002).

2.4.9 GENETICS

With obesity reaching the epidemic, an explanation of the obesity epidemic has to include both the role of the environment and genetics. Over the past decade, scientists have identified many of the genes that regulate body weight and have proved that in some instances, different variants of these genes can lead a person to be fat or thin. These genes underlie a weight-regulating system that is remarkably precise (Bell, 2005). More recently, insights regarding gene-gene interactions have begun to emerge. Genome-wide scans for obesity phenotypes have led to the identification of several chromosome regions that are likely to harbor obesity susceptibility genes (Damcott et al., 2003).

According to the Centers for Disease Control and Prevention (CDC), a commonly quoted genetic explanation for the rapid rise in obesity is the mismatch between today's environment and "energy-thrifty genes" that multiplied in the past under different environmental conditions (Farooqi, 2007). The variation in how people respond to the same environmental conditions is an additional indication that genes play a role in the development of obesity (Farooqi, 2007). This is consistent with the theory that obesity results from genetic variation interacting with shifting environmental conditions. However, genetics factors has not be assessed in this study due to the limitations in the study and non-availability of information since it is an uncommon practice in Thailand to measure this kind of genetic variations (Sriamporn et. al, 2005). Furthermore, hormonal and genetic factors are rarely the cause of childhood obesity; unnecessary diagnostic

evaluations can be avoided with a careful history and physical examination (Moran, 1999).

2.5 BILINGUAL SCHOOLS

Before 1992, Thai parents who wished their children to have a school education where curriculum content was taught in English had two choices – international schools or overseas schools. These choices, however, are limited and available to only a very small percentage of the community. In addition, many Thai parents were uncomfortable about sending their children abroad or to schools which Thai culture and language were given very little attention.

Since 1992, through bilingual schools, the option of education in two languages has become available to a much greater number of students and the study of content through English has become possible without loss of attention to Thai language and culture. This has created a demand for more bilingual schools. However, under the Bangkok Metropolitan Administration (BMA), there are 435 schools, of which 6 are bilingual schools at the time of the study (BMA, 2010).

2.6 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, 2006).

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 (MOE, 2008). However, the actual condition of the program is not regularly reviewed by expertise and evaluation study at national level is still underway (Kai et al., 2008).

2.7 INTERVENTIONS

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 (Ebell, 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, 2003).

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, 2005). 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 (Katz et al., 2008). Another study conducted by Dr. Nemet in 2005, demonstrated that there are short and longer-term beneficial effects of a combined dietary behavioral-physical activity intervention among obese children (Nemet et al., 2005). Multidisciplinary intervention also resulted in significant positive effects on body weight, BMI, body fat, habitual activity, fitness, and body lipids (Gortmaker et al., 1999).

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 (Lyznicki et al., 2001, an age at which children have begun to determine their own eating habits (Summerbell et al., 2005; Hedley et al., 2004). 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.

As studies have shown school programs are effective in preventing childhood obesity, the need for broader implementation in school-based program indicates a promising approach to reduce childhood obesity.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 RESEARCH DESIGN

The research was a cross-sectional, analytical study.

3.2 STUDY AREA

The study was conducted in six bilingual schools under the Bangkok Metropolitan Administration (BMA). The schools included are Benjamaborphit Bilingual School, Wat Mahah Bilingual School, Wat Pasee School, Sawasdee Wittaya School, Wat Don Bilingual School, and Rittiyawannalai School.

3.3 STUDY POPULATION

The study population was children attending grade levels 5-9 of both sexes who are students studying at the six BMA bilingual schools.

3.4 SAMPLE SIZE

In order to determine the sample size for the study, the Cochran's formula for sample size calculation was applied;

$$n = \frac{Z^2 pq}{d^2}$$

(Source: Cochran, W.G. 1963. Sampling techniques, 2nd Ed, New York: John Willey and Sons, Inc.)

In which,

n = sample size;
 95% confidence interval, Z = 1.96;
 d = Precision difference (0.03);
 q = proportion of subjects who are not overweight.(1-p)
 p = proportion of subjects who are overweight., p = 0.189

Sample size required for the research

$$\text{Sample Required} = \frac{1.96^2 (.189) (1 - .189)}{(.05)^2} = 236$$

In this study, p was set as 0.189, due to the previous study conducted by Pawloski in 2006, which reported that 18.9% of Bangkok children aged 7-10 years was overweight. As a result, the total number sample size required was 236. Assuming the parents refusal rate of 10 percent and the students refusal rate or the drop rate of additional 10 percent, an extra 64 students were chosen, resulting with an overall sample size of 300.

3.5 SAMPLING TECHNIQUE

The sampling technique for choosing the school was purposive sampling. All the bilingual schools listed on the BMA's website at the time of the study were included in the study. In order to investigate all the six schools, a fixed number of students from each school had to be included to achieve the sample size of 300. The schools have an average of 20 students per class that makes an expected 600 grade 5-9 students, which makes it sufficient for the study. Ten students were randomly selected for each grade level from each school, making a total of 300 students.

The sampling technique used in choosing the subjects was stratified random sampling. The students' population investigated was stratified by grade level (grade 5-9) in each school. Within each grade level "stratum," 10 students were randomly selected. Hence, due to the stratification, the sampled population had the same number of students for each grade.

3.5.1 INCLUSION CRITERION:

- Subjects who gave consent participated in the research.
- Both male and female children attending grade levels 5-9 studying in a bilingual school.

3.5.2 EXCLUSION CRITERION:

- Subjects who were injured (arms and hands) and were unable to use both hands to answer the questionnaire on the date of the data collection.
- Students who were absent on the date of the data collection.

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

3.6 DATA COLLECTION

3.6.1 DATA COLLECTION INSTRUMENTS

The study employed self-administered questionnaire. The questionnaire was composed of three separate parts. The first part (4 questions) covered sociodemographic characteristics of children. The second part was about knowledge, attitude, and practice, which was divided into three sections: Section A (17 questions) is on diet, Section B (14 questions) is on physical activities, and Section B (4 questions) is on overweight and obesity. The third part was about psychological factors that affects a child's overweight and obesity, which was divided into four sections. Section A (8 questions) is on body image, Section B (9 questions) is on depression, Section C (10 questions) is on anxiety, and Section D (3 questions) is on peer pressure.

The content of the questionnaires had been validated by British Heart Foundation (Part II Section A Questions 11-14)), CDC (Part II Section A Questions 1-6, Part III Section A Question 1), European Prospective Investigation Center (Part II Section A question 7-10, Part C questions 2-4), Kaiser Family Foundation (Part II Section B Questions 1-10, Part III Section D Questions 1-3), Synovate Research Reinvented (Part II Section B Questions 11-14, Section C question 1), Athens State University (Part II Section B Questions 5-8) Thailand Ministry of Public Health (Part II Section B), and Nist and Diehl (Part II Section C). All questions were pre-tested with 30 students and reliability of 0.9 was calculated using Cronbach's alpha co-efficient method on questionnaire on knowledge and attitude in Part II on diet and physical activity.

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 heels, 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, which is included in the Appendix B. In addition, the researcher observed food availability and food purchasing habits of students during the day of the data collection.

3.6.2. DATA COLLECTION PROCEDURES

Prior to conducting the study, permission was obtained from the Managing Director and the Principal of the six schools, with parents signing a written consent for permission. Data was collected from January until February 2012. The school after approval arranged the site of interview.

Subjects were asked to fill a self-administered questionnaire. The researcher explained questions asked during the questionnaire filling process in Thai and/or in

English. The researcher thoroughly explained the objective of the research and the components of the questionnaire to students while they were answering the questionnaire.

Then, the researcher measured height and weight, respectively, using the same standard protocols provided by CDC Standard of Measurement (Appendix B) 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.

3.7 DATA ANALYSIS

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

Logistic regression was used to compute unadjusted odd ratios (OR), 95% confidence interval (CI), and a *p*-value less than 0.20 was selected for inclusion in multivariate logistic regression analysis. For each variable included, a *p*-value of less than 0.05 was used to consider statistically significant.

Under the section for knowledge, attitude, and practice, data was displayed in a table according to the percentage of correctly answered questions. There are 6 questions on knowledge on diet, and the scoring criteria are as follow: High (5-6 correct answers), Moderate (3-4 correct answers), and Low (0-2 correct answers). There are 4 questions on knowledge on physical activity, and the scoring criteria are as follow: High (4 correct answers), Moderate (2-3 correct answers), and Low (0-1 correct answer). There are 4 questions on attitude on diet, and the scoring criteria are as follow: High (4 correct answers), Moderate (2-3 correct answers), and Low (0-1 correct answer). There are 4 questions on attitude on physical activity, and the scoring criteria are as follow: High (4 correct answers), Moderate (2-3 correct answers), and Low (0-1 correct answer). There

are 7 questions on practice on diet, and the scoring criteria are as follow: High (6-7 correct answers), Moderate (3-5 correct answers), and Low (0-2 correct answer). There are 6 questions on practice on physical activity. The scoring criteria are as follow: “Practice” are children who reported answered “Yes” to moderate exercise (Part II B-Q9), answered B or C “exercise more than 3 times a week” (Part II B-Q10), and answered B or C “exercise more than 30 minutes a week” (Part II B-Q11). In addition, children who answered A “less than 30 minutes” in Part II B-Q11, but had answered over 30 minutes of walking or riding bicycle to school (Part II B-Q12) are placed under “Practice” criteria. While, “Did not practice” are children who answered otherwise.

For the questionnaire on body image, 1 point was given for the answer that corresponds to positive body image, while 0 point was given for the answer that corresponds to negative body image. Answers was given according to Eating Disorders Awareness and Prevention Inc. (EDAP), which states that a person with "positive body image" has a true and clear perception of their body shape, celebrates and appreciates this shape, and understands that one’s physical appearance says little about one’s character and value as a person. A person with a positive body image feels comfortable and confident in their body. While, a person with “negative body image” feels awkward or uncomfortable in his/her body (Small et al., 2001).

For the questionnaire on depression, 0 point was given for the answer of NONE, 1 point for the answer of SELDOM, 2 points for the answer of FREQUENT and 3 points for the answer of EVERYDAY. The scores ranged from 0 to 27 and was classified as follow:

No Depression	= 0 – 6 points
Mild Depression	= 7 – 12 points
Moderate Depression	= 13-18 points
Severe Depression	= More than 18 points

For the questionnaire on anxiety (Nist & Diehl, 1990), scores ranged from 10 to 50. A low score (10-19 points) indicates that a child does not suffer from test anxiety. Scores between 20 and 35 indicate that, although a child exhibits some of the characteristics of

test anxiety, the level of stress and tension is probably healthy. Scores over 35 suggest that a child is experiencing an unhealthy level of test anxiety.

3.8 ETHICAL CONSIDERATION

The study was reviewed and approved by Chulalongkorn University Ethics Review Committee. Since the study was conducted in a school, agreement was 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 was assured that the information obtained from the questionnaire was utilized purely for this study and confidentiality of the respondents was maintained throughout the study by presenting data as a 6 schools block not school by school. Children that are found to be overweight and/or obese was advised to seek medical attention and recommended to Chulalongkorn Hospital Pediatrics Departments. Children who were found to be depressed and overweight was further advised to consult a psychologist at Chulalongkorn Hospital.

3.9 LIMITATION

Due to limitation of time for the research, the study carried out only in six bilingual schools in Bangkok, Thailand, hence, the findings of the study cannot be generalized to the whole of Bangkok students. Another limitation was that the research would collect information based on the sample size of 300 subjects in BMA bilingual schools. Hence, the results of the research cannot represent the whole prevalence and risk factors of overweight and obesity children in Thailand. Lastly, due to time constrains, researcher did not get chance to directly observe other risk factors for overweight and obesity that involves laboratory tests and relied only on the response to the questionnaire.

3.13 RESEARCH BUDGET

No.	Item	Unit Cost	Total Unit	Total Amount
1	Subject token (souvenir)	10	500	5,000
2	IRB, local help	8000	1	8,000
3	Data Collection: (Photocopy, Printing)	20	1000	20,000
4	Stationary	100	10	1000
5	Traveling	6000	1	6000
6	Data processing (Documents, hardware, software, analyzing, etc.)	30000	1	30,000
GRAND TOTAL (THB): 70,000				

CHAPTER IV

RESEARCH RESULTS

The research was a cross-sectional, analytical study to determine the prevalence and risk factors of obesity and overweight in young Thai children attending grade levels 5-9 in BMA bilingual schools. Out of the 300 contacted participants, 28 did not provide parental consent and 12 dropped out during completion of questionnaire. Therefore, resulting with 250 students participating in the study.

Descriptive studies were used to tabulate general characteristics of children and their knowledge, attitude, and practice on diet and physical activity, alongside psychological factors and other dependent variables. Generalized linear models were used to conduct analyses of variances and to test the associations between the independent variables and childhood overweight and obesity. Multivariate analysis using binary logistic regression was conducted to determine factors associated with childhood overweight and obesity. In the logistic models, overweight and obesity (each categorized as a dichotomous variable) served as the dependent outcome variables.

The results of the study are presented in the following orders:

- 4.1 General characteristics of the population
- 4.2 Knowledge on diet and physical activity
- 4.3 Attitude on diet and physical activity
- 4.4 Practices on diet and physical activity
- 4.5 Psychological characteristics
- 4.6 Nutritional status among school children
- 4.7 Associations between childhood overweight and obesity and independent variables

4.1 General characteristics of the population

Two hundred and fifty children were enrolled from six BMA schools in Bangkok, Thailand. The description of general characteristics of the study subjects includes gender, age, educational level, daily allowance, and ethnicity. The socio-demographic characteristics of children are presented in Table 4.1.

Gender

Among the 250 respondents, there were more male respondents (57.2%) than female (42.8%).

Age

Regarding the age, all respondents were above 10 years and under 14 years old. The mean age was 13.1 and SD was 0.81. The majority of the respondents were 13 years olds (43.6%). Only a few were 11 years old (3.6%).

Educational level

All participants were from grade levels 5 to 9. There were 50 (20%) respondents from each grade level.

Ethnicity

The majority of the respondents were Thai (65.2%), followed by Thai-Chinese (16.0%), and Chinese (5.6%). Thai-Indian (0.4%), Thai-Others (10%), and others or respondents who were not sure about their ethnicity (2.8%) made up the rest of the total. More details of the sociodemographic characteristics are presented in Table 4.1

Table 4.1: Socio-demographic characteristics of respondents

Characteristics	Frequency	Percentage (%)
Gender		
Male	143	57.2
Female	107	42.8
Total	250	100.0
Age		
11	9	3.6
12	44	17.6
13	109	43.6
14	88	35.2
Total	250	100.0
Mean (SD)	13.1 (0.81)	
Educational level		
Grade 5	50	20.0
Grade 6	50	20.0
Grade 7	50	20.0
Grade 8	50	20.0
Grade 9	50	20.0
Total	250	100.0
Daily allowance		
<50 baht	74	29.6
50-100 baht	120	48.0
101-200 baht	48	19.2
>200 bath	8	3.2
Total	250	100.0
Ethnicity		
Thai	163	65.2
Chinese	14	5.6
Thai-Chinese	40	16.0
Thai-Indian	1	0.4
Thai-Others	25	10.0
Others/Not sure	7	2.8
Total	250	100.0

4.2 Knowledge on diet and physical activity

Table 4.2 displays the results of the children's knowledge on diet. Series of questions were asked to the respondents on knowledge on diet. There were 6 questions on knowledge, with each right answer scoring one point. The scoring of the levels of knowledge was divided into 3 parts: High, Moderate, and Low. Most respondents scored moderately (64.4%), with 29.6% scored highly, and only 6.0% scored below average.

Table 4.2: Distribution of children's knowledge on diet

Level of knowledge	Frequency	Percentage
High (5-6 correct answers)	74	29.6
Moderate (3-4 correct answers)	161	64.4
Low (0-2 correct answers)	15	6.0
Total	250	100.0

Table 4.3 displays the results of the children's knowledge on physical activity. Series of questions were asked to the respondents on knowledge on physical activity. There were 4 questions on knowledge, with each right answer scoring one point. The scoring of the levels of knowledge was divided into 3 parts: High, Moderate, and Low. Most respondents scored highly (63.2%), with 34.4% scored moderately, and only 2.4% scored below average.

Table 4.3: Distribution of children's knowledge on physical activity

Level of knowledge	Frequency	Percentage
High (4 correct answers)	158	63.2
Moderate (2-3 correct answers)	86	34.4
Low (0-1 correct answers)	6	2.4
Total	250	100.0

4.3 Attitude on diet and physical activity

The questionnaire composed of 4 questions that tested the attitude of respondents on diet. Table 4.4 displays the results of the children's attitude on diet. Among the 250 respondents, most respondents scored moderately (66.8%), while 21.6% scored poorly. Only 11.6% had a good attitude towards diet.

Table 4.4: Distribution of children's attitude on diet

Level of attitude	Frequency	Percentage
Good (4 correct answers)	29	11.6
Moderate (2-3 correct answers)	167	66.8
Poor (0-1 correct answers)	54	21.6
Total	250	100.0

Another 4 questions tested the attitude of respondents on physical activity. Table 4.5 displays the results of the children's attitude on physical activity. Among the respondents, the majority (72.0%) scored moderately, while 20% scored above average, and (8.0%) scored below average.

Table 4.5: Distribution of children's attitude on physical activity

Level of attitude	Frequency	Percentage
Good (4 correct answers)	50	20.0
Moderate (2-3 correct answers)	180	72.0
Poor (0-1 correct answers)	20	8.0
Total	250	100.0

4.4 Practices on diet and physical activity

In the questionnaire, there were 7 questions asking the children on their eating habits. One point was given for each correct habit. The levels of the practice were categorized into three groups: high, moderate, and low. Table 4.6 displays children's reported practice on diet. The majority of respondents (60.0%) scored moderately, while 14.0% scored highly, and 26.0% scored lowly.

Table 4.6: Reported practice on diet

Level of practice	Frequency	Percentage
High (6-7 correct habits)	35	14.0
Moderate (3-5 correct habits)	150	60.0
Low (0-2 correct habits)	65	26.0
Total	250	100.0

Table 4.7 present the result of another 7 questions asking the children on their moderate physical activity. The levels of the practice were categorized into either they did moderate exercise or not. Table 4.7 displays children's reported practice on physical activity. 40.8% of the respondents did moderate exercise, while 59.2% did not.

Table 4.7: Reported practice on physical activity

Level of practice	Frequency	Percentage
Practice	102	40.8
Did not practice	148	59.2
Total	250	100.0

Table 4.8 provide additional information on children physical activity. 23.5% of the respondents reported not doing moderate exercise. Among the 76.5% respondents who did moderate exercise only 42.6% exercise for 31-60 minutes.

Table 4.8: Distribution of physical activities among children.

Practices	Frequency	Percentage
Do you do moderate exercise?		
No	52	23.5
Yes	169	76.5
Total	250	100.0
How many minutes do you spend on average per time on exercise?		
<30 minutes	83	49.1
31-60 minutes	72	42.6
>60 minutes	14	8.3
Total	169	100.0

4.5 Psychological characteristics

Four psychological factors were assessed for childhood overweight and obesity. They include body image, level of depression, level of anxiety, and peer pressure. Table 4.9 displays the respondents who have different levels of body image. 97.2% reported to have positive body image, while 2.8% reported normal to have negative body image.

Table 4.9: Self-assess of body image

Level of body image	Frequency	Percentage
Positive (3-6 correct answers)	243	97.2
Negative (0-2 correct answers)	7	2.8
Total	250	100.0

Table 4.10 displays the results of depression among males and females. Of the total respondents, 44.0% were not depressed, 48.8% were mildly depressed, 5.2% were moderately depressed, and 2.0% were severely depressed. However, there were more males (3.2%) who were moderately depressed than females (2.0), but more females (1.6%) who were severely depressed than males (0.4%).

Table 4.10: Self-assess of depression between different gender

	Frequency		
	Male (%)	Female (%)	Total (%)
Depression			
No depression	62 (24.8)	48 (19.2)	110 (44.0)
Mild depression	72 (28.8)	50 (20.0)	122 (48.8)
Moderate depression	8 (3.2)	5 (2.0)	13 (5.2)
Severe depression	1 (0.4)	4 (1.6)	5 (2.0)
Total	143 (57.2)	107 (42.8)	250 (100.0)

Table 4.11 reveals that most respondents do not suffer from anxiety. Only 5 respondents (2.0%) of the 250 respondents suffers from unhealthy level of anxiety. Whereas, 40.0% do not have any anxiety, and 58.0% has a health level of anxiety. Table 4.11 displays the overall distribution of anxiety levels among respondents.

Table 4.11: Self-assess of anxiety level

Level of anxiety	Frequency	Percentage
No anxiety	100	40.0
Healthy anxiety	145	58.0
Unhealthy anxiety	5	2.0
Total	250	100.0

The last section on the questionnaire assessed the fourth psychological factor on childhood obesity and overweight. Table 4.12 displays the results of the ability to resist peer-pressure. Respondents were categorized into two categories, whether they can resist peer pressure or not depending upon the right answers scored on the questionnaire. One hundred fifty-five respondents (62.0%) were able to resist peer pressure, while 38% were not able to resist peer pressure.

Table 4.12: Self-assess ability to resist peer-pressure

Ability to resist peer pressure	Frequency	Percentage
Can resist	155	62.0
Cannot resist	95	38.0
Total	250	100.0

4.6 Nutritional status among school children

Weight (kg) and height (cm) of 250 children were measured. After that, their body mass indexes were calculated using $\text{weight}/\text{height}^2$ (kg/m^2). Using the cutoff point of CDC growth charts, children were classified as underweight, normal, overweight, and obese. The results of the study showed that 11.6% were underweight, 69.6% were normal, and the prevalence of overweight was 10.4% and obesity was 8.4% in school children attending grade levels 5-9 in BMA bilingual schools. Table 4.13 displays the nutritional status among children Table 4.14 summarizes the nutritional status of the population with the variables observed.

Table 4.13: Nutritional status among children

Level of BMI percentile	Frequency	Percentage
Underweight (<5 th percentile)	29	11.6
Normal (5<84.9 th percentile)	174	69.6
Overweight (85-94.9 th percentile)	26	10.4
Obese (\geq 95 th percentile)	21	8.4
	250	100.0

Table 4.14 summarizes the nutritional status of the population with the variables observed.

Table 4.14: Nutritional status among children in BMA bilingual schools according to socio-demographic and other variables.

Characteristics	Nutritional status				Total
	Underweight	Normal	Overweight	Obese	
	n (%)	n (%)	n (%)	n (%)	n (%)
Gender					
Male	15 (6.0)	96 (38.4)	18 (7.2)	14 (5.6)	143 (57.2)
Female	14 (5.6)	78 (31.2)	8 (3.2)	7 (2.8)	107 (42.8)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)
Age					
10	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
11	1 (0.4)	6 (2.4)	2 (0.8)	0 (0.0)	9 (3.6)
12	7 (2.8)	33 (13.2)	2 (0.8)	2 (0.8)	44 (17.6)
13	17 (6.8)	71 (28.4)	11 (4.4)	10 (4.0)	109 (43.6)
14	4 (1.6)	64 (25.6)	11 (4.4)	9 (3.6)	88 (35.2)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)
Educational level					
Grade 5	8 (3.2)	36 (14.4)	4 (1.6)	2 (0.8)	50 (20.0)
Grade 6	5 (2.0)	34 (13.6)	7 (2.8)	4 (1.6)	50 (20.0)
Grade 7	12 (4.8)	28 (11.2)	4 (1.6)	6 (2.4)	50 (20.0)
Grade 8	3 (1.2)	40 (16.0)	3 (1.2)	4 (1.6)	50 (20.0)
Grade 9	1 (0.4)	36 (14.4)	8 (3.2)	5 (2.0)	50 (20.0)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)
Daily allowance					
<50 baht	14 (5.6)	51 (20.4)	4 (1.6)	5 (2.0)	74 (29.6)
50-100 baht	6 (2.4)	89 (35.6)	14 (5.6)	11 (4.4)	120 (48.0)
101-200 baht	6 (2.4)	31 (12.4)	6 (2.4)	5 (2.0)	48 (19.2)
>200 bath	3 (1.2)	3 (1.2)	2 (0.8)	0 (0.0)	8 (3.2)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)
Ethnicity					
Thai	17 (6.8)	112 (44.8)	17 (6.8)	17 (6.8)	163 (65.2)
Chinese	4 (1.6)	9 (3.6)	1 (0.4)	0 (0.0)	14 (5.6)
Thai-Chinese	5 (2.0)	28 (11.2)	4 (1.6)	3 (1.2)	40 (16.0)
Thai-Indian	0 (0.0)	1 (0.4)	0 (0.0)	0 (0.0)	1 (0.4)
Thai-Others	2 (0.8)	19 (7.6)	3 (1.2)	1 (0.4)	25 (10.0)
Others/Not sure	1 (0.4)	5 (2.0)	1 (0.4)	0 (0.0)	7 (2.8)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)

Characteristics	Nutritional status				Total
	Underweight	Normal	Overweight	Obese	
	n (%)	n (%)	n (%)	n (%)	n (%)
Knowledge of diet					
High	10 (4.0)	48 (19.2)	8 (3.2)	8 (3.2)	74 (29.6)
Moderate	16 (6.4)	114 (45.6)	18 (7.2)	13 (5.2)	161 (64.4)
Low	3 (1.2)	12 (4.8)	0 (0.0)	0 (0.0)	15 (6.0)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)
Knowledge of physical activity					
High	21 (8.4)	11 (44.4)	17 (6.8)	9 (3.6)	158 (63.2)
Moderate	7 (2.8)	60 (24.0)	8 (3.2)	11 (4.4)	86 (34.4)
Low	1 (0.4)	3 (1.2)	1 (0.4)	1 (0.4)	6 (2.4)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)
Attitude of diet					
High	2 (0.8)	20 (8.0)	6 (2.4)	1 (0.4)	29 (11.6)
Moderate	24 (9.6)	114 (45.6)	15 (6.0)	14 (5.6)	167 (66.8)
Low	3 (1.2)	40 (16.0)	5 (2.0)	6 (2.4)	54 (21.6)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)
Attitude of physical activity					
High	2 (0.8)	36 (14.4)	8 (3.2)	4 (1.6)	50 (20.0)
Moderate	27 (10.8)	123 (49.2)	16 (6.4)	14 (5.6)	180 (72.0)
Low	0 (0.0)	15 (6.0)	2 (0.8)	3 (1.2)	20 (8.0)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)
Practice of diet					
Practice	3 (1.2)	22 (8.8)	4 (1.6)	6 (2.4)	35 (14.0)
Did not practice	19 (7.6)	106 (42.4)	18 (7.2)	7 (2.8)	150 (60.0)
Total	22 (8.8)	128 (50.8)	22 (8.8)	13 (5.2)	185 (74.0)
Practice of physical activity					
Practice	5 (2.0)	84 (33.6)	9 (3.6)	4 (1.6)	102 (40.8)
Did not practice	21 (8.4)	87 (34.8)	22 (8.8)	18 (7.2)	148 (59.2)
Total	26 (10.4)	171 (68.4)	31 (12.4)	22 (8.8)	250 (100.0)
Body image					
Positive	28 (11.2)	172 (68.8)	25 (10.0)	18 (7.2)	243 (97.2)
Negative	1 (0.4)	2 (0.8)	1 (0.4)	3 (1.2)	7 (2.8)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)
Levels of depression					
No	9 (3.6)	83 (33.2)	12 (4.8)	6 (2.4)	110 (44.0)
Mild	19 (7.6)	82 (32.8)	10 (4.0)	11 (4.4)	122 (48.8)
Moderate	1 (0.4)	5 (2.0)	4 (1.6)	3 (1.2)	13 (5.2)
Severe	0 (0.0)	4 (1.6)	0 (0.0)	1 (0.4)	5 (2.0)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)

Characteristics	Nutritional status				Total
	Underweight	Normal	Overweight	Obese	
	n (%)	n (%)	n (%)	n (%)	n (%)
Levels of anxiety					
No anxiety	9 (3.6)	67 (26.8)	12 (4.8)	12 (4.8)	100 (40.0)
Healthy anxiety	19 (7.)	104 (41.6)	14 (5.6)	8 (3.2)	145 (58.0)
Unhealthy anxiety	1 (0.4)	3 (1.2)	0 (0.0)	1 (0.4)	5 (2.0)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)
Peer pressure					
Can resist	23 (9.2)	104 (41.6)	15 (6.0)	13 (5.2)	155 (62.0)
Cannot resist	6 (2.4)	70 (28.0)	11 (4.4)	8 (3.2)	95 (38.0)
Total	29 (11.6)	174 (69.6)	26 (10.4)	21 (8.4)	250 (100.0)

4.7 Associations between childhood overweight and obesity and independent variables

In order to identify the association for childhood overweight and obesity, the dependent variables were the nutritional status of children (normal versus overweight and obesity). Overweight and obesity were categorized as a dichotomous variable. The factors that may be related to childhood overweight and obesity includes the following:

- Socio-demographic characteristics; gender, age, educational level, daily allowance, and ethnicity.
- Knowledge, attitude, and practice on diet and physical activity.
- Body image, level of depression, level of anxiety, and peer pressure.

The bivariate analysis was used to determine the association between the dependent and independent variables shown in Table 4.15. Variables that are significant at a *p*-value less than 0.20 have been selected for inclusion in multivariate logistic regression analysis.

Table 4.15: Unadjusted odd ratios (OR) and 95% confidence interval (95% CI) for childhood overweight ($\geq 85^{\text{th}}$ percentile)

	OR	95% CI		<i>p</i> value
Gender				
Male	1.00	Reference		
Female	1.73	0.876	3.429	0.11**
Age				
11-13	1.00	Reference		
14	0.79	0.408	1.512	0.47
Educational level				
Grade 5-6	1.00	Reference		
Grade 7-9	0.84	0.432	1.642	0.61
Daily allowance				
<50 baht	1.00	Reference		
50-100 baht	0.46	0.178	1.199	0.11**
>100 bath	0.74	0.337	1.599	0.43
Ethnicity				
Thai	1.00	Reference		
Others	1.45	0.711	2.946	0.30
Knowledge on diet				
High	1.00	Reference		
Moderate/Low	1.36	0.680	2.968	0.38
Knowledge on physical activity				
High	1.00	Reference		
Moderate/Low	0.70	0.366	1.350	0.29
Attitude on diet				
High	1.00	Reference		
Moderate/Low	1.35	0.533	3.410	0.52
Attitude on physical activity				
High	1.00	Reference		
Moderate/Low	1.31	0.620	2.786	0.47
Practice on diet				
High	1.00	Reference		
Moderate/Low	1.87	0.815	4.280	0.14**
Practice on physical activity				
Practice	1.00	Reference		
Did not practice	0.84	0.434	1.607	0.59
Body image				
Positive	1.00	Reference		
Negative	0.13	0.022	0.705	0.018**
Level of depression				
No	1.00	Reference		
Mild	0.87	0.091	8.229	0.90
Moderate	1.02	0.109	9.653	0.98
Severe	5.60	0.472	66.447	0.17**

Level of anxiety				
No anxiety/Healthy anxiety	1.00	Reference		
Unhealthy anxiety	0.81	0.082	7.941	0.85
Peer pressure				
Can resist	1.00	Reference		
Cannot resist	1.59	0.792	3.178	0.19**

** *p*-value <0.20 to be entered into the multiple logistic regression model

In the bivariate analysis presented in the above Table 4.15, there were 16 independent variables in total. There were no statistically differences in the age, educational level, ethnicity, knowledge on diet and physical activity, attitude on diet and physical activity, practice on physical activity, and anxiety towards childhood overweight and obesity. However, six independent variables were found to be statistically significant at a p -value ≤ 0.20 . In unadjusted logistic regression of childhood overweight and obesity, female was associated with an increased risk of overweight by 1.73 times (crude OR 1.73, 95% CI 0.876-3.429). Children who received daily allowance of 50-100 baht a day are almost half likely to be overweight/obese (crude OR 0.46 95% CI 0.178-1.199). Children who had a moderate/low practice levels of eating habits were almost twice more likely to be overweight than children with high attitude towards diet (crude OR 1.87, 95% CI 0.815-4.280). Children who were severely depressed were almost six times more likely to be overweight (crude OR 5.60, 95% CI 0.472-66.447) than children who were not depressed. Children who could not resist peer pressure were found to be almost one and half time more likely to be overweight than children who reported to be able to resist peer pressure (crude OR 1.59, 95% CI 0.792-3.178).

In order to evaluate the relative importance of gender, daily allowance, practice on diet, body image, level of depression, peer pressure, and childhood overweight and obesity, multiple logistic regression analysis was used to evaluate relative importance of variables that showed statistically significant with childhood overweight and obesity at a p -value ≤ 0.05 . The results are shown in Table 4.16. Since this study focused on childhood overweight and obesity, children who were classified as underweight were omitted in the analysis.

Table 4.16: Adjusted odd ratios (OR) and 95% confidence interval (95% CI) for childhood overweight ($\geq 85^{\text{th}}$ percentile)

	OR	95% CI		<i>p</i> value
Gender				
Male	1.00	Reference		
Female	1.53	0.742	3.175	0.34
Daily allowance				
<50 baht	1.00	Reference		
50-100 baht	0.37	0.135	1.004	0.06
>100 bath	0.67	0.289	1.530	0.47
Practice on diet				
High	1.00	Reference		
Moderate/Low	2.4	0.148	0.735	0.04*
Body image				
Positive	1.00	Reference		
Negative	0.20	0.079	0.519	0.001*
Level of depression				
No	1.00	Reference		
Mild	0.61	0.057	6.593	0.68
Moderate	0.73	0.068	7.759	0.79
Severe	4.01	0.294	56.865	0.29
Peer pressure				
Can resist	1.00	Reference		
Cannot resist	1.65	0.794	3.445	0.18

* Significant at *p*-value <0.05

Eating habits were significant and children who don't have good eating habits were almost two and half times likely to be overweight (adjusted OR 2.4, 95% CI 0.946-1.603). Children who have negative body image are almost 80% unlikely to become overweight/obese (adjusted OR 0.20, 95% CI 0.079-0.519). Therefore, the important factors leading to childhood overweight and obesity was eating habits.

CHAPTER V

DISCUSSION, CONCLUSION, AND RECOMMENDATION

5.1 Discussion

Childhood overweight and obesity has become an important public health problem in Thailand. A cross-sectional, analytical study was carried to determine the prevalence and risk factors of obesity and overweight in Thai children attending grade levels 5-9 in BMA bilingual schools. Two hundred and fifty students were selected as subjects for the study from six different BMA bilingual schools.

The earlier proposed six bilingual schools include Benjamaborphit Bilingual School, Wat Mahah Bilingual School, Wat Pasee School, Sawasdee Wittaya School, Wat Don Bilingual School, and Rittiyawannalai School. However, Rittiyawannalai School has been substituted by Wat Mai Chong Lom. The replacement school is a bilingual school under BMA and has similar characteristics.

Another important observation was that there were no children aged 10 in the study group. As students were in bilingual school and English not being their native language, majority of students spend an extra year learning English. Hence, assumption made that 10 years old should be in Grade 5 was not valid for this study group.

The results of the study indicated that the prevalence of overweight and obese children were 10.4% and 8.4% respectively. It is noticeable that these rates are adjacent to studies conducted earlier, which reported that 11.5% Thai children were overweight (Mosuwan et al., 1998). National Health and Nutritional Examination Survey (NHANES) indicated that 14.6% children in Bangkok Metropolitan schools were overweight (Ogden et al., 2000). Moreover, this percentage corresponds well with studies in 2006 that reported 18.9% of Bangkok children were overweight (Pawloski, 2006).

Since, the prevalence in childhood overweight increased from 5.8% in 1997 to

6.7% to 2006 for 6–12-year-olds (Aekplakorn et al., 2009). However, this data showed disproportionate increases since the obesity rates in rural and urban areas are different respectively. Statistics from the Global School-based Student Health Survey (GSHS), which is conducted by Thailand Department of Health periodically to monitor the prevalence of health risk behaviors and protective factors among students, including overweight and obesity indicated that overweight among children is about 10%. However, the result of this study may not be fully comparable to Thailand's Department of Health data, since it did not distinguish between overweight and obese children.

Based on the Thai National Statistical Office, the national prevalence of obesity by gender are 7.0% obese boys and 6.7% obese girls (National Statistical Office, 2006). However, this study reported a lower prevalence in boys (5.6%) and a much lower prevalence in obese girls (2.8%). In the study, gender was significantly associated with overweight. Girls were more likely to be overweight than boy (OR 1.44, 95% CI). Whereas, some studies have reported the odd of being overweight and obese in males and females were similar (Patton et al., 2010), other studies pointed out that boys from grade 4 to 6 were significantly higher than girls.

Although, the overweight children had a good knowledge and attitude towards diet and physical activity, they still practiced unhealthy behavior, sedentary lifestyle, and compensatory eating when they were stressed. Yet, children are more knowledgeable on physical activity than diet. Though children had a better knowledge on diet, their attitude was lower. This is not surprising as many studies shown such dissociation between knowledge and attitude (Manios et al., 1999). However, children's attitude on diet and physical activity showed similar results.

As in the WHO 2010 publications, WHO clearly points out that unhealthy diet is the key modifiable risk for overweight and obesity, this study supports the claim with eating habits showing a significant association with childhood overweight and obesity. Children who have poor eating were more than twice likely to be overweight than children who practice good eating habits. Early adolescents is a critical period for

development of overweight (Adair, 2008), hence it is a concern as childhood overweight is positively correlated with eventual adult obesity (Juhola et al., 2011).

One interesting observation was the low level of moderate exercise. The percentage of students who do moderate exercise was lower than expected. Many students exercised but did not do moderate exercise. It is likely that many students did not understand the importance of moderate exercise. Various studies have pointed that moderate exercise clearly attenuated many health risks associated with obesity (Vastaneda et al., 2010).

Furthermore, there was a high percentage of students who exercised less than 30 minutes. WHO recommends at least 30 minutes of regular, moderate-intensity physical activity on most days. This low frequency of exercise can be likely due to the lack of health education in BMA bilingual schools. In fact, it has been shown in various studies that health education has increased physical activities among students. (Veugelers, 2005; Katzel et al., 2008). Another explanation could be due to the urbanization lifestyle. Many students (62%, data not shown in table under RESULTS) reported to spend more than 2 hours on television and/or play video games after school.

Various literature reviews had shown significant differences in depression level among males and females. Depression was not a factor for childhood overweight and obesity. Though, adolescents were associated with more experience of depression, the case for a relationship between obesity and depression is far from proven (Wardle et al., 2005). While studies showed that overweight children had higher anxiety (Morgan et al., 2002), the study showed no association between levels of anxiety and overweight. Another interesting observation was the very low prevalence of unhealthy anxiety against health and no anxiety. Hence, it made it impossible to find the level of association. Another factor could be that is likely to be the cause of no association between anxiety and childhood obesity is that the measure on anxiety used in the study was limited to anxiety on school performance only. Anxiety on daily lives experience would have been a better tool to study the association between anxiety and childhood overweight and obesity.

Another interesting observation was the significance association of body image with childhood overweight and obesity (p -value <0.5). Though there was significance, it was a dissociation effect. Children with negative body image were 90% unlikely to become overweight. Though, more studies have to be conducted on body image to fully understand the association. However, we assume children who have negative body image are likely to be conscious about their weight and hence eat less. A study reported that body mass index was positively related to body dissatisfaction (Paxton et al., 1991)

Whereas, the study pointed that peer pressure was associated with overweight during bivariate analysis (p -value <0.2), it showed no significant association during the multivariate analysis. Thought, there have been other studies that pointed that peer influence and eating behaviors of friends contributed significantly to the prediction of individual eating habits (Hutchinson, 2010).

All the six BMA schools implementing the School Lunch Program (SLP) subsidized by the government and Bangkok Metropolitan Administration to serve lunch to primary students the prevalence of childhood overweight in Thai children attending grade levels 5-9 is still arguably high. This has been beneficial towards primary students. However, observation made during school visits indicated that food-vendors within school compound sell high-caloric food, such as fried chicken and french-fries to students. Soda-machines and/or soft drinks were also freely available to students within the school compounds. Many primary students visit these vendors after having their lunch.

Furthermore, no lunch programs were available for secondary students, which in this study included grade levels 7-9. Secondary students have a freedom of food choice, and it can be problematic, since not all food available on the school compounds are healthy. As a whole, all children, regardless of grade levels, should be further educated and encouraged to make right food choices.

Overall, there were very few associations between independent and depend variables. A reason for few associations could highly be due to children at this age is heavily influenced by hormonal changes than other age groups (Moran, 1999).

5.2 Conclusion

Childhood overweight and obesity is a serious public health problem based on its increasing rates and the associated health risks. Obesity is a multifactorial chronic diseases stemming from complex interactions between genes and environment. However, dietary and physical activity are behavioral risk factors that are modifiable. This study indicated that the prevalence of childhood overweight and obesity in BMA bilingual schools is of concern. Our finding highlights the importance of two risk factors for childhood overweight: eating habits and peer pressure.

In view of the recognition that diet can make a substantial contribution to childhood overweight and obesity, research is needed to evaluate family based intervention that target the promotion of fruit and vegetable consumption and the practice of physical activity. However, researches about childhood overweight and obesity in Thailand are still in the early stages. Though, this study has some limitations, the number of participants and schools are low and the results cannot be generalized to the rest of Bangkok children or the entire Thai. There are still alot to explore to conduct valuables studies to help the country tackle this arising problem. Nevertheless, further studies are needed to investigate childhood overweight and obesity in a larger scale.

5.3 Recommendation

5.3.1 Recommendation for further studies

1. Further studies should include hormonal assessment, and an assessment of daily life anxiety instead of school-performance based anxiety only.
2. There should be cohort studies to follow the nutritional status of children.

5.3.2 Recommendation for program implementation

1. Updated study on National Health Examination Survey of Thailand should be conducted by Ministry of Public Health in accordance with World Health Organization goals.
2. A revised health-education program, which signifies the importance of dietary habits and physical activity. Combination of dietary modifications, increased physical activity, decreased sedentary life style and behavior modification is recommended, both on an individual and population basis.
3. A healthy school program. A program, which aims to improve children's perception of one's body image, eating habits, and physical activities. The program should have a directive approach on availability of food on school compounds. Children should be educated on how to calculate their body mass in order to have positive attitude on control of one's weight.
4. Interventions strategies should be directed not only at children, but should include the whole family.
5. The Thai government should promote more mass media health campaign to build awareness, since obesity is now a problem disease in Thailand. This should be done not only to save cost in medical treatment but also to gain good productive and quality citizen of the nation.
6. Establish a call-center to advise and support overweight and obese individuals to consult about their eating habits and physical activity.

REFERENCES

- Adair, L.S. (2008). Child and adolescent obesity: Epidemiology and developmental perspectives. Physiology & Behavior 9: 8-16.
- Aekplakorn, W. et al. (2004). Prevalence and determinants of overweight and obesity in Thai adults: Results of the Second National Health Examination Survey. Journal of the Medical Association of Thailand 8: 685-693.
- Aekplakorn, W., and Mo-Suwan, L. (2009). Prevalence of obesity in Thailand. Obesity Reviews 10(6): 587-588.
- Bloem, M.W. et al. (1989). Iron metabolism and vitamin A deficiency in children in northeast Thailand. American Journal of Clinical Nutrition 50: 332-338.
- BMA. (2010). Education Bangkok Metropolitan Administration. [Online]. Available from: <http://www.bangkok.go.th/th/page/index.php?&125-Education&lang=en&l=en>[2011, September]
- Braet, C. (2006). Patients Characteristics as Predictors of Weight Loss after an Obesity Treatment for Children. Obesity 14: 148-155.
- Breat, C., Tanghe, A., Decaluwe, V., Moens, E., and Rosseel, Y. (2004). Inpatient treatment for children with obesity: Weight loss, psychological well-being, and eating behaviour. Journal of Paediatric Psychology 29(7): 519-529.
- Bralic, I., Vrdolijak, J., and Kovacic, V. (2005). Associations between parental and child overweight and obesity. Collegium Antropologicum 29: 481-486.
- Caballero, B. et al. (2003). Pathways Study Research Group. Pathways: a school-based, randomized controlled trial for the prevention of obesity in American Indian schoolchildren. American Journal of Clinical Nutrition 78(5):1030-8.

- Castaneda et al., (2010). Overweight, obesity, high blood pressure, and lifestyle factors among Mexican children and their parents. Environmental Health and Preventive Medicine 6: 358-366.
- Chamruengsri, K., Kietduriyakul. V., Pava-Ro, U., Sapsamarnwong, C., and Chandumpai, P. (1991). Nutritional status of low socioeconomic school children at Srakaew Temple, AngThong. Journal of the Medical Association of Thailand 74: 24-29.
- Cochran, W.G. (1963). Sampling techniques, 2nd Ed. New York: John Willey and Sons, Inc.
- Chu, N.F. (2001). Prevalence and trends of obesity among school children in Taiwan-The Taipei children heart study. International Journal of Obesity 25(2): 170-176.
- Damcott, C.M., Sack P, and Shuldiner, A.R. (2003). The genetics of obesity. Endocrinology Metabolism Clinics of North America 32(4): 761-786.
- Del-Rio-Navarro, B.E. et al. (2008). Obesity and metabolic risks in children. Archives of Medical Research 39: 215-221.
- Detels, R., Beaglehole, R., Lansang, M.A., and Gulliford, M. (2011). Oxford Textbook of Public Health 5th Edition. Oxford University Press.
- Dietz, W.H. (1994). Critical periods in childhood for the development of obesity. American Journal of Clinical Nutrition 59: 955-959.
- Deurenberg-Yap, M. et al. (1999). Manifestation of cardiovascular risk factors at low levels of body mass index and waist-to-hip ratio in Singaporean Chinese. Asia Pacific Journal of Clinical Nutrition 8: 177-183.
- Ebelling, C.B. et al. (2002). Childhood obesity: Public-health crisis, common sense cure. Lancet 360: 473-482.
- Farooqi, I.S. (2007). Genetics factors in human obesity. Obesity Reviews 8(S1): 37-40.

- Friedlander, S.L. et al. (2003). Decreased quality of life associated with obesity in school-aged children. Archives of Pediatrics and Adolescent medicine 157(12): 1206-1211.
- Finkelstein, E.A., Trogon, J.G, Cohen, J.W, and Dietz, W. (2009). Annual medical spending attributable to obesity: Payer- and service-specific estimates. Health Affairs 28(5): 822-831.
- Fisac, J.L., Regidor, E., and Rodrigues, C. (1996). Trends in obesity differences by educational level in Spain. Journal of Clinical Epidemiology 49(3): 351-354.
- Freedman et al. (1999). The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. Pediatrics 103: 1175-1182.
- Gardner, G., and Halweil, B. (2000). State of the World. 500 Fifth Avenue, New York: Norton & Company, Inc.
- Garrow, J.S. (1988). Obesity and related disease. London: Churchill Livingstone .
- Gorstein, J., and Grosse, R.N. (1994). The Indirect Costs of Obesity to Society. Pharmoeconomics 5: 58-61.
- Gortmaker et al. (1999). Reducing obesity via a school-based interdisciplinary intervention among youth. Archives of Pediatrics & Adolescent Medicine 153: 409-418.
- Gunnell, D.J., Frankel, S.J., Nanchahal, K., Peters, T.J., and Davey, S.G. (1998). Childhood obesity and adult cardiovascular mortality: a 57-y follow-up. American Journal of Clinical Nutrition 67(6):1111–1118.
- Hirata et al. (1998). Obesity among school children in a province of southern Thailand and its Association with Socioeconomic Status. Environmental Health and Prevention Health 3(2): 67-72.

- Hutchinson, D.M. (2010). Body dissatisfaction and eating disturbances in early adolescence: A structural modeling investigation examining negative affect and peer factors. The Journal of Early Adolescence 30(4): 489-517.
- Jumpatong, D. (2006). School lunch program and rice consumption behavior in Thailand. Proceedings for Workshop and Conference on Rice in the World at Stake.
- Jonides, L.K. (1990). Childhood obesity: an update. Journal of Pediatric Health Care 4: 244-251.
- Juhola et al. (2011). Tracking of serum lipid levels, blood pressure, and body mass index from childhood to adulthood: the cardiovascular risk in young Finns study. Journal of Pediatrics 159(4): 584-590.
- Kai, E., Pongpanich, S., and Sinawat, S. (2008). A comparison study of the school lunch program in the public primary schools belong to Bangkok Metropolitan Administration (BMA) and Thai Ministry of Education (MOE). International Journal of Health Research 22(3): 147-150.
- Kantachuvessiri, A. (2005). Obesity in Thailand. Journal of the Medical Association of Thailand 88(4): 554-562.
- Katz, D.L., O'Connell, M., Nijike, V.Y., Yeh, M.C., Nawaz, H. (2008). Strategies for the prevention and control of obesity in school setting: systematic review and meta-analysis. International Journal of Obesity 32: 1780-1789.
- Kelly, Small. (2001). Addressing Body Image, Self-Esteem, and Eating-Disorders. EGALLERY [Online]. Available from: <http://www.people.ucalgary.ca/~egallery/volume2/small.html> [2012, February]
- Khader et al. (2009). Overweight and obesity among school children in Jordan: Prevalence and associated factors. Maternal and Child Health Journal 13: 424-431.

- Kimbro, R.T., Gunn, J.B., and McLanahan, S. (2007). Racial and ethnic differentials in overweight and obesity among 3-year-old children. American Journal of Public Health 97(2): 298-305.
- Ko, G.T.C., Chan, J.C.N., Cockram, C.S., and Woo, J. (1999). Prediction of hypertension, diabetes, dyslipidaemia or albuminuria using simple anthropometric indexes in Hong Kong Chinese. International Journal of Obesity 23: 1136-1142.
- Kosulwat, V. (2002). The nutrition and health transition in Thailand. Public Health Nutrition 5(1A): 183-189.
- Kraff et al. (2006). A prospective study of psychological predictors of body fat gain among children at high risk for adult obesity. Pediatrics 117: 1202-1209.
- Kushner, R.F. (1993). Body weight and mortality. Clinical Nutrition Research Unit 51(5):127-136.
- Maffeis, C. (2000). Aetiology of overweight and obesity in children and adolescents. European Journal of Pediatrics 159(S1): 35-44.
- Manios, Y., and Kafatos, A. (1999). Health and nutrition education in elementary schools: Changes in health knowledge, nutrient intakes and physical activity over a six year period. Public Health Nutrition 2(3a): 445-448.
- McTigue, K.M., Garrett, J.M., and Popkin, B.M. (2002). The natural history of the development of obesity in a cohort of young U.S. adults between 1981 and 1998. Annals of Internal Medicine 136: 857-864.
- Molarius, A., Seidel, J.C., Sans, S., Tuomilehto, J., and Kuulasmaa, K. (2000). Educational level, relative body weight, and changes in their association over 10 years: an international perspective from the WHO MONICA Project. American Journal of Public Health 9(8): 1260-1268.

- Moran, R. (1999). Evaluation and treatment of childhood obesity. The American Academy of Family Physicians. [Online]. Available from:
<http://www.aafp.org/afp/990215ap/861.html> [July, 2011]
- Morgan et al. (2002). Loss of control over eating, adiposity, and psychopathology in overweight children. Internal Journal of Eating Disorders 31(4): 430-441.
- Mo-suwan, L., Pongprapai, S., Junjana, C., and Puetpaiboon, A. (1998). Effects of a controlled trial of a school-based exercise program on the obesity indexed of preschool children. American Journal of Clinical Nutrition 68: 1006-1011.
- Mueller et al. (1995). Under-eating and over-eating concerns among adolescents. Journal of Child Psychology and Psychiatry 36(6): 1019-1025.
- Nemet, D., Barkan, S., Epstein, Y., Friedland, O., Kown, G., and Eliakim, A. (2005). Short and long term effects of a combined dietary-behavioral-physical activity intervention for the treatment of childhood obesity. Pediatrics 115(4): 443-449.
- Ogden et al. (2006). Prevalence of overweight and obesity in the United States, 1999-2004. JAMA 295 (13): 1549-1555.
- Patton et al. (2011). Overweight and obesity between adolescence and young adulthood: A 10-year prospective cohort study. Journal of Adolescent Health 48: 275-280.
- Pawloski, L. (2006). Obesity in Thailand?: An examination of nutritional data from Thai adolescents living in suburban Bangkok. Journal of Nutrition Education and Behavior 28(Suppl4): 47-48.
- Paxton et al. (1991). Body image satisfaction, dieting beliefs, and weight loss behaviors in adolescent girls and boys. Journal of Youth and Adolescence 20(3): 361-379.
- Pine, D.S., Goldsterin, R.B., Wolk, S., and Weissman, M.M. (2001). The association between childhood depression and adulthood body mass index. Pediatrics 107: 1049-1056.

- Pomeranaz, J.L. (2011). Advancing public health obesity through state attorneys general. American Journal of Public Health 101(3): 425-431.
- Popkin, B.M. (2001). The nutrition transition and obesity in developing world. Journal of Nutrition 131: 871s-873s.
- Prentice, A.M., and Jebb, S.A. (2001). Beyond body mass index. Obesity Reviews 2(3):141–147.
- Puhl, R., and Brownell, K.D. (2001). Bias, discrimination, and obesity. Obesity Research 9(12): 788-805.
- Ricciardelli, L.A., and McCabe, M.P. (2001). Children’s body image concerns and eating disturbance: a review of literature. Clinical Psychological Review 21(3): 325-332.
- Sakamoto et al. (2001). A social epidemiologic study of obesity among preschool children in Thailand. Nature 25(30): 389-394.
- Salmon, J., and Timperio, A. (2007). Prevalence, Trends, and Environmental Influences on Child and Youth Physical Activity. Pediatric Fitness 50: 183-199.
- Schwimmer, J.B., Burwinkle T.M., and Varni, J.W. (2003). Health-related quality of life of severely obese children and adolescents. JAMA 45(289): 1813-1819.
- SEAMIC. (1997). Health statistics Tokyo. 1997. SEAMIC Publication.
- Seidell et al. (1997). Assessing obesity: classification and epidemiology. British Medical Bulletin 53(2): 238–252.
- Silventoinen, K., Lahelma, E, and Sarlio-Laheteenkorva, S. (2004). Relative weight and income at different levels of socioeconomic status. American Journal of Public Health 94(3): 468-472.
- Sirilulchayanota, C., Rattanopas, W., Temcharoen, P., and Srisorrachatr, S. (2011). Self discipline and obesity in Bangkok school children. BMC Public Health 11: 158.

- Small, L., Anderson, D., and Melnyk, B.M. (2007). Prevention and early treatment of overweight and obesity in young children: Obesity/Overweight and preschool and young school-aged children. *Pediatric Nursing Journal* 33(2):149-161.
- Sriampornet. al. (2005). A prospective study on diet, lifestyle, and genetic factors and the Risk of Cancer in Kohn Kaen Province, Northeast Thailand: Description of Cohort. *Asian Pacific Journal of Cancer Prevention* 6: 295-303.
- Stamatakis et al. (2005). Overweight and obesity trends from 1974 to 2003 in English children: what is the role of socioeconomic factors? *Archives of Diseases in Childhood* 90: 999-1004.
- Story et al. (2003). Obesity in American-Indian children: prevalence, consequences, and prevention. *Preventive Medicine* 37(S3):3-12.
- Stunkard, A.J. (1993). Obesity and socioeconomic status – a complex relation. *New England Journal of Medicine* 329: 1036-1037.
- Summerbell et al. (2005). Interventions for preventing obesity in children. *Cochrane Database of Systematic Reviews* 3: 1-39
- Svensson et al. (2011). Associations between severity of obesity in childhood and adolescence, obesity onset and parental BMI: a longitudinal cohort study. *International Journal of Obesity* 35: 46-52.
- Tremblay et al. (2005). Obesity, overweight and ethnicity. *Health Reports* 16(4): 4-13.
- Vanhala, M., Vanhala, P., Kumpusalo, E., Halonen, P., and Takala, J. (1998). Relation between obesity from childhood to adulthood and the metabolic syndrome: population based study. *British Medical Journal* 317: 319.
- Veugelers, P.J. (2005). Fitzgerald AL. Effectiveness of School Programs in Preventing Childhood obesity: A multilevel comparison. *American Journal of Public Health* 95(3): 432-435.

- Wanwimol Kittidilokkul. (1993). Factors influencing obesity in school children in Bangkok Metropolitan. Master's Thesis, Department of Nutrition, Faculty of Science Nutrition, Mahidol University.
- Wardle, J, and Cooke, L. (2005). The impact of obesity on psychological well-being. Best Practice & Research Clinical Endocrinology & Metabolism 19(3): 421-440.
- Weisell, R.C. (2003). Body mass index as an indicator of obesity. Asia Pacific Journal of Clinical Nutrition 11(S8): 681-684.
- Whitaker et al. (1997). Predicting obesity in young adulthood from childhood and parental obesity. New England Journal of Medicine 337:869-873.
- Wolf, A.M. (1998). Current estimates of the economic cost of obesity in the United States. Obesity Research 6(2):97-106.
- WHO. (2000). Obesity: Preventing and managing the global epidemic. Report of a WHO Consultation. Technical Report Series 894. Geneva: WHO.
- WHO. (2002). Physical inactivity a leading cause of disease and disability, warns WHO. [Online]. Available from: [2011, July]
<http://www.who.int/mediacentre/releases/release23/en/print.html>.
- WHO. (2003). Global strategy on diet, physical activity, and health. Available from:
<http://www.who.int/dietphysicalactivity/en/> [2011, July]
- WHO. (2011). Obesity and overweight; Facts about obesity and overweight. [Online]. Available from: <http://www.who.int/mediacentre/factsheets/fs311/en/index.html> [2011, September]
- WHO. (2006). Health Promotion. Report of an Inter-country Workshop Bangkok, Thailand, 2006. Geneva: WHO

- Yamborisut et al. (2010). Waist circumference and body fat distribution indexes as screening tools for the overweight and obesity in Thai preschool children. Obesity Research45: 307-314.
- Yoshiike, N., Matsumura, Y., Zaman, M.M., and Yamaguchi, M. (1998). Descriptive epidemiology of body mass index in Japanese adults in a representative sample from the National Nutrition Survey 1990-94. International Journal of Obesity 22: 684-687.
- Zaini, M.Z., Lim, C.T., Low, W.Y., and Harun, F. (2005). Factors affecting nutritional status of Malaysian primary school children. Asia Pacific Journal of Public Health 17: 71-80.

APPENDICES

APPENDIX A
QUESTIONNAIRE FOR CHILDREN

Grade _____

Survey Date _____

Part I. Socio Demographic characteristics of Children

1. Please fill in your birthday (day/month/year): ___/___/___
2. Please put a (√) next to your gender: Male Female
3. 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.
4. What is your ethnicity? (Select one or more responses.)
 - A. Thai
 - B. Chinese
 - C. Indian
 - D. Thai-Chinese
 - E. Thai-Indian
 - F. Mixed (Thai-Others)
 - G. Others or not sure

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

A. DIET The following questions are about your eating habits. Please choose the best answer only. (KNOWLEDGE Questions 1-6, ATTITUDE Questions 7-10, PRACTICE Questions 11-17)

1. Which food group should you eat the least amount of? (Check only 1)
 - A. meat, fish, poultry (chicken)
 - B. milk, yogurt, cheese
 - C. fats, oils, sweets
 - D. vegetable and fruit
 - E. bread, cereal, rice, pasta
2. Which food group should you eat the most of? (Check only 1)
 - A. milk, yogurt, cheese
 - B. fats, oils, sweets
 - C. vegetable and fruit
 - D. bread, cereal, rice, pasta
 - E. meat, fish, poultry
3. Please circle all the choices of foods you think are high in fat:
 - A. fried chicken
 - B. bananas
 - C. white bread
 - D. broiled fish
 - E. popcorn
 - F. peanut butter
4. Please circle all the choices of foods you think are high in fiber:
 - A. bran flakes
 - B. carrots
 - C. hamburger
 - D. doughnuts
 - E. lettuce
 - F. ravioli
5. How many servings (number of times the food is served) of fruit and vegetables is a person supposed to eat each day?
 - A. 2
 - B. 1
 - C. 5
 - D. 3
6. Are fast foods a cause of overweight? (Please put a (✓) next to correct answer)
 Yes No

7-10. Please put a (√) under **AGREE** if you think the statement is true or (√) under **DISAGREE** if you think the statement is false. If you cannot decide, you may answer **Don't Know**.

STATEMENT	AGREE	DISAGREE	Don't Know/ refused
7. Fast food restaurants should not offer toys because they encourage kids to eat unhealthy food.			
8. Fast foods are easy to get.			
9. Fast foods have portions that are too big.			
10. Fast food restaurants and food companies make too much unhealthy food.			

11. Do you eat at least 5 portions of fruit and/or vegetables every day? (Remember that fruit juice only counts as 1 portion a day, regardless of how much you drink.)
 Yes No

12. Do you choose low-fat products when available? (Low-products mean the item which has a sign of low-fat on it.)
 Yes No

13. Do you regularly eat cakes, sweets, chocolates or biscuits? (Regularly means when you have at least 4 or more times in a week.)
 Yes No

14. Do you skip breakfast more than once a week?
 Yes No

15. How often did you drink soft drinks (eg. Coke, Pepsi, etc.) in the past 30 days?
QUESTION.16
 A. Never (**GO TO**) F. 5–6 times per week
 B. 1 time in the last 30 days. G. 1 time per day
 C. 2–3 times per month H. 2–3 times per day
 D. 1–2 times per week I. 4–5 times per day
 E. 3–4 times per week J. 6 or more times per day

16. Each time you drank soft drinks (ex: Coke, pepsi, 7-up, ..), how much did you usually drink? (1 can/bottle = 330 ml)
 A. Less than 1 can/bottle
 B. 1 can/bottle
 C. More than 1 can/bottle

17. How often do you eat food that was fried?

- A. Daily
- B. 1-3 times a week
- C. 4-6 times a week
- D. Less than once a week
- E. Never

B. Physical Activities The following questions are about your physical activity. (Exercise in this content refers to at least moderate exercise. By moderate exercise we mean an exercise where that you make an effort in breathing but you still can which a child converse in short sentences) Please remember to answer about moderate exercise only. (KNOWLEDGE Questions 1-4, ATTITUDE Questions 5-8, PRACTICE Questions 9-14)

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. How many minutes should a person spend on average per time on exercise?

- A. Less than 30 minutes
- B. 31-60 minutes
- C. More than 60 minutes

4. How important is exercise for health?

- A. Very important
- B. Little important
- C. Not very important
- D. Not at all important
- E. Don't know/Refused

5-8. Please put a (√) under AGREE if you totally agree with the statement or (√) under DISAGREE if you absolutely disagree with the statement. If 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 reduces stress or helps you get away from problems you might have.			
6. Taking part in physical activities could be dangerous.			
7. Taking part in physical activities will give you a chance to meet new people.			
8. I think physical activities are necessary to maintain a normal weight.			

9. Do you do moderate exercise? By moderate exercise we mean an exercise where that you make an effort in breathing but you still can which a child converse in short sentences. (Please put a (√) next to correct answer)

Yes

No (**GO TO QUESTION 12**)

10. How *many* times do you exercise in a week?

A. Less than 3 times

B. 4-5 times

C. 6-7 times

11. How many minutes do you spend on average per time on exercise?

A. Less than 30 minutes

B. 31-60 minutes

C. More than 60 minutes

12. How do you normally come to school? (For Answer B and C, please put number of minutes as well)

A. Public transportation

B. Walking for ____ minutes.

C. Riding a bicycle for ____ minutes.

D. Parents drop or own vehicle

E. I stay in the school's dormitory.

13. 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.
- Less than 1 hour
 - 1-3 hours
 - 3 hours or more
 - Don't know/Not sure/Refused
 - None
14. On a typical SCHOOL DAY, how many hours do you usually spend playing video or computer games?
- Less than 1 hour
 - 1-3 hours
 - 3 hours or more
 - Don't know/Not sure/Refused
 - None

C. Overweight and Obesity. The following questions are about knowledge and attitude towards overweight and obesity. Please choose the best answer only

- What do you believe is the main cause of obesity? (You can choose more than 1)
 - Genetics / runs in the family
 - Unhealthy food choices
 - Emotional eating (eating when depressed, stressed, happy etc.)
 - Lack of exercise
 - Lack of education
 - Eating in restaurants too much
 - Don't know
 - Refused

2-4. Please put a (√) under AGREE if you totally agree with the statement or (√) under DISAGREE if you absolutely disagree with the statement. If you cannot decide or refused to answer, put a (√) under Don't Know/Refused.

STATEMENT	Agree	Disagree	Don't Know/Refused
2. Overweight children and teens have a harder time making friends than other kids.			
3. Overweight children and teens are less attractive than other kids their age.			
4. Overweight children and teens are unhealthy.			

Part III. The following sections are divided into four parts: Part A is about Body Image, Part B is about Depression, Part C is about Anxiety, and Part D is about Peer Pressure.

A. Body Image. The following questions are about your perception (psychological factors). Please choose the best answer only.

1. How do you describe your weight?
 - A. Very underweight
 - B. Slightly underweight
 - C. About the right weight
 - D. Slightly overweight
 - E. Very overweight

2. What do you think about your body image?
 - A. I'm thin and not happy with that
 - B. I'm thin and happy with that
 - C. I'm fat and not happy with that.
 - D. I'm fat and happy with that.
 - E. I'm neither thin nor fat and happy with that.
 - F. I'm neither thin nor fat and not happy with that.

3. Which of the following are you trying to do about your weight?
 - A. Lose weight
 - B. Gain weight
 - C. Stay the same weight
 - D. I am not trying to do anything about my weight

4. Have you ever gone without eating for 24 hours or more (also called fasting) to lose weight or to keep from gaining weight?
 - A. Yes
 - B. No

5. Have you ever taken any diet pills, powders, or liquids without a doctor's advice to lose weight or to keep from gaining weight? (Do not include meal replacement products such as Slim Fast.)
 - A. Yes
 - B. No

6. Have you ever vomited or taken laxatives to lose weight or to keep from gaining weight? (Laxatives are medicine that stimulates you to poo).
 - A. Yes
 - B. No

B. Depression. The following questions are about depression. Please choose the best answer only.

Do you have the following symptoms in the past 2-weeks period	None	Seldom	Frequent	Everyday
1. I don't feel like doing anything.				
2. I am sad. I am displeased about myself				
3. I have difficulties in sleeping or I over sleep.				
4. I feel tired easily or lack energy.				
5. I loss appetite for food or over eat.				
6. I feel worthless or guilty about myself.				
7. I lack concentration while doing work, watching TV, or even listening to radio.				
8. I am too agitated to stay still or speak and do things slowly throughout the day.				
9. I think of hurting myself or committing suicide.				

C. Anxiety. Indicate how often each statement describes you by choosing a number from one to five as outlined.

Never Rarely Sometimes Often Always
1 2 3 4 5

1. ____ I have visible signs of nervousness such as sweaty palms, shaky hands, and so on right before a test.
2. ____ I have "butterflies" in my stomach before a test.(Butterflies in the stomach means when you are scared and you can feel it in the stomach).
3. ____ I feel nauseated before a test.
4. ____ I read through the test and feel that I do not know any of the answers.
5. ____ I panic before and during a test.
6. ____ My mind goes blank during a test.
7. ____ I remember the information that I blanked on once I get out of the testing situation.
8. ____ I have trouble sleeping the night before a test.
9. ____ I make mistakes on easy questions or put answers in the wrong places.
10. ____ I have difficulty choosing answers.

D. Peer Pressure. Now we'd like to ask you some general questions about peer pressure. Please tell me if you would support or oppose each of the following.

Statements (1-3)	Strongly Support	Somewhat Support	Strongly Oppose	Somewhat Oppose	Don't Know/Refused
1. Friends can have negative influence on my health.					
2. When I go out with my friends, I eat what my friends eat, even though, I don't want to.					
3. Peer pressure causes people to eat unhealthy food.					

Thank you for your participation and cooperation in this research.

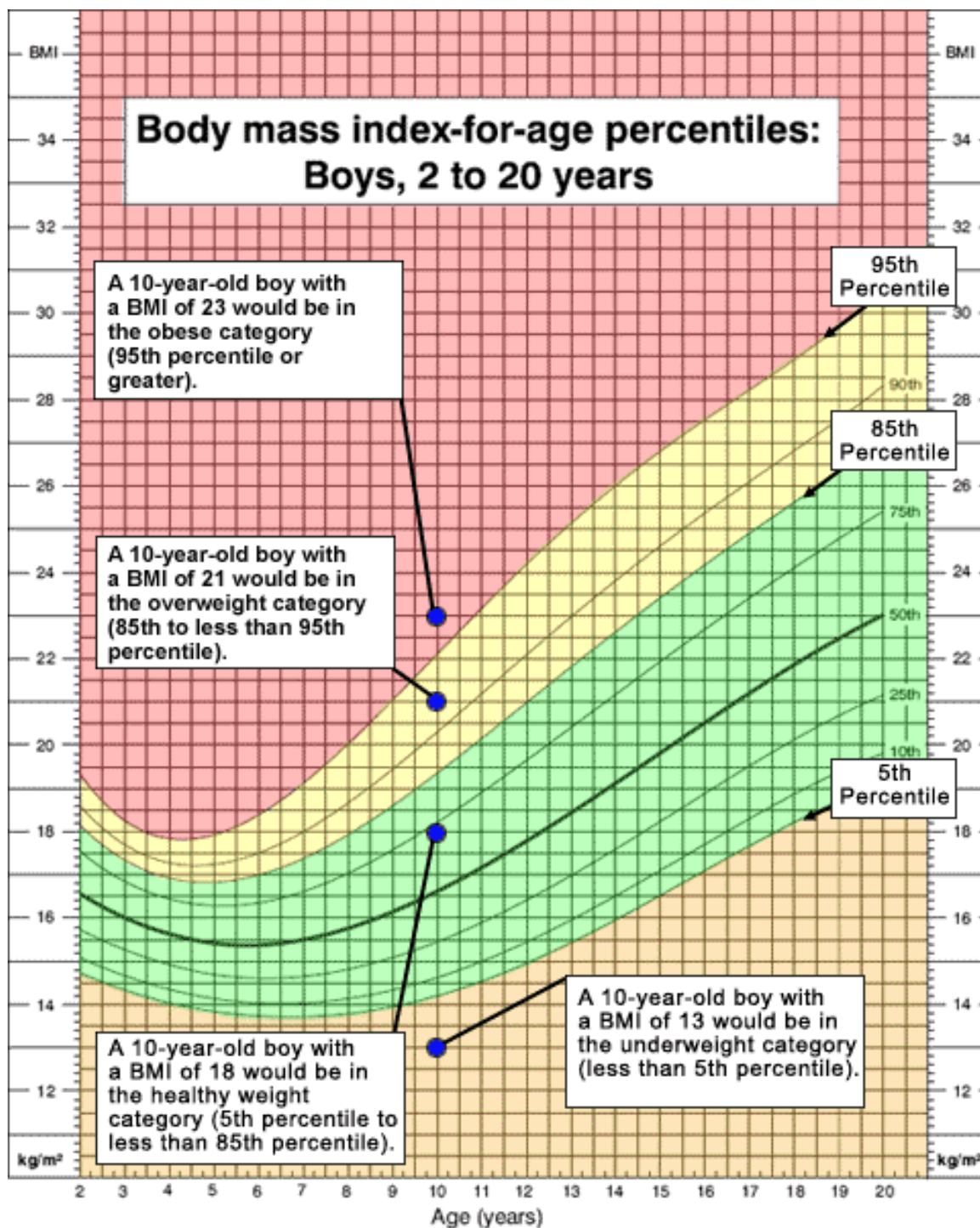
Please return the questionnaire to the researcher, and kindly allow him to measure your weight and height.

MEASUREMENT BY THE RESEARCHER ONLY

Weight: _____kg Height: _____cm BMI: _____

APPENDIX B

CDC BODY MASS INDEX-FOR-AGE PERCENTILE



APPENDIX C

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).



VITAE

Name: Mr. Nattapon Chawla

Date of Birth: September 16th, 1985

Pace of Birth: Bangkok, Thailand

Education: Bachelors of Science (in Biology) Asia Pacific International University, Thailand. 2008.

Work Experience: Secondary level Science teacher,
Srivikorn School, Bangkok, Thailand (2008 – present)

Assistant teacher and lab instructor,
Mission College, Saraburi, Thailand (2007-2008)

Office Address: 1020 Sukhumvit Road, Phrakhanong, KlongToey,
10110, Bangkok, Thailand

Email: nattaponchawla@gmail.com