FACTORS RELATED TO OBESITY IN PRIMARY SCHOOL CHILDREN: A CASE STUDY OF NAKHON PATHOM PROVINCE, THAILAND

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ABSTRACT

A cross sectional survey was conducted in Maung District, Nakhon Pathom Province, Thailand during January 2004, with the aim to identify prevalence of obesity and its related factors. Two hundred children and their parents were selected by stratified random sampling with proportional to size.

The results of this study revealed the prevalence of obesity was 26 % among the children surveyed. This study revealed that children's higher age (p value= 0.0131), boys (p value < 0.001), father's obesity (p value= 0.013), higher frequency of meals (p value= 0.018), higher frequency of consume snack (p value= 0.047) and higher frequency of fried food consumption (p value= 0.0019) had relationship to obesity status. On the other hand, mother's obesity, other family members' obesity, eating habits, exercise, daily activity, parent's occupation, parent's educational level, family income and maternal knowledge and practice on child feeding did not have any significant relationship with obesity status.

The result also showed that the majority of the children (86 %) went to school by parent's car. Half of them (52 %) spent time watching television every day less than 2 hours. Almost half of them (51 %) spent time 2-3 hours per day playing in-doors. Only a few of them (9 %) spent more than 3 hours playing out-door. The children who preferred to spend their pocket money on snacks were found to be more than half.

Due to the relationship of obesity to eating habits, it is recommended that the nutritional education program to encourage good eating habits for parents and children, emphasizing eating behavior and control weigh gain is strengthened. Also, to create a weight controlling program in the school to prevent the increased in the prevalence of obesity and to promote healthy behavior through distribution of leaflets for parents to encourage motivation and enable individuals to lose weight.

KEY WORDS: FACTORS/OBESITY/PRIMARY SCHOOL CHILDREN

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CHAPTER I
INTRODUCTION

1.1 Rationale and Justification

Obesity is an important public health problem. It is a major contributor to the global burden of many non-communicable diseases, including type 2 diabetes mellitus, coronary heart disease, stroke, cancer, gallbladder diseases, musculoskeletal disorders, and respiratory problems and disability [1, 2]. The obesity epidemic is not restricted to industrialized societies; this increase is often faster in developing countries with under nutrition. Obesity is a complex condition, affecting virtually all ages and socioeconomic groups.

Obesity is a disease that has assumed epidemic proportions, posing one of the greatest threats to human health and wellbeing in the 21st century, with more than one billion adults' overweight- at least 300 million of them clinically obese. In 1995, there were an estimated 200 million obese adults worldwide and another 18 million under five children classified as overweight. As of 2000, the number of obese adults has increased to over 300 million. In developing country, it is estimates that over 115 million people suffer from obesity related problems [3].

The rapid rise in obesity is affecting more children than ever before. Despite the wealth of evidence about the associated risk of developing diabetes, heart disease, hypertension, some types of cancer, gallbladder problems, osteoarthritis and psychosocial disturbances. The prevalence and incidence of obesity continue to increase worldwide [3].

Current obesity levels range from below 5 % in China, Japan and certain in African nations, to over 75 % in urban Samoa, but even in relatively low prevalence countries like China, rates almost 20 % in some cities. The prevalence of obese

children aged 6 to 11 years has more than doubled since the 1960. Obesity prevalence in youth aged 12 – 17 years old has increased dramatically from 5 % to 13 % in boys and from 5 % to 9 % in girls between 1966 – 70 and 1988 – 91 in USA. The problem is global and increasingly extends into developing country, for example in Thailand the prevalence of obesity in 5 to 12 years old children rose from 12.2 % to 15.6 % in 1993 [4].

Table 1 Time trends in the prevalence (%) of obesity in representative samples of men and women.

Country	Year	Age range	Men	Women
England	1980	16-64	6.0	8.0
	1987		8.0	12.0
	1991		12.7	15.0
	1994		13.2	16.0
	1995		15.0	16.5
Netherlands	1987	20-59	6.0	8.5
	1995		8.4	8.5
Sweden	1980	16-84	4.9	8.7
	1988		5.3	9.1
USA	1960	20-74	10.0	15.0
	1978		12.0	14.8
	1991		19.7	24.7
Australia	1980	25-64	9.3	8.0
	1989		11.5	13.2
Japan	1976	20+	0.7	2.8
	1993		1.8	2.6
Brazil	1975	25-64	3.1	8.2
	1989		5.9	13.3
Samoa(urban)	1978	25-69	38.8	59.1
	1991		54.8	76.8
Samoa(rural)	1978		17.7	37.0
	1991		41.5	59.2
China	1989	20-45	0.29	0.89
	1991		0.36	0.86

Source: WHO, 1998.

Prevalence figures of obesity in worldwide up to 70% have been reported in adults and up to 30 % in children [4]. A major cause for concerning of childhood obesity is its association with obesity in adulthood and its consequences [5]. Data

based on several studies carried out in western societies estimate the percentage of obese children becoming obese adults as 26 - 41 % of obese pre-school children, 42 – 63% of school age children and 80% of obese adolescents [6].

A summary of the results of prevalence studies among children that have been published is shown in table 2. The reported prevalence ranges from 12 % to 33 % in USA and 3 % to 16 % in Asia.

Table 2: Prevalence data from studies focusing on childhood obesity.

Place	Author/year	Age range	Prevalence (%)
Thailand : Northeast	Germaine Langendijk,et.al,2000	7-9 years	10,8 %
Thailand: Southern	Tontisirin, 1999	Primary school age	14 %
Thailand: Hat Yai	Mo-suwan et.al 1993	6-12 years	14.3%
Thailand: Bangkok	Suttapreyasri et al 1990	6-18 years	14.3%
Indonesia: Jakarta	Droomers et.al 1995	2-5 years	16.1%
Taiwan	Chen 1997	7-9 years	9%-14%
Kuwait	Al-Isa 1998	0-5 years	8.2%
Italy	Maffeis et.al 1998	8 years	22.3%
USA:New York City	Melnik et.al 1998	Primary school age	17.8%-19.9%
USA:Florida	Hernandez et.al 1998	Preschool age	32 %
USA: Alabama	Figueroa et.al 1997	7-9 years	12%-22% (white) 20%-33% (Black)
USA:Central Harlem	Okamoto et al.1993	5-11 years	13.8%
USA: Texas	Muecke et.al 1992	Primary school age	30 %

Sources: Germaine Langendijk, 2003

The rising epidemic reflects the profound changes in society and in behavior pattern of communities over recent decades. While genes are important in determining a person's susceptibility to weight gain, energy balance is determined by calorie

intake and physical activity. Thus societal change and worldwide nutrition transition are driving the obesity epidemic. Economic growth, modernization, urbanization and globalization of food markets are just some of the forces though to underlie the epidemic.

As income rise and population become more urban, diets high in complex carbohydrates gives way to more varied diets with a higher proportion of fats, saturated fats and sugars. At the same time, large shifts towards less physically demanding work have been observed worldwide; moves towards less physical activity are also found in the increasing use of automated transport, technology in the home and more passive leisure pursuits.

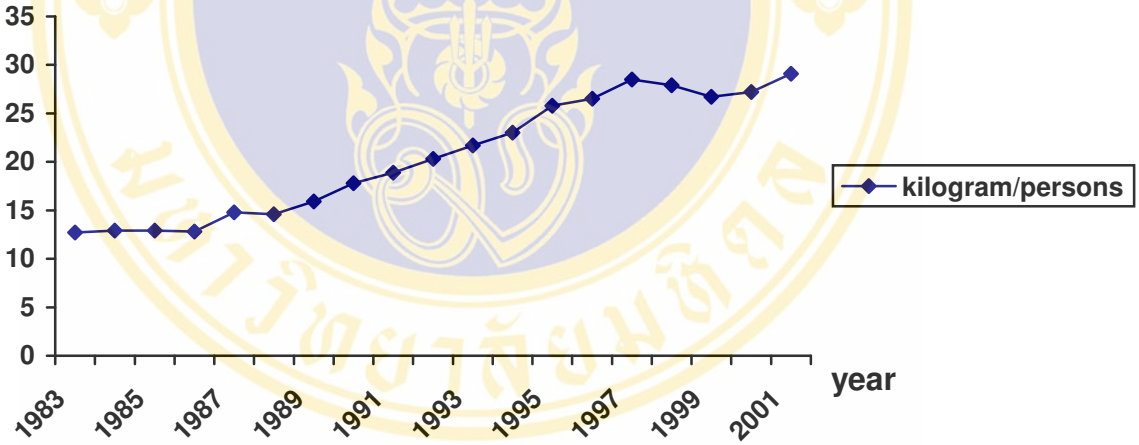
According to the Surgeon General, 2001, overweight children face greater risk of a host of problems, including type- 2 Diabetes, high blood pressure, high blood lipids, asthma, sleep apnea, chronic hypoxemia (too little oxygen in the blood), early maturation and orthopedic problems. Overweight children also suffering from psychosocial problems, including low self esteem, poor body image and symptoms of depression for girls in particular, poor self image from being categorized as obese follows them into adulthood. Obese children are also hospitalized more often than children with healthy weight. In some communities, obese persons may also suffer from social stigmatization and discrimination [7].

Thailand is a developing country and facing with the increasing problem of obesity. With rapid changes in social and economic circumstances of the country, including influx of western culture, people's lifestyles are altering, in particular food consumption culture. Based on a study conducted by Prapapen Suwan et.al., showed that youths, housewives and factory workers adopt unhealthy eating habits, regardless of nutritional benefits (Table 3) [8]. Increasingly, the major content of dietary intake includes high carbohydrate and sugar, as demonstrated in sugar intake per person that has increased from 12.7 in 1983 to 29.1 kilograms/person/year in 2001 (Figure 1).

Table 3: Percentage of youth, housewives and factory workers practicing a continuous dietary intake behavior, 1996

Continuous dietary Intake behaviors	Youths (%)		Housewives (%)		Factory workers (%)	
	BKK	Upcountry	BKK	Upcountry	BKK	Upcountry
High fiber dietary intake	36.0	35.2	35.3	38.7	40.9	34.0
Less high fat diet consumption	17.1	14.6	16.0	17.0	14.3	12.7
Supplementation in take, i.e. vitamin, etc.	23.2	11.6	28.3	12.2	29.3	13.1

Source: Prapapen Suwan et.al, 1996



Source: Supply Administrative Center, Office of the Sugar Cane, 2002.

Figure 1: Quantity of sugar intake in Thailand, 1983 - 2001

A great number of people tend to favor eating out and buying food from restaurant, fresh market and street vendors. Most of people are residing in the cities usually like to buy ready-cooked foods from fresh market while those in the rural regions prefer to buy from neighboring stores. Table 4 showed that both of urban and

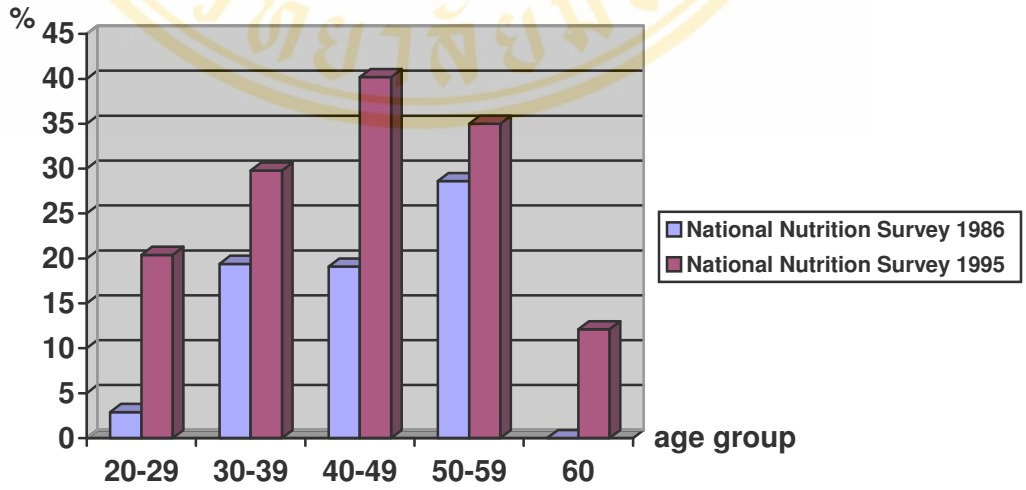
rural areas, most of household prefer to buy ready cooked foods at the restaurant or the fresh market.

Table 4 Percentage of food service places where household favor to buy ready cooked foods by residential area, 1995

Residential area	Percentage of food service places where household prefer to buy			
	Restaurant	Fresh market	Supermarket	Street vendor
Total	35.2	28.2	1.6	3.9
Urban	30.6	50.6	2.9	1.5
Rural	36.4	22.6	1.3	4.5

Source: Nutrition Division. The 4th National Nutrition Survey, 1995.

Not only have these foods incomplete nutrient, but also have excessive calories and are expensive, causing nutritional problems such as obesity. From the report on the 3rd and 4th National Nutrition Survey in 1986 and 1995, the prevalence of obesity among Thai people has increased in all age groups. Besides in the population with ages over 20, obesity is found in children and youths at a rate of 9.3 – 13.6 % [8].



Source: Department of health, MOPH

Note: Obesity in population aged > 20 years and BMI ≥ 25 kilograms/square meter.

Figure 2: Prevalence rate of obesity in Thailand by age, 1986 and 1995

Nakhon Pathom is located in central of Thailand. Maung district is a district of Nakhon Pathom one of urban area in this province. As the urban area, the increasing prevalence of obesity was an important health problem in Maung district affected from changing life style, changing eating habits and changing daily life activity. Primary prevention has been acknowledged as the most effective solution to obesity and this should begin in early life [9]. Learning what factors related to obesity in primary school children will give us useful information that can be used by Provincial Health office and Ministry of Education to initiate intervention and make a healthy life among the younger age groups in the future.

1.2 Research Question.

"What is the prevalence of obesity and its related factors among primary school children in Maung district, Nakhon Phathom province, Thailand?"

1.3 Research Objectives

1.3.1 General Objective :

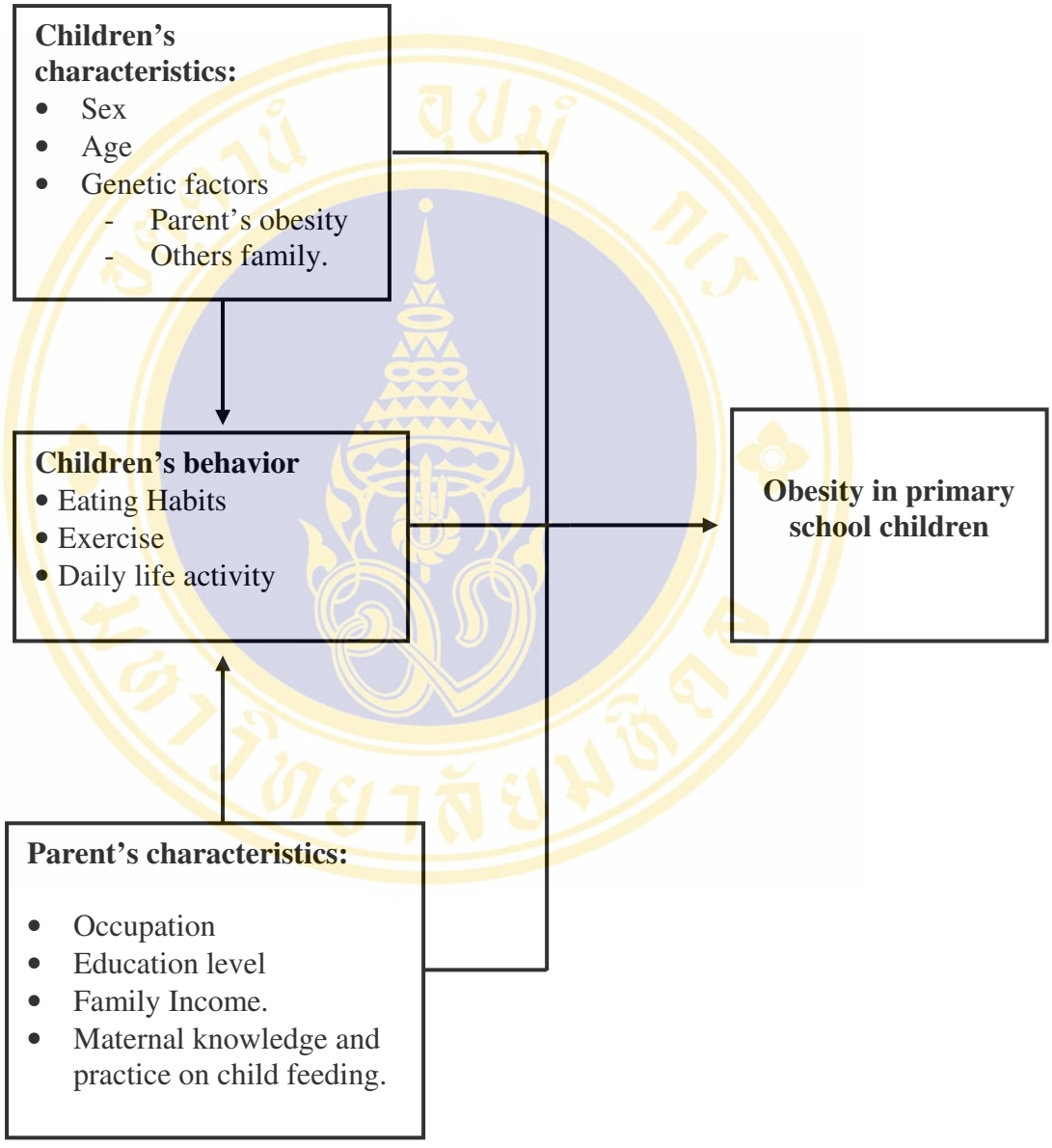
"To identify prevalence of obesity among primary school children in Maung district, Nakhon Pathom province and its related factors"

1.3.2 Specific Objectives: this study aimed:

a. To identify prevalence of obesity among primary school children in Maung district, Nakhon Pathom province, Thailand.
b. To describe children's characteristics among the primary school children in Maung district, Nakhon Pathom province, Thailand.
c. To describe children's behavior among the primary school children in Maung district, Nakhon Pathom province, Thailand.
d. To describe parent's characteristics among the primary school children in Maung district, Nakhon Pathom province, Thailand.
e. To identify relationship between obesity in primary school children and children's characteristics, children behavior and parent's characteristics.

1.4 Conceptual framework.

Independent variables Dependent Variable



1.5 Operational definition of variables

1.6.1 Obesity.

Classification of obesity based in this study on National Center for Health Statistic (NCHS) growth standard [10]. It is a comparison of observed weight of child expressed as Z scores of the expected weight of a child that height. The reference value is Thai standard. Classification is as follows:

Table 5 NCHS classification of nutritional status by weight for height

No	Z Score expected weight for height	Category of Nutritional status
1	-1.5 SD - + 1.5 SD	Normal
2	> 1.5 SD – 2 SD	Pre-obese
3	> 2 SD – 3 SD	Obese
4	> 3 SD	Severe obese

Source: Nutrition Division, Department of Health, MOPH, 2000

1.6.2 Age

"This refers to the age of children in completed years or the age as of last birthday."

1.6.3 Eating habits

"The eating habits of children in primary school were based on food frequency questionnaire. It is concerning type of food usually consumed in a week. The categories of each group which are classified as below:

- Everyday/almost everyday: Everyday or five to six days/week.
- Several days per week : Three to four days/week or one to two days/week.
- Never/very seldom : Never, two days per month, one day per month.

1.6.4 Daily life activity

This refers to the average length of time the children spend on each activity in a day. It is comprises in amount of time sleeping, watching television, reading a book /doing homework, playing indoor games (Computer games, board games).

1.6.5 Exercise

This refers to whether the child participates in any type of sports, duration of sports and frequency of sports.

1.6.6 Genetic factors

Refers to nutritional status of the child's parents and other family members such as child's sibling. This information was obtained from asking the parents about their actual weight and height (recent measured at least not more than one month ago).

1.6.7 Parents' occupation

Main occupations in this study are related to wage earner, unemployed/housewife, labor, farmer, government employee, private employee, small trade vanders, and business.

1.6.8 Parents' education level

Educational level was composed of illiterate, primary school, secondary and high school, university and higher.

Illiterate : Not schooling or not finish six years compulsory education.
Primary school : Finish six years compulsory education.
Secondary school : Finish three years compulsory education after primary school.
High school : Complete three years after secondary school.
University and higher : Graduate at university level or higher.

1.6.9 Family income

Actual value of family income (baht) per month gains from all sources.

1.6.10 Maternal knowledge and practice on child feeding.

Maternal knowledge means the mother's wisdom about the nutrient's needed for her child development. Maternal practice means the mother's habits how to provide food and nutrients to her child. In this study is measured by using a constructed questionnaire asking toward food intake, cause of obesity, and prevention of obesity, and also practice about profit of nutrient food, cooking meal and how she prepares enough nutrient foods and number of meals for her child.

CHAPTER II
LITERATURE REVIEW

2.1 Epidemiology of obesity

2.1.1 Definition

Obesity is often defined simply as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired [4]. The underlying disease is the undesirable positive energy balance and weight gain. However, obese individuals differ not only in the amount of excess fat that they store, but also in the regional distribution of that fat within the body. The distribution of fat induced by weight gain affects the risks associated with obesity, and the kinds of disease that result.

2.1.2 Prevalence

Evidence is now emerging to suggest that the prevalence of overweight and obesity is increasing worldwide at an alarming rate . Both developed and developing countries are affected. Moreover, as the problem appears to be increasing rapidly in children as well as in adults [4].

The International Obesity Task Force (IOTF) and The World Health Organization (WHO) report that about 20 % of Europeans and white Americans between the ages of 20 to 60 were grade two overweight (30.0 – 39.99 kg/m^2), while 40 % of Mediterranean and Eastern Europeans and African American women were of grade 2 overweight according to the WHO criteria. The highest rates found in Melanesians, Micronesians and Polynesians where the percentages of grade 2 overweight were as high as 70 % for women and 65 % for men. Although the prevalence for obesity was found to be lower within Africa and Asia, what was most striking was that obesity was shown to be on the rise rapidly in these regions and it coexists with a large prevalence of under nutrition [3].

Compared to adult obesity there is relatively little data available on childhood obesity prevalence and trends globally. Data regarding obesity in children 12 to 60 months old were available from 50 countries, obesity was defined as greater than two standard deviations above. The mean, using the international reference population recommended by WHO. The prevalence of obesity in the reference population is 2,3 percents with the exception of Pakistan, where 2.6 percent of children were obese. Obesity was rare in South Asia (including India). The countries examined in Sub-Sahara Africa had low levels of obesity, except Malawi, with 5.2 percent. Seven of 13 countries in Latin America and the Caribbean, 1 of 2 countries in the CEE/CIS region, and all 4 middle Eastern and North African Countries exceeded 2.3 percent. In the United States 3.1 percent of children were obese.

Obesity was more common in urban areas and was more prevalent in girls and children of mothers with higher education. At the country level, child obesity was positively related to gross national product and negatively related to stunting.

2.1.3 Health consequences of obesity

The health consequences of obesity are many and varied, ranging from an increased risk of premature death to several non fatal but debilitating complaints that have an adverse effect on quality of life.

Although obesity should be considered as a disease in its own right, it is also one of the key risk factors for other non communicable diseases, such as Non-insulin dependent Diabetes Mellitus (NIDDM) and Coronary Heart Disease, together with smoking, high blood pressure and hypercholesterolemia [11]. The adverse health consequences of obesity are influenced to a greater or lesser extent by body weight, the location of body fat, the magnitude of weight gain during adulthood, and a sedentary lifestyle [12].

Obesity related symptoms in children include psychosocial problems, increased cardio vascular disease (CVD) risk factors, abnormal glucose metabolism, hepatic gastro intestinal disturbances, sleep apnoea and orthopedic complications.

The most common consequence of obesity in children is poor psychosocial functioning. Pre adolescent children associated the shape (or silhouette) of an overweight body with poor social functioning, impaired academic success and reduced fitness and health [13], as well as with character defects. However there is little evidence to suggest that self esteem is significantly affected in obese young children [14].

Among teenagers, however, cross sectional studies consistently show an inverse relationship between body weight and both overall self esteem and body image [19]. A marked self awareness of body shape and physical appearance develops during adolescence so that it is perhaps not surprising that the pervasive, negative social messages associated with obesity in many communities have a major impact at this stage. Overweight in adolescence may also be associated with later social and economic problems. A large prospective study conducted in the USA has shown that women who were overweight during adolescence and young adulthood were more likely to have lower family incomes, higher rates of poverty and lower rates of marriage than women with various other forms of chronic physical disability during adolescence [15].

Dislipidermia, hypertension and insulin resistance are frequently seen in obese children [16] and dislipidermia appears to be related to increased abdominal fat accumulation [17]. Caprio and coworkers suggest that insulin resistance in children may also be associated with abdominal obesity [18].Although Non-insulin dependent Diabetes Mellitus (NIDDM) is very rare, it accounts for one third of all new cases of diabetes seen in some institutes in the USA [19]. Elevated serum lipid and lipoprotein levels blood pressure and plasma insulin in childhood are all carried over into young adulthood, obesity status in childhood at baseline being a significant predictor of adult value [20,21].

Hepatic complications in obese children have been reported, particularly hepatic steatosis characterized by raised serum transaminase levels [22]. Abnormal liver enzymes may be associated with cholelithiasis, but this condition is rare in children

and adolescents. Gastro esophageal reflux and gastric emptying disturbances, which affect a minority of obese children, may be a consequence of raised intra abdominal pressure due to increased abdominal fat.

Obese children can suffer from orthopedic complications. The more serious of these include Slipped capital femoral epiphysis and Blount disease (a bone deformity resulting from overgrowth of the tibia) [23, 24] . While more minor abnormalities include knock knee (genu valgum) and increased susceptibility to ankle sprains.

Other serious complications have been reported in obese children include obstructive sleep apnoea and pseudo motor cerebri. Obstructive sleep apnoea can cause hypoventilation and even sudden death in severe cases [25, 26] Pseudo motor cerebri is a rare condition linked to raise intracranial pressure, it requires immediate medical attention.

2.2 Methods of measuring obesity

The criteria used to assess obesity in children vary widely. However, it is essential to determine the most appropriate measurements to define obesity in children. The choice of appropriate measurements for obesity is difficult, especially as there is currently no internationally agreed index to assess childhood obesity, nor is there an established cut off point to define overweight and obesity in children. Changing growth patterns and nutritional requirements in children complicates the process of accurately identifying obese children because growth and weight varies among children, even of the same age [27]. According to Flegal, the ideal measurement of obesity will estimate body fat content accurately, will have appropriate reference values available, and will be easy to measure. There are several methods that directly determine an individual's body fat or lean tissue mass with high precision and accuracy, including underwater weighing, dual photon absorptiometry, dual energy X-ray absorptiometry and computed tomography. The indirect measures of body composition include anthropometry, bioelectrical impedance analysis and total body electroconductivity, where results are interpreted according to certain assumptions. The direct methods are appropriate when it is essential to distinguish

clinically between subjects or trends within a subject, such as in nutritional/metabolic research. However in large population studies they are costly and inconvenient. The indirect measures of body composition are mainly used in population studies, where it is not as critical to finely distinguish between individuals [28, 29]. The waist-to hip ratio is most commonly used to measure fat distribution in adults. However, it seems to be a poor measure of fat distribution in prepubertal children, because of the growth process in a child to achieve sexual maturation [30, 31, 32]

2.2.1 Weight for height

Weight and height are the most widely available and easily obtainable data. The three most commonly used anthropometric indices in children are weight-for-height, height-for age and weight-for age. Weight for height reflects body weight relative to height and is thus more likely to reflect body fatness. Weight for height indices is sensitive to current nutritional status and relatively independent of ethnicity and age between one and ten years. In addition, they are non-invasive and inexpensive. The weight for age index reflects body weight relative to age and height for age, reflects height relative to age. A child who is heavy for age may also be tall for age, so weight for age is an unsatisfactory indicator of body fatness. Frame size may also cause variations in weight. Children may either be classified overweight because they have a larger frame size or because they have increased body fat [31, 33]

The World Health Organization recommends the use of the conventional indicator of weight for height in children based on the National Center for Health Statistics (NCHS) growth standard and regards > + 2.0 Z scores as a cut off for overweight in children. The NCHS reference data have also been endorsed by the WHO Expert Committee as the most appropriate growth reference data for assessing infant and children. Although the NCHS growth reference data were not developed from children of various ethnic backgrounds, they provide the best approach of comparing various populations of children against a known reference point to provide a population interpretation. The Z score is the standard deviation score and a fixed Z score implies that a fixed height or weight difference exist for children at a specific age. The advantage of using the Z score in population based studies is that the mean

and standard deviation can be combined and compared across groups differing by age. Other advantages are that the Z scores adhere to the reference distribution that uniform criteria are used across indices and that changes at the extremes of the distribution may easily be detected [3]

2.2.2 Body mass index

The definition of obesity in adults is based on the body mass index (BMI) or Quetelet's Index [weight (kg)/height (m^2)]. An advantage of using BMI is that height and weight can be measured easily and relatively accurately. Although BMI is often used as an index of body fatness in adults, it does not measure body fatness directly, because it does not differentiate fat weight (fat tissue) from non fat tissue (lean tissue). Moreover any variation in frame size and increases in fatness will increase the BMI [34, 35, 31]. This makes its use in children limited. BMI changes with age, which makes it less useful for defining obesity in children. As in adults, the BMI for children also differs among age, gender and ethnic groups. In addition, if BMI is used to evaluate body fatness, the sexual maturation stage of the child and the distribution of fat in the body should be considered in analysis and interpretation data [36].

2.3 Methods of identified risk factors of obesity

2.3.1 Dietary assessment methods

Fat and overall energy intake has been implicated in the etiology of obesity. Accurate assessment of food intake in children is of concern in this study to explore its association with obesity. The four methods of dietary assessment relevant to epidemiologic studies are Food frequency questionnaire, twenty four hour recall, food records and dietary history. These methods are most frequently used to assess habitual intake of foods or specific classes of foods [37, 29]

The food frequency questionnaire is used to assess usual intakes of foods or classes of foods over a long period. The questionnaire usually consists of a list of foods and asks about the number of times each listed food is consumed over a

specified period. This list of food can be comprehensive to estimate total food intake or it can focus on specific groups of foods, certain foods or specific combinations of food as predictors of intake of certain nutrients. This is a quick method with low respondent burden and high response rate, and may be appropriate to assess the pattern of food use in an individual and/or for a group [29]

Although the food frequency is currently used more in epidemiological studies, its validity is highly dependent on the correct inclusion of foods and the correct nutrient content of these foods. Because foods have a complex, varied and dynamic nutrient composition, they should be grouped on pre coded food frequency questionnaire, based on the same nutrient composition for the nutrient or dietary component of interest. This will decrease the measurement error for the selected nutrient.

2.3.2 Physical activity assessment

Physical inactivity has been implicated in etiology of obesity. There is no consistent definition of physical activity, with studies defining it differently depending on the type of measurement used. The assessment of physical activity in free living individuals is possible through a variety of methods: physical activity questionnaires, physical activity diaries, total energy expenditure by doubly labeled water, motion sensors and direct observation.

Currently, the most widely used and the most practical approach to assessing physical activity is through the physical activity questionnaire. Issues to consider in designing physical activity questionnaires include the mode of data collection, the amount of time required for administration, the nature and detail of physical activities, the time frame over which physical activity will be assessed and the type of measurement scale and how these relate to the outcome [38, 39]. There is no acknowledged ‘gold standard’ to validate physical activity questionnaires. However, they are usually validated by comparison with objective measures of physical activity, such as doubly labeled water, motion detectors. However, these criteria are not free of measurement error and they have their own inherent limitations, as they measure

different aspects of physical activity [40, 41]. Although there are limitations to account for, physical activity questionnaires are convenient and inexpensive for use in epidemiological research [41]

Time spent watching television offers an index of inactivity in physical activity assessment procedures, as it represents a major source of inactivity and is associated with obesity [42, 43]. It should include measuring the actual hours or minutes per day watching television either through an activity diary or a physical activity questionnaire [43]

2.4 Factors related to obesity in children

2.4.1 Gender and age

Findings concerning the effect of gender on childhood obesity are mixed. Gender affects the weight status of the child in different ways according to cultural influences [44, 45]. Some ethnic groups studied expected girls to carry excess weight. A prospective cohort study on 4,062 Australian children aged from 6 months to 5 years, found female gender to be an independent positive predictor of severe obesity (≥ 95 % Body Mass Index). The authors quote a UK study that had similar findings, with upper percentiles of BMI dominated by females over males in children [46]. According to a summary of research studies of food acceptance patterns," boys seem to be able to adjust for energy intake after eating energy rich foods more precisely than girls [47]. Some researchers have concluded that neither age nor gender has any correlation with childhood adiposity [48]. While others have found increasing age to be one significant factor associated with increasing BMI [9].

2.4.2 Eating habits

Socio cultural beliefs and practices greatly influence man's eating habits, which in turn affect the health status of an individual, family, community and the nation. However, dietary beliefs and practices are notoriously difficult to change, even after they are established to interfere with nutritional adequacy.

A significant positive association between fat content of the diet and obesity has been shown in large population based cross sectional surveys in Brazil and Scotland [59, 60]. Higher rates of obesity were observed in those consuming the highest proportion of energy as fat. In the Brazilian study, above a fat intake of 12 % there was a positive relationship between fat content of the diet and BMI. Fat contributing to greater than 30 % of energy intake was associated with having a BMI greater than or equal to 27.6 kg/m2. In addition, several laboratory studies have supported a positive relationship between obesity and a high fat diet by showing the bodies' greater ability to regulate weight on a diet high in carbohydrate and low in fat [49].

Evidence suggests that early child feeding practices play a large role in the establishment of lifelong food habits [50]. State that an enormous amount of learning regarding food and eating is done during early childhood [51]. Parents influence the types and amounts of food available as well as modeling eating behavior to the child. A study carried out on 18 American children aged between three to five years, found children's preferences for, and intake of, fat to be strongly related to their parent's adiposity. Another study found children's preferences for, and intake of, "novel food" (i.e. high fat snacks) increased as exposure to these foods increased [52].

2.4.3 Physical activity.

Cross-sectional data often reveal an inverse relationship between BMI and physical activity, indicating that obese and overweight subjects are less active than their lean counterparts. However, such correlations do not demonstrate cause and effect relationships, and it is difficult to be certain whether obese individuals are less active because of their obesity or whether a low level of activity caused the obesity. Results of other types of study, however, suggest that low and decreasing levels of activity are primarily responsible; for instance, obesity is absent among elite athletes while those athletes who give up sports frequently experience an increase in body weight and fatness . Furthermore, the secular trend in the increased prevalence of obesity seems to parallel a reduction in physical activity and a rise in sedentary behavior. One of the best examples of this is provided by Prentice and Jebb, who used crude proxies for inactive, such as the amount of time spent viewing television or the

number of cars per household. These studies all suggest that decreased physical activity and/or increased sedentary behavior play an important role in weight gain and the development of obesity. This conclusion is further supported by prospective data. Dietz and Gortmaker, have shown that the amount of television watching by young children is predictive of BMI some years later, while Rissanen et.al have shown that a low level of physical activity during periods of leisure is predictive of substantial weight gain ($\geq$ 5 kg) in 5 years' time [4].

Many studies have found a positive correlation between low physical activity and childhood obesity. Sedentary behavior, using TV viewing time as an index, has been independently linked to obesity in children [42]. Studies using parental questionnaires have found a correlation between low physical activity according to the perception of the parents and childhood obesity [9, 43]. Other studies have made use of electronic monitoring or motion sensors to monitor physical activity in children and have found associations between low levels of physical activity and increased body fatness [44] and high physical activity and reduced risk of increased body fatness [48].

2.4.4 Parent's occupation.

Rolland-Cachera and colleagues indicated that the individual susceptibility to obesity is either due to or correlated with father's occupation. They assessed caloric intake and body mass index in 1 to 3 years old and 7 to 12 year old children of families with fathers in unskilled versus skilled occupations. Several interesting finding emerged in both samples. As others have reported, there were no differences in intake across body composition, even when comparing lean versus obese children. Likewise, children of unskilled fathers had higher caloric intake than children of skilled fathers, and there was more obesity in families with unskilled fathers. These results suggest that given the same intake, children with unskilled fathers are more likely to become obese than children with skilled fathers [53].

2.4.5 Family Income

Income is strongly associated with dietary quality. Studies in developed countries were shown that high income is negatively correlated with obesity in populations [54]. In Developing countries, the lesser obesity rates observed in the lower income population are associated with a situation where people are limited in their ability to provide enough food. However, as per capita income increase, the nature of the diet in traditional societies tends to change in a pervasive and well documented manner [55]. The increase in income may be associated with increased away-from-home consumption of high fat food items, as in the Philippines, or with increased consumption of meat, as China. However, the overall effect tends to be a greater intake of total fat and increased prevalence of obesity [56].

Studies indicate that change in income has little effect on dietary structure in countries where income levels are already quite high in relation to basic food needs; instead, increases in income are spent on more elaborately packaged and processed or higher quality foods rather than on a greater quantity of food. In the poorest income groups, however, food demand is much more price and income sensitive, and many people struggle to obtain enough high quality food for what is considered to be a healthy diet [4].

Langendijk Germaine et.al indicated that there was significantly related to obesity and family income. Children were more likely to obese if the parents have high income [36].

2.4.6 Parent's education

Education has been associated with health outcomes perhaps through its influence on many lifestyle characteristics, including diet and exercise. The most commonly used measure of education is the number of school years completed, type of school attended, and degrees or certificates obtained [57]. However, there are other aspects of education, such as quality, quantity, content and type of education, which are usually not captured when only highest educational attainment is measured. These are important if a complete and detailed index of education is needed to be able to

explain, clarify and understand education and its relationship to health outcomes [54, 58].

Parent's education, especially mothers have great influence on the nutritional status such as obesity. The study on prevalence and patterns of obesity in seven to nine years old children in urban Khon Kaen Northeast Thailand indicated that the children were more likely to be obese if the parents have high income, with high mother's education being the strongest social risk factor [59].

When stratified by the father's education level (high, low) the relationship of the mother's education on the outcome of obesity was modified. Under the strata of high father's education the odds ratio was 6.91 (2.39, 20.56) while the crude odds ratio was 2.23. The odds ratios differ by stratum interaction, since the odds ratio not only differ from the crude odds ratio but also from each other, there is effect modification by the father's education level. This means that the observed association of mother's education level with obesity of the child was conditioned by the father's education level.

2.4.7 Parental obesity

The fact of genetic influence on obesity is supported by the clustering of obesity within families and by studies of adopted and twin children. The relative weight of adults who were adopted as children is positively associated with the relative weight of their biological parents, but no such relationship exists between them and their adoptive parents. Similarly, the relative weight of adoptive twins reared apart in different family environments are similar to those of twins reared together. The discovery of leptin and the leptin gene raised the hope that obesity genes would be identified [60].

Population studies using a variety of family data designs have found that heritability of body mass or body fat, that is, the proportion that can be explained by genetic transmission, is in the range of 24-70 %. It is hypothesized that this effect is polygenic (caused by several genes). The phenotypical expression of these genes may

differ depending on a person's age and sex. In addition the genes may only increase susceptibility to obesity, an obesity encouraging environment, which includes an abundant food supply and minimal physical activity requirements, may also be necessary for their expression [61].

CHAPTER III
RESEARCH METHODOLOGY

3.1 Study design

This study design was a cross-sectional study.

3.2 Place of study

The study area was carried out at Watsaneha primary school in Maung district, Nakhon Pathom Province, Thailand.

3.3 Study population

All primary school children from grade 1st to 6th of Watsaneha primary school aged between 6-12 years old, as presented in table 6.

3.4 Sample and sampling technique

To obtain the required sample size purposive sampling technique was used to select the sample. The study subject was selected in three stages. In the first stage, the district was chosen purposively in the target province. For the second stage, a simple random sampling performed to select the target school in that area. For the third stage, 200 children was selected by stratified random sampling according to proportional to size of grade 1, 2, 3, 4, 5 and 6^{th}, respectively.

Tabel 6 Number of total sample was selected by grade.

Grade	Total population (N)	Total sample was selected (n)
1	111	34
2	105	32
3	112	34
4	112	34
5	105	32
6	110	34
Total	655	200

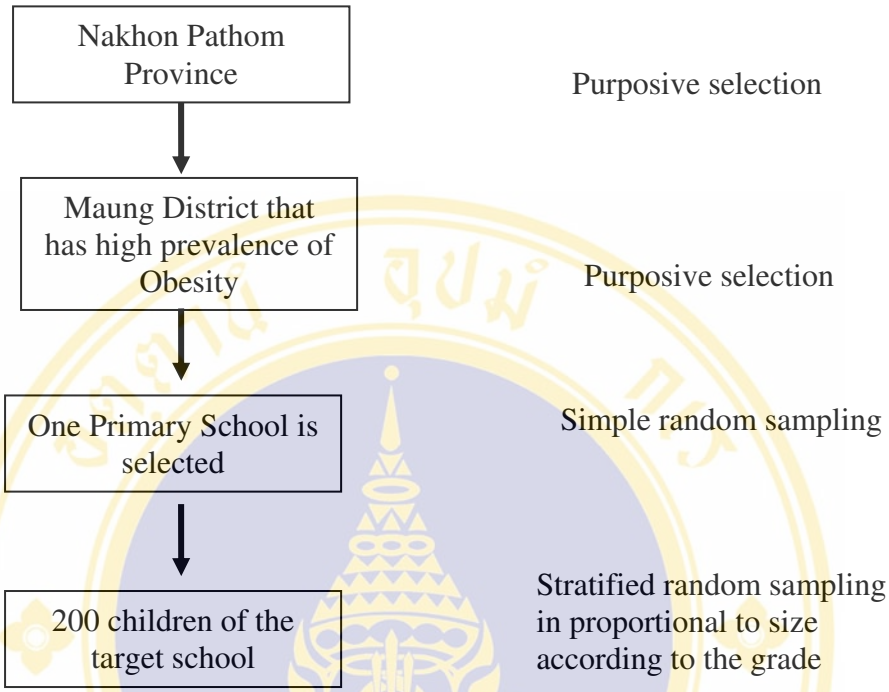


Figure 3: Sampling technique diagram.

3.5 Sample size estimation

$$n = \frac{Z^{2}_{\alpha/2}(PQ)}{d^{2}} \quad [62]$$

$$n = \frac{(1.96)^{2}(0.11)(0.89)}{(0.05)^{2}}$$

Sample size was equal to 150 primary school children.

n = required sample size for study

P = 0.11 (the prevalence of obesity in Thailand, 2000) [36].

$Z_{\alpha/2}$ = 1.96 (95 % confident level for two-sided test)

d = the precision was set at 5 %

Q = 1 – P =1-0.11 = 0, 89 %

According to sample size estimation, the required sample size was 150; however the sample size taken into account in case of any dropouts or incomplete data, a sample of 200 children was selected for this study.

3.6 Research instrument

Objective data:

Anthropometric measurement of weight and height was done by the researcher using a weighing machine and height scale. Before measuring the weight, a standardized zeroing procedure of the machine was made and then there was also reset during operation. After the measurements of weight and height, the data wrote into the recording form together with their age and sex. Then the degree of obesity was identified using a reference scale of Thai standard .

Subjective data:

For the data collection of other factors, a structured questionnaire was used. The questionnaire was prepared in English and translated into Thai language. The questionnaire comprised of the following sections:

Part 1 : Children' characteristics consisted of age, sex, height and weight, and nutritional status.

Part 2 : Children's behavior consisted of eating habits, daily activity, and exercise.

Part 3 : Parent's characteristics consisted of age, family size, occupation, education level, family income, height and weight of parent's (both father and mother).

Part 4 : Maternal knowledge on child feeding.

Part 5 : Maternal practices on child feeding.

After completion of data collection, editing and coding should be done by following coding instruction. To calculate number and percentage of the qualitative data, mean, standard deviation, minimum, maximum, and median of the quantitative data in this study by using descriptive statistic. To test the relationship among variables using the Chi-square test was used. The level of statistical significant was set at α =0. 05

3.7 Validity and reliability test of instrument

The pre-test of questionnaire had been done prior to the real data collection. The pre-test questionnaire was conducted among 30 children in the same school that selected for this study in Maung District, Nakhon Pathom Province. The pre-test respondents were excluded from the real data collection. To test the reliability for the questionnaire of maternal knowledge on child feeding was used Kuder Richardson formula (KR-20). The result was 0.69. After the pre-test some improper questions were revised in order to increase more reliability and validity and to ensure that all the objectives were covered.

3.8 Data collection procedure

Data collection procedure took place on 19th January to 5th February 2004. The children were identified with the help of school records and teachers, for inclusion in the study. The data are both qualitative and quantitative collection. The researcher observed for qualitative data, the quantitative data were collected by using a self-administered questionnaire and anthropometric measurement for weight and height of the children.

Researcher observation was used in order to obtained the information about school environment such as food or snack availability in the school and activity of the children in the school.

Physical examination such as height and weight of children were done for assessment of obesity. The self-administered questionnaire was given to each child for their parent's response on children's characteristics, parent's characteristics, children's behavior, maternal knowledge and maternal practice on child feeding. The parents filled out together with their child.

3.9 Data analysis

3.9.1 Data entry and cleaning

The questionnaire was labeled and coding under the supervision of the thesis committee. The data analysis was conducted by using Minitab Release 13 program. Data was cleaned and edited before analysis.

3.9.2 Statistical data analysis

1. Descriptive statistics

Descriptive statistics (number, percentage, mean, standard deviation, minimum, maximum and median) were used to describe the distribution of variables such as: the detail characteristics of children and parents, daily life activity, exercise, eating habits, maternal knowledge and practice on child feeding.

2. Analytic statistics

The proportion of the children with obesity prevalence was tested by using cross tabulation by Chi-square test. Details of the analytic statistics were summarized as follows:

Children's characteristics /children's behavior/ parent's characteristics

Each variable belonging to this category was classified into several categories make by the researcher. For categorical variables such as sex, genetic, daily life activity, exercise, parent's education level, parent's occupation, univariate analysis (number, percentage) and bivariate analysis (χ^2-test) was performed in order to examine the relationship with the obesity status of children

For measurement variables such as children's age, eating habits, parents' age, family income, mean and standard deviation (SD) were obtained in addition to the number and frequency. Prior to the bivariate analysis, the normality of the distribution of each variable was examined. If it is not normally distributed, Mann Whitney U test

was performed in order to compare differences of the variables between the obese and the non obese group.

Mothers' knowledge

Number, percentage, maximum, minimum mean, and standard deviation were used to describe the maternal knowledge on child feeding.

Total knowledge scores above 80% was stated as good, from 60 % to 80% of total score was stated as fair and less than 60% of the total score was stated as poor. The mother who answer correctly was given 1 score, while who answer incorrectly was given 0 score. Total score was 15 for 15 questions. Above or equal 12 scores of knowledge was good, from 9 to 12 was fair and below 9 score was poor. Mann Whitney-U test was used to compare relationship between mother's knowledge among obese and non obese group.

Mother's practice on child feeding

To maternal practice on child feeding, three levels based on the criteria as: if the maternal practice score >80% of standard score (11 scores) was high, from 60-80% of standard score (8-11 score) was average and <60% of standard score (<8score) was low. To the positive statements, if the mother said "yes", she got 1 score and if she said "no" she got 0 score. Among the negative statements, if the mother says "yes, she gets 0 score and if the mother says "no" she gets 1 score.

CHAPTER IV
RESULTS

There were 200 children and 200 parents of the primary school children included in this study. The children's weight and height were measured on January 19, 2004 at Watsaneha primary school in Maung district, Nakhon Pathom province, Thailand. The parents were fulfilled the questionnaire by self-administered. The results from the study were presented into 6 parts as follows:

Part 4.1 Prevalence of obesity among primary school children.

Part 4.2 Children's characteristics consisted of: socio-demographic characteristics composed of sex, age and genetic factors as parent's obesity and other family members obese.

Part 4.3 Children's behavior consisted of: eating habits, daily activity and exercise.

Part 4.4 Parents' characteristic consisted of: age, occupation, education level, and family income.

Part 4.5 Maternal knowledge and practice on child feeding.

Part 4.6 Relationship between obesity status and independent variables.

4.1 Prevalence of obesity in primary school children

Obesity status of children was determined by measuring weight for height. According to the classification of obesity on Thai standard, the prevalence of obesity in this study was 26 % (52 among the 200 children surveyed)

Table 7 Number and percentage of children obese classified by Thai standard.

Obesity status of children	Number (n= 200)	Percent
Normal (normal+malnutrition+preobese)*	148	74.00
Obese (>2SD)	52	26.00

* Malnutrition : < - 2SD
* Pre-obese : (>1.5 SD – 2 SD)

4.2 Children characteristics

Children characteristics investigated in this study included socio demographic as sex and age, and genetic factors as parent's obesity status and other family members obese.

Age among 200 children, average of them 9 years old (with SD= $\pm$ 1.69). The youngest was 6 years old and the oldest was12 years old. Majority of them (63.00 %) were female.

Genetic factor refers to parental obesity status. It was determined by asking the parents' weight and height. One hundred seventy fathers of the children know their weight and height and 184 mothers of the children know their weight and height. Among 170 fathers of children 41.18 % were obese and among 184 mothers of children about one-third (33. 70 %) were obese. To other family members one fourth (24 %) have family members who were obese such as brother or sister, grand mother, grand father, aunt, uncle and other relatives.

Table 8 Number and percentage of children by children's characteristics

Children's characteristics	Number (n= 200)	Percent
Age of children (years):		
6 - 8	63	31.50
9 - 10	75	37.50
11 - 12	62	31.00
Mean ± SD = 9 ± 1.69	**min. : 6**	**max. : 12**
Sex:		
Male	74	37.00
Female	126	63.00
Genetic factors:		
Father	**(n= 170)**	
Normal	100	37.00
Obese	70	41.18
Mother	**(n= 184)**	
Normal	122	66.30
Obese	62	33.70
Other family members.		
Normal	152	76.00
Obese	48	24.00

4.3 Children's behavior.

4.3.1 Eating habits.

Majority of them (70.00%) had three meals per day (breakfast, lunch and dinner) and proportion that they were have two meals or four meals nearly the same (16.50 % and 13.00 %). Only one child was having more than 4 meals per day. Majority of them (77.00 %) always have breakfast before going to school. More than fifty percent were have the last meals at 6 pm and 19 children among 200 (9.50%) were have the last meals before going to sleep.

There were more than half (51.50 %) of children consumed snack one time per day, more than one-third (35.50 %) consume snack 2 – 3 times, a few of them (8.50 %) mentioned never consume snack per day. To drink such as soft drink, more than half (54.5 %) drank one time per day, one-third of them (36.00 %) drank 2 – 3 times per day, 5 % and 4.5 % drank more than 3 times and never drinking any soft drink per day.

The children preferred to spend their pocket money for snack were found to be more than half (59.50 %), they preferred to spend for sweet/candies and beverage 19.50 % and 8.50 %, while the rest (12.50%) preferred to spend for the others like bread, ice cream, rice noodles and soybean milk.

Dietary habits were determined by food frequency. It was concerning types of food usually consumed in a week. Majority of them (97.5 %) consumed rice every day. The proportion of children who consumed sticky rice several times per week and never consumed sticky rice were more or less equal (44.5 % and 45.0 %). Half of them (51.5 %) consumed bread several times per week, more than half (66.0 %) consumed noodles several times per week. Half of them (54.5 %) consumed sugar everyday or almost everyday. Only one-third (31.5 %) never consumed fatty meats. Half of them (56.0 %) consumed fried food everyday/almost everyday. Half of them (51.5 %) consumed food with coconut milk several times. Half of them (50.5 %) consumed vegetables everyday and more than half of them (65.5 %) consumed fruits everyday.

Table 9 Number and percentage of children by children behavior

Children's behavior	Number (n= 200)	Percent
Meals usually have per day		
- Two meals (lunch and dinner)	33	16.50
- Three meals (breakfast, lunch and dinner)	140	70.00
- Four meals (breakfast, lunch, dinner and late meals before going to sleep	26	13.00
- More than four	1	0.50
Breakfast before going to school		
- Yes	154	77.00
- No	46	23.00
Time for the last meals		
- Before go to sleep	19	9.50
- At 8 pm	57	28.50
- At 6 pm	116	58.00
- At 4 pm	8	4.00
Frequency consume snack per day		
- Never	9	4.50
- One time per day	103	51.50
- 2-3 times per day	71	35.50
- More than 3 times per day	17	8.50
Drink such as soft drink		
- Never	9	4.50
- One time per day	109	54.50
- 2-3 times per day	72	36.00
- More than 3 times per day	10	5.00

Table 9 Number and percentage of children by children behavior Cont.)

Children's behavior	Number (n= 200)	Percent
Child prefer to spend pocket money for :		
- Snack	119	59.50
- Sweet/candies	39	19.50
- Beverages	17	8.50
- Others	25	12.50

Table 10 Distribution of children by dietary habits based on food frequency

Dietary habits	Number (n=200)	Percent
Rice		
• Everyday/almost everyday	195	97.5
• Several times per week	4	2.0
• Never/very seldom	1	0.5
Sticky rice		
• Everyday/almost everyday	21	10.5
• Several times per week	89	44.5
• Never/very seldom	90	45.0
Bread		
• Everyday/almost everyday	58	29.0
• Several times per week	103	51.5
• Never/very seldom	39	19.5
Cereal		
• Everyday/almost everyday	42	21.0
• Several times per week	52	26.0
• Never/very seldom	106	53.0
Noodles		
• Everyday/almost everyday	53	26.5
• Several times per week	132	66.0
• Never/very seldom	15	7.5
Sugar		
• Everyday/almost everyday	109	54.5
• Several times per week	59	29.5
• Never/very seldom	32	16.0
Fatty meats		
• Everyday/almost everyday	59	29.5
• Several times per week	78	39.0
• Never/very seldom	63	31.5
Skin of pork or poultry		
• Everyday/almost everyday	37	18.5
• Several times per week	73	36.5
• Never/very seldom	90	45.5

Table 10 Distribution of children by dietary habits based on food frequency (Cont.)

Dietary habits	Number (n=200)	Percent
Meat without skin		
• Everyday/almost everyday	100	50.0
• Several times per week	67	33.5
• Never/very seldom	33	16.5
Fried food		
• Everyday/almost everyday	112	56.0
• Several times per week	74	37.0
• Never/very seldom	14	7.0
Food with coconut		
• Everyday/almost everyday	30	15.0
• Several times per week	103	51.5
• Never/very seldom	67	33.5
Vegetables		
• Everyday/almost everyday	101	50.5
• Several times per week	79	39.5
• Never/very seldom	20	10.0
Fruits		
• Everyday/almost everyday	131	65.5
• Several times per week	57	28.5
• Never/very seldom	12	6.0

4.3.2 Daily activity.

Among 200 children majority of them (60.50 %) they get up everyday at below 6.30 am, one-third (36.50 %) at 6.30 am – 7.00 am the rest 3.00 % get up at above 7.30 am. The earliest time to get up was at 5.00 am and the latest time to get up was 7.30 am. On holiday they were get up late, more than of them (61.00 %) got up at above 7.00 am, One third of them (30.50 %) got up at 6.30 – 7.00 am and only a few (8.50 %) said they got up below 6.30 am. Majority of them (81.00%) took time for sleeping more than 8 hours everyday.

Majority of the children (85.93 %) went to school by parent's car, some (7.04 %) by riding bicycle and some (5.53 %) by walking where the rest only a few (1.51 %) by school bus.

Half of them (51.00%) spent time for watching television everyday less than 2 hour, one third of children (30.00 %) spent time 2 – 3 hours and some (19.00) % said they spent time more than 3 hours. On holiday they spent time longer, nearly half of them (48.50%) they spent time 2-3 hours and one-third (34.50 %) they spent time more than 3 hours and only a few (17.00 %) they spent time less than 2 hours.

More than half of them (63.00%), did their homework or reading everyday take time 1 hour and one-third of them (37.00 %) mentioned that they spent time more than 1 hours per day. On holiday, half of them (54.00 %) still spent time for doing home work or reading for 1 hour and nearly half (46.00%) they spent time more than 1 hour.

Regarding how long they spent time for playing indoor games like computer game or board games, they mentioned almost half of them (51.00 %) take time 2 – 3 hours per day in everyday and one-third of them (36.50 %) they spent time below 2 hours and 12.50% spent more than 3 hours. On holiday, still half of them (51.00 %) took time 2 – 3 hours for playing in door and one quarter (28.50 %) they spent time below 2 hours and more than 3 hours accounted for 20.50 %.

The proportion of children who spent time for playing out door below 2 hours and 2 -3 hours everyday were more or less equal (44.00 % and 47.00 %). Only a few of them (9.00%) they spent time more than 3 hours. On holiday half of them (52.50 %) spent time 2 – 3 hours and one-fourth (26.50 %) spent time less than 2 hours and nearly one-fourth (21.00 %) they spent time more than 3 hours.

4.3.3 Exercise.

Table 12 presents the distribution of children by exercise. Almost (80 %) of them participated in any type of sports, exercise or physical activities. It was comprise one-

third they participated in exercise such as aerobic and martial art, one-third they participated in sports such as running, cycling, badminton, taekwondo, swimming, and football. Twelve children they have another physical activities like house work (ironing, cleaning house, cooking and gardening) and fishing.

Among 157 children who participated in any type of exercise, half of them (58.60 %) spent time more than 30 minutes. The other hand (41.40 %) spent time less than 30 minutes.

Table 11 Number and percentage of children by daily activity

Daily activity on weekday	Number (n= 200)	Percent
Spend time for sleeping (hours)		
- ≤ 8	38	19.00
- > 8	162	81.00
Time to get up (am)		
- < 6.30	121	60.50
- 6.30 – 7.00	73	36.50
- > 7.00	6	3.00
Go to school by	**(n= 199)**	
- Walking.	11	5.53
- Riding bicycle	14	7.04
- School bus	3	1.51
- Parent's car	171	85.93
Spend time for watching television (hours)		
- < 2	102	51.00
- 2 – 3	60	30.00
- > 3	38	19.00
Median = 2	**Min: 1**	**Max: 6**
Spend time for doing home work or reading (hours).		
- 1	126	63.00
- > 1	74	37.00
Median = 1	**Min.: 1**	**Max.: 5**
Spend time for playing in door (hours)		
- < 2	73	36.50
- 2 – 3	102	51.00
- > 3	25	12.50
Median = 2	**Min: 1**	**Max.:6**

Table 11 Number and percentage of children by daily activity. (Cont.)

Daily activity on weekend	Number (n= 200)	Percent
Spend time for playing out door (hours)		
- < 2	88	44.00
- 2 – 3	94	47.00
- > 3	18	9.00
Median = 2	**Min.: 1**	**Max.:6**
Spend time for watching television (hours)		
- < 2	34	17.00
- 2 – 3	69	34.50
- > 3	97	48.50
Median = 3	**Min.: 1**	**Max.: 10**
Spend time for doing home work or reading (hours)		
- 1	109	54.00
- > 1	91	46.00
Median = 1	**Min.: 1**	**Max.:5**
Spend time for playing in door (hours)		
- < 2	57	28.50
- 2 – 3	102	51.00
- > 3	41	20.50
Median = 2	**Min.: 1**	**Max.: 8**
Spend time for playing out door (hours)		
- < 2	53	26.50
- 2 – 3	105	52.50
- > 3	42	21.00
Median = 2	**Min.: 1**	**Max.: 6**

Table 12 Number and percentage of children by exercise

Exercise	Number	Percent
Participate in any type of sports, exercise or other physical activities	**(n= 199)**	
- No	43	21.61
- Exercise	66	33.17
- Sport	78	39.20
- Other	12	6.03
Time spend for participation in exercise, sport, or others (Minutes)	**(n= 157)**	
- < 30	65	41.40
- ≥ 30	92	58.60
Frequency of exercise (per week)		
- < 3 times	45	28.85
- ≥ 3 times	112	71.15

4.4 Parents' characteristics.

Table 13 shows parents' characteristics of the children in this study. Age among 184 fathers, majority of them (52.51 %) was found belonged to the age group 30 – 39 years old. One-third (36.41) was found belonged to the age group 40 – 49 years old. Fathers' age ranged from 23 to 57 years old with the mean age of 38.70 ± 6.32.

Age among 195 mother, majority of them (63.59%) were found belonged to the age group 30 – 39 years old. Nearly one-fourth (22.59 %) belonged to the age group 40 – 49 years old. A few of them (12.82 %) belonged to the age group 20 – 29 years old and only 2 persons belonged to the age group 50 – 59 years old. Mothers' age ranged from 22 to 51 years old with the mean age of 35.38 ± 5.57.

Regarding the occupation, majority of father and mother were working as labor were (56.76 % and 43.15 %). The second majority were employed in a small business/trade (20.00 % and 28.93 %) only 3 fathers (1.62 %) were unemployed while the percentage was found 17.77 % among mother who were unemployed.

Most of father were completed primary school education (51.89 %), one-third (35.68 %) were secondary school and only a few (10.81 %) were at the high school, college or university level, some of them (1.62 %) were illiterate.

Majority of mother (60.41 %) were completed primary school education. One third (30.46 %) were secondary school level and a few (12.00 %) were at high school, college or university level, only 6 mothers (3.05 %) were illiterate.

Total income of family varied considerably from 3,000 baht per month to 50,000 baht/month with the mean of average 9,557 baht (SD $\pm$ 7,190 baht) per month. Nearly half of them (48.22 %) had a total income belonged to the group 5,000 – 9,999 baht per month. One-third belonged to the group 10,000 – 29,999 baht per month. Only a few of them (16.24 %) belonged to group less than 5, 000 baht per month and there were eight families that had total income more than 30,000 baht per month.

Table 13 Number and percentage of children by parent's characteristics

Parent's characteristics	Number	Percent.
Age group of father (years)	**(n = 184)**	
- 20 – 29	9	4.89
- 30 – 39	97	52.72
- 40 – 49	67	36.41
- 50 – 59	11	5.98
Means ± SD = 38,70 ± 6,32	**Min : 23**	**Max. : 57**
Age group of mother (years)	**(n = 195)**	
- 20 – 29	25	12.82
- 30 – 39	124	63.59
- 40 – 49	44	22.56
- 50 – 59	2	1.03
Means ± SD = 35,38 ± 5,57	**Min : 22**	**Max. : 51**
Occupation of father	**(n = 185)**	
- Government employee	16	8.65
- Company employee	13	7.03
- Labor	105	56.76
- Agriculture	11	5.95
- Trade/small business	37	20.00
- Unemployed	3	1.62

Table 13 Number and percentage of children by parent's characteristic (Cont.)

Parent's characteristics	Number	Percent.
Occupation of mother	**(n= 197)**	
- Government employee	5	2.54
- Company employee	11	5.58
- Labor	85	43.15
- Agriculture	4	2.03
- Trade/small business	57	28.93
- Unemployed (including house work)	35	17.77
Education level of father	**(n=185)**	
- Illiterate	3	1.62
- Primary school	96	51.89
- Secondary school	66	35.68
- College/university and higher	20	10.81
Education level of mother	**(n= 197)**	
- Illiterate	6	3.05
- Primary school	119	60.41
- Secondary school	60	30.46
- College/university and higher	12	6.09
Total income (baht/month)	**(n= 197)**	
- < 5,000	32	16.24
- 5,000 – 9,999	95	48.22
- 10,000 – 29,999	62	31.47
- ≥ 30,000	8	4.06
Means ± SD = 9,557 ± 7,190	**Min : 3,000**	**Max : 50,000**

4.5 Maternal knowledge and practice on child feeding.

4.5.1 Maternal knowledge.

Maternal knowledge about nutrient and nutrition were shown in table 14 by 15 statements and percentage of correct answer in each statement. Statement number 2 and 8 < 60 % of the mothers were answered correctly while statement 9, 13, 14, and 15 the ranges of percentage of mothers who answered correctly were found between 60 – 80 %. Knowledge statement 1, 3, 4, 5, 6, 7, 10, 11 and 12 were achieved > 80 % correct answer.

Table 14 Percentage distribution of mother's knowledge on child feeding

Knowledge statement	Correct answer	
	Number (n= 197)	**Percent**
1. Obesity means excess weight	185	92.50
2. Major causes of obesity were due to the excess energy intake	73	36.50
3. The obese child is healthy	181	90.50
4. Over food consumption is good for children	163	81.50
5. Consumption of high carbohydrate and fat food could cause obesity	172	86.00
6. The five food groups which we ate in daily consist of meat, starch ,fat, vegetables, and fruits	179	89.50
7. The obese pupils should increase their regular exercises because these could eradicate the excess body fat	189	94.50
8. Fat (cooking oil, butter, coconuts milk, etc) is one of the essential nutrients for children	48	24.12
9. Carbohydrate (rice, noodle, bread, etc) intake is necessary to produce the energy for body	158	79.00

Table 14 Percentage distribution of mother's knowledge on child feeding (Cont.)

Knowledge statement	Correct answer	
	Number (n= 195)	Percent
10. Protein (egg, meat, fish, milk, bean, etc) intake is necessary to the growth of child	189	94.50
11. To prevent Obesity, we have to skip one or two meals per day	185	92.50
12. Obesity can affect children's health	163	81.5
13.Vegetables should be cooked for long time until the color really change	154	77.00
14. Western food for example KFC, Mc Donald is good for child because it contains high protein and energy	149	74.87
15.Vegetables and fruits is good only for child's obese	124	62.50

Table 16 showed the level distribution of mothers according to their total knowledge scores on child feeding. Three levels of total knowledge score based on criteria as :

- More than 80 % of total score (> 12 scores) was good, this group accounted for 6.50 %.
- From 60 – 80 % of total score (8-12 sores) was fair, this group accounted for 71.50 %.
- Less than 60 % of total score (< 8 scores) was poor, this group accounted for 22.00 %.

Table 15 Number and percentage of respondent by level of knowledge on child feeding

Level of knowledge	Number (n= 197)	Percent
Good (> 12)	62	31.47
Fair (8-12)	122	61.93
Poor (< 8)	13	6.60
Mean ± SD = 8.97 ± 1.8	**Min : 3**	**Max : 13**

4.5.2 Maternal practice.

Table 16 described the number and percentage of practice answers among the mothers. One question that the mother usually feed instant food as a meal got 15.50 % not practice. Practice statement 2, 6, 11, 12, 13 and 14 reached practice answer less than 60 %. Practice statement 1, 7 and reached practice answer 60 – 80 % the rest 3, 4, 5, 8 and 10 was more than 80 %.

Table 16. Percentage distribution of mother practice on child feeding.

Practice statement	Practice answer	
	Number (n=197)	Percent
1. You always pay attention to the nutrients in daily meals such as pay attention to dietary allowances for your child	129	64.82
2. You feed your children more than three times everyday	115	57.50
3. You always try to feed nutritious food (consist of meat, starch, fat and vegetables or fruits) to your child	176	88.00
4. Fast foods are better than cooked foods at home	175	87.50
5. You feed western food to children between two meals	186	93.00
6. You usually feed your child instant food as a meal	31	15.50
7. You sometimes feed your child snack between meals every day	140	70.00
8. You or other family members usually cook meal at home for your child	160	80.50
9. You always buy cooked foods from food shops as meals for your child	135	67.50
10. You allow your child to skip their breakfast	170	85.00
11. You allow your child eating when he or she is watching television	80	40.00
12. You feed your child meals at fixed time everyday	98	49.00
13. You pressure your child to eat more	116	58.00
14. You pressure your child to do exercise	82	41.00

Concerning the levels of maternal practice, the distribution was based on the criteria as score of maternal practice > 80 % of standard was high, this group accounted for 6.50 %. Score of maternal practice 60 – 80 % of standard score was accounted for 71.50 %. The low score (< 60 % of standard score) was accounted for 22.00 %.

Table 17 Number and percentage of mother by level of practice on child feeding

Level of practice	Number (n=197)	Percent
High (>11 score)	13	6.60
Average (8 – 11 score)	140	71.07
Low (< 8 score)	44	22.33
Mean ± SD = 11,53 ± 1,77	**Min : 4**	**Max : 14**

4.6 Relationship between obesity and independent variables.

Before bivariate analysis, among quantitative variables such as age of child, family income, mother and father's age, total score of knowledge and practice on child feeding, length of time spend on watching TV, reading or doing homework, playing in door and playing outdoor, at first the normality distribution of data among both obesity group and normal group were examined. It was found that all of the variables in this study were not normally distributed. Therefore, in bivariate analysis of these variables, Mann Whitney U test was performed. For the categorical variables such as genetic factor, eating habits, exercise, parent's education level and parent's occupation, χ^2 test was done to examine the relationship with obesity status. For all of statistical tests performed in this study, the significance level of 0.05 was applied.

4.6.1 Relationships between obesity status of children and children's characteristics.

Table 18 showed the results of comparison of the children's age of respondent between the normal group and obesity group by using Mann-Whitney U test. From the results of this analysis, it was found that there was significant different between the normal group and the obesity group. As a result, it could be concluded that children's age was related to obesity status.

Table 18 Comparison of children's age between obese and normal group

Factor	Obesity status	Number	Median (25^{th}, 75^{th} percentile)	p value*
Child's age	Normal	148	9 (8, 11)	**0.0131**
	Obese	52	10 (9,11)	

* Mann Whitney test

Table 19 presented the relationship between sex of child, genetic factor of father and obesity status by using χ^2 test. From the results of this analysis it was found significant relationship between sex (p value < 0.001) and father obese (p value = 0.013) with obesity status while there are no significant relationship between genetic factor of mother and other family members obese with the obesity status.

Table 19 Relationship between children socio demographic factors and obesity status

Children socio-Demographic factors	Obesity status		χ^2 (df)	p value
	Obese (%)	Normal (%)		
Sex			15.41	**< 0.01**
Male	31(41.89)	43(58.11)	(1)	
Female	21(16.67)	105(83.03)		
Genetic Factor				
Father :			6.13	**0.013**
Non obese	20(20.00)	80(80.00)	(1)	
Obese	26(37.14)	44(62.86)		
Mother :			1.28	0.258
Non Obese	28(22.95)	94 (77.05)	(1)	
Obese.	19(30.65)	43(69.35)		
Other family member			1.765	0.184
Non obese	36(23.68)	116(76.32)	(1)	
Obese	16(33.33)	32(66.67)		

4.6.2 Relationships between obesity status of children and children's behavior.

a. Eating habits

Table 20 shown the results of relationship between the normal group and obesity group in terms of children's behavior such as frequency meals per day, breakfast, time last meals, frequency consume snack per day, frequency consume soft drink per day and dietary habits by using χ^2 test. The tests showed that there was significant relationship between frequency meals (p-value = 0.018) and frequency consume snack per day (p-value = 0.047) and frequency consume fried food per week (p-value = 0.001) and the obesity status but there was no significant relationship

between the children have breakfast or not before go to school, time last meals before go to sleep, frequency consume soft drink per day and dietary habits.

Tabel 20 Relationship between eating habits of children and obesity status

Eating habits	Obesity status		χ^2 (df)	p value
	Obese (%)	Normal (%)		
Frequency meals per day			7.996	**0.018**
- Two meals	7(21.21)	26(78.79)	(2)	
- Three meals	32(22.86)	108(77.14)		
- More than three meals	13(48.15)	14(51.85)		
Breakfast			0.564	0.453
- Have breakfast	42(27.27)	112(72.73)	(1)	
- No have breakfast	10(21.74)	36(78.26)		
Time last meals			2.830	0.092
- Before going to sleep	8(42.11)	11(57.89)	(1)	
- More than 2 hours before sleep	44(24.31)	137(75.69)		
Frequency consume snack per day			3.950 (1)	**0.047**
≤ one time per day	23(20.54)	89(79.46)		
> one time per day	29(32.95)	59(67.05)		
Frequency consume soft drink per day			0.303 (1)	0.582
- ≤ one time per day	29(24.58)	89(75.42)		
- > one time per day	23(28.05)	59(71.95)		

Table 20 Relationship between eating habits of children and obesity status (Cont)

Eating habits	Obesity status		χ^2 (df)	p value
	Obese (%)	Normal (%)		
Dietary habits				
Freq. consumed rice				
- Everyday/almost everyday	52(26.67)	143(73.33)		1.000*
- Others	0	5 (100.00)		
Freq. consumed sticky rice				0.4209
- Everyday/almost everyday	4 (19.05)	17(80.95)	1.73	
- Several days per week	27(30.33)	62(69.66)	(2)	
- Never/almost seldom	21(23.33)	69(76.67)		
Freq. consumed bread				0.2385
- Everyday/almost everyday	12(20.69)	46(79.31)	2.87	
- Several days per week	26(25.24)	77(74.76)	(2)	
- Never/almost seldom	14(35.90)	25(64.10)		
Freq. consumed cereal				0.3242
- Everyday/almost everyday	8(19.05)	34(80.95)	2.25	
- Several days per week	12(23.07)	40(76.92)	(2)	
- Never/almost seldom	32(30.19)	74(69.81)		
Freq. consumed noodle				0.2009
- Everyday/almost everyday	18(33.96)	35(66.04)	0.20	
- Several days per week	32(24.24)	100(75.76)	(2)	
- Never/almost seldom	2(13.33)	13(86.67)		
Freq. consumed sugar				0.4977
- Everyday/almost everyday	31(28.44)	78(71.56)	1.40	
- Several days per week	12(20.34)	47(79.66)	(2)	
- Never/almost seldom	9(28.13)	23(71.87)		

***** Fisher's Exact test

Table 20 Relationship between eating habits of children and obesity status (Cont)

Factor	Obesity status		χ^2 (df)	p value
	Obese (%)	Normal (%)		
Dietary habits				
Freq. consumed fatty meat			2.40	0.3000
- Everyday/almost everyday	18(30.50)	41(69.49)	(2)	
- Several days per week	22(28.20)	56(71.80)		
- Never/almost seldom	12(19.05)	51(80.95)		
Freq.consumed skin pork/poultry			2.03	0.3615
- Everyday/almost everyday	11(29.73)	26(70.27)	(2)	
- Several days per week	22(30.14)	51(69.86)		
- Never/almost seldom	19(21.11)	71(78.89)		
Freq. consumed meat			0.08	0.9612
- Everyday/almost everyday	26(26.00)	74(74.00)	(2)	
- Several days per week	18(26.87)	49(73.13)		
- Never/almost seldom	8(24.24)	25(75.76)		
Freq. consumed fried food			12.52	**0.0019**
- Everyday/almost everyday	33(29.46)	79(70.54)	(2)	
- Several days per week	11(14.86)	63(85.14)		
- Never/almost seldom	8(57.14)	6(42.86)		
Freq. consumed food with coconut milk			0.82 (2)	0.6662
- Everyday/almost everyday	6(20.0)	24((80.0)		
- Several days per week	29(28.16)	74(71.84)		
- Never/almost seldom	17(25.37)	50(74.63)		
Freq. consumed vegetables			0.42	0.8120
- Everyday/almost everyday	27(26.73)	74(73.27)	(2)	
- Several days per week	21(26.58)	58(73.42)		
- Never/almost seldom	4(20.0)	16(80.0)		

Table 20 Relationship between eating habits of children and obesity status (Cont)

Eating habits	Obesity status		χ^2 (df)	p value
	Obese (%)	Normal (%)		
Freq. consumed fruit.			0.61 (2)	0.7378
- Everyday/almost everyday	32(24.43)	99(75.57)		
- Several days per week	17(29.82)	40(70.18)		
- Never/almost seldom	3(25.0)	9(75.0)		

b. Daily activity

Table 21 was shown that results of comparison for daily activity of children between the normal group and obesity group. From the results of this analysis, it was found that there was no significant difference between the normal group and the obesity group in terms of daily activity of children. As a result, it could be concluded that daily activity of children everyday or in holiday did not directly related to obesity status of children.

Table 21 Comparison of daily activity of children between obese and normal group

Factor	obesity status	Number	Median (25^{th}, 75^{th} percentile)	p value*
Everyday				
Length of spend for watching TV	Normal	148	2 (2,3)	0.5624
	Obese	52	3(2,3)	
Length of time spend for reading	Normal	148	1(1,2)	0.9113
Or doing homework	Obese	52	1(1,2)	
Length of time spend for playing in door	Normal	148	2(1,3)	0.724
	Obese	52	2(1,3)	
Length of time spend for playing outdoor	Normal	148	2(1,2)	0.7194
	Obese	52	2(1,2)	
Holiday				
Length of spend for watching TV	Normal	148	3(3,5)	0.8324
	Obese	52	3(3,4)	
Length of time spend for reading	Normal	148	1(1,2)	0.3458
Or doing homework	Obese	52	1(1,2)	
Length of time spend for playing in door	Normal	148	2(1,3)	0.8269
	Obese	52	2(2,3)	
Length of time spend for playing outdoor	Normal	148	2(1,3)	0.3034
	Obese	52	3(1,3)	

* Mann Whitney test

4.6.3 Relationship between obesity status of children and parent's characteristics

a. Parents' socio-demographic factors

Table 22 showed the relationship between occupation and education level of parents and obesity status of children by χ^2 test. Occupation father, occupation mother, education level of father and mother were analyzed, and there was found to be no significant relationship between these factors and the obesity status of children.

Table 22 Relationship between parents' socio-demographic factors and obesity status of children

Parents' Socio-demographic	Obesity status		χ^2 (df)	p-value
	Normal(%)	Obesity(%)		
Occupation father				0.122
- Labor	72(68.57))	33(31.43)	2.385	
- Others	63(78.75)	17(21.25)	(1)	
Occupation mother				
- Labor	63(74.12)	22(25.88)	2.582	0.275
- Others	82(73.21)	30(36.59)	(1)	
Education level of father				
- ≤ Primary school.	70(70.70))	29(29.30)	0.554	0.457
- ≥ Secondary school.	65(75.58)	21(24.42)		
Education level of mother				
- ≤ Primary school.	92(73.60)	33(26.40)	0.000	0.999
- ≥ Secondary school.	53(73.61)	19(26.39)		

b. Mother's knowledge and practice on child feeding

In table 25, the comparison of the total scores for the questions on mother's knowledge and food practice using Mann-Whitney U test were shown. There was found to be no significant difference between the normal group and the obesity group in terms of the total scores of these two factors. It was found that in this study,

mother's knowledge and practice on child feeding did not affect the obesity status of children.

Table 24. Comparison of mother' knowledge and practice scores on child feeding between the obese and the normal group

Factor	Obesity status	Number	Median (25^{th}, 75^{th} percentile)	p value*
Knowledge score	Normal	148	9 (8, 10)	0.8269
	Obesity	52	9 (8, 10)	
Practice score on child feeding	Normal	148	12 (11,13)	0.8936
	Obesity	52	12 (11, 12,7)	

* Mann Whitney test

CHAPTER V
DISCUSSION

5.1 Prevalence of obesity in primary school children.

The present prevalence of obesity in primary school in this study was measured by weight for height according to the classification of obesity on Thai standard the comparison of the present findings with other previous study presented in table 7. The prevalence of obesity found in this study was 26.00 %, which higher than that found in other urban studies carried out in southern and central Thailand and also higher than the National Nutritional Survey in 1994 (11.2 – 16.9 %).

Table 24 Comparison of prevalence of obesity among the primary school children in Thailand

Place	Author/year	Age range (Years)	Result prevalence (%)
Bangkok	Suttapreyasri,et.al,1990	6-18	14.3
Hat Yai	Mo-suwan,et.al,1993	6-12	14.3
National Nutrition survey	MOPH,1994	primary school	11.2- 16.9
Southern	Tontisirin,1999	primary school	14.0
Northeast.	Germaine L,et al,2000	7-9	10.8
Nakhon Pathom	Yunimar Usman,2004	6-12	26.0

Maung district is an urban area and more likely to have experienced greater economic transition than rural areas. Increasing economic development in this region is often associated with an increasing prevalence of obesity, not only in industrialized countries but also in newly developed nations or in developing countries [64].

In a study on childhood obesity in Taiwan, Chen,1997 reported that in 1954 no primary school children were found to be obese, in 1970 he found a 2 % obesity prevalence, and 16 years later in 1986 the prevalence of obesity in the primary school children had risen to 17.4 %. This increasing of childhood obesity coincides with the strong economic growth that has been experienced in the region since 1952 through to the present day [63].

As the economic of the region continue to improve, the risk of becoming obese increases across all socioeconomic classes as a result of improved access to food decreased physical activity and the consumption of western diet. This phenomenon was described by DJ Hoffman, 2001. He mentioned that the high rate of obesity prevalence had contributed by various factors such as changing lifestyle like dietary changes and physical inactivity and genetic factors [64].

5.2 Children's characteristics and its relation to obesity status.

Children's age this study proved that there was a significant different of ages of children between the obesity group and the normal group. The older child was having more chance to get obesity. The same study has done in Kuala Lumpur, Malaysia, 2002 by Tee, ES [65]. It is in contrary, the other study done by Al-Shammari, SA, 2001 [66] shown that the younger child was found to be higher prevalence of obesity. The finding of this study may be due to inadequate dietary and physical inactivity. The older child can choose the food they like without healthy justification. In this present study frequency meals per day, frequency consume snack per day and frequency consume fried food per week was also related to obesity in children. In this present study also found that the children with the older age consumed more food than the younger. They used consumed sugar and fried food. They also consumed more than three meals per day. Additionally, they took snack in between the meals more than the younger children.

Even though length of time spending on watching television is not statistically significant related to obesity. The obese children slightly spend longer time than the normal group.

Sex. In this study, boys more likely to be classified obese than girls. A study carried out by Langendijk, et.al in Northeast Thailand it also found the same. It's reported that difference in the prevalence of obesity between the sexes due to cultural factors, boys were acceptable to carry excess weight but not girls, indicating a possible culturally influenced gender bias [59].

This is also supported by studies carried out in The United States of America across different ethnic groups that found the association between gender and weight status to vary according to cultural influences. Melnik and colleagues found a greater proportion of obese second grade males compared to females on average in the USA [46]. However, when analyzed by using population subgroups it was found that girls of Hispanic backgrounds were the most at risk of being obese when compared to the non Hispanic girls. Thus the weight status of a child is suggested to be affected depending on their sex and the associated culturally defined influences.

More over, it was found out in this present study that boys used consumed sugar, ate fatty meat and fried food more than female. The proportion among boys who had exercise was higher than the proportion among girls but the exercise may not enough compare with food intake. Therefore, it seems the energy intake is greater than the energy expenditure.

Genetic factors, some research has shown that obesity runs in families. Obese children are more likely to have obese parents and obese siblings than non-obese children. Parental obesity and child obesity also interact in the prediction of obesity [67]. However, in this study the relationship was only significant with father's obese. In this study measures of parental obese status were based on the self reported for heights and weights, as leading to underestimation of the parents'body mass index (BMI).

5.3 Children's behavior and its relationships to obesity status.

It was found statistically significant difference of frequency of meals per day between obese children and normal group. Among the obese group, almost of them have three meals and more than three meals. If the child has high frequency of meals they will have more chance of obese.

Some studies of varied meal size and frequencies have not documented substantial effect on energy intake and fat deposition. Although Fabry et.al, 1996 reported greater fat deposition among adolescents eating three meals per day (versus 5 or 7) over a year, other prospective study have generally found little effect of meals frequency on normal energy balance. Some investigators have suggested that high eating frequency in the form of "snacking" is common in the obese and possibly causally related to obesity [68]. In this study also found that the children obese have high frequency of consuming snack significant different with the normal group.

Breakfast, this study did not found any significant relationship between the children who have breakfast or not with obesity status. The same result was found in the study has done in Bangkok, Thailand in 1993 by Kittidilokkul [69].

Almost of children were have breakfast before they going to school everyday. Among the children who did not have breakfast found a few of them (21.74 %) was obese and majority of them (78.26 %) were normal group. On the other, hand not only the children who not eat breakfast belonged to obese group. The reason why they don't have any breakfast, they mentioned he or she get up late, have no time for breakfast, no hungry, they will vomiting or get stomach pain after eat, don't have anything for breakfast, severe obese, and almost of them said because they don't like eating.

This present study found that only variable for frequency consumed fried food per week had significantly relationship with obesity. On the other hand frequency consumed bread, noodle, sugar, fatty meat, food with coconut, vegetable and fruit are

not significantly relationship with obesity but some studies have found a significant relationship that food intake as a percentage of total energy intake with the children obesity status [51] [50] [69].

Regarding physical activity of children, this study found no significant relationship with obesity status. All of them have the same amount of time spent on watching television, reading/doing homework, playing in door or outdoor even in weekend.

Mayuree reported that obese pupils have less physicals activities. They spent time in their daily life for watching television, shopping at the department store at the weekends and they said that they had no large area for playing, sport or exercise. They also said that if they got more exercise, they would feel hungrier and ate more foods [70].

Another study by Worsle et.al showed that obese children did not like to exercise because they found that endurance activities such as distance runs, push up etc. were more difficult and were not fun [71].

Gortmaker SL et.al also indicated that incidence of overweight were 8.3 times greater for youth who were watching more than 5 hours of television per day compared with those watching for 0 – 2 hours per day. He was also suggested that television viewing can reduce activity levels in children and promote energy intake, increase energy intake can occur by increasing consumption [72]. It also supported by Mayuree, she found that obese pupils spent approximately 2-3 hours for watching television and during that time they mostly consumed main dish. In weekends, they spent approximately 5-7 hours for watching television and during that time they consumed at least one type of food such as main food, snack or beverages [70].

5.4 Parents' characteristics and its relationship to obesity status.

Occupation, in this study there was no significant relationship between occupation both of mother and father with obesity. It was consistent with other study carried out in Bangkok conducted by Kittidilokkul in 1993 [68]. Nevertheless it was in contrary, the other study by Rolland et.al, 1988, they assessed calories intake and body mass index in children of families with fathers in unskilled compared skilled occupations. The results suggested that given the same intake, children with unskilled father are more likely to become obese than children with skilled fathers. The individual susceptibility to obesity is either due to or correlated with father's occupation [53].

Family income was also not successful to reach the relationship to obesity. This result is the same to the report of Kittidilokkul, 1993 [69]. Other study by Langendijk et.al 1999 found that household income have significant different between obese children and normal children. The children belonged to the household income high ($\geq$ 30,000 baht/month) had greater risk to become obese[59].

No statistical relationship was found between education levels of father and mother and obesity status of children. It was in contrary with the study by Langendijk et. al 1999 [59] which reported that mother's education levels and father's education levels have significant different between obese children and normal children. They also mentioned when stratified by the father's education (high, low) the relationship of mother's education on the outcome of obesity was modified. Under the strata of high father education the odds ratio was 1.04 (0.50, 2.17) and under the strata of low father education the odds ratio was 6.91 (2.39, 20.56), while the crude odds ratio was 2.23 the odds ratio differ by stratum interaction. Since the odds ratio not only differ from the crude odds ratio but also from each other, there is effect modification by the father's level of education. This means that the observed association of mother's education level with obesity of the child was conditioned by the father's education level [59].

Occupation, family income and education were the variables as measures of socio economic status. In this study socioeconomic status have not significantly relationship with obesity status. The review of Sobal and Stunkard indicated childhood obesity showed negative or no correlation with social and economic status in developed countries, while positive correlation was seen in developing countries [57]. Study by Langendijk, et al also supported the conclusion of the review. The prevalence of childhood obesity was significantly different between higher and lower socioeconomic status. The higher prevalence was seen in higher socioeconomic [59].

Concerning the mother's knowledge on child feeding, both mother's belonged to obese and normal group had fairly to good nutritional knowledge as assessed by questionnaires. On maternal knowledge statement only two statements reached less than 60 % of correct answer. It was the statement about major cause of obesity and fat as one of the essential nutrients for children. On the maternal practice half of the statement reached correct practice answer less than 60 %, this indicates that there might be same disparity between mother knowledge and practice.

Family eating environment influence the development of eating behavior in children. On the one hand as providers of the food children eat, mother knowledge and practice on child feeding have an important role. In addition, mothers who are concerned about their child's risk of becoming obese may adopt controlling feeding practices in attempts to reduce the risk or prevent obesity in their children.

The high prevalence of obesity in this present study may have related to the knowledge on child feeding of the mothers. There were important question where mother did not know about the knowledge on major causes of obesity. There was only one-third (36.50 %) of them had correct answer. Another question was about the knowledge on essential nutrient particularly fat, only one-fourth of mother (24.12 %) had correct answer.

Knowledge is an influencing component of individual in understanding, expressing any behavior and accumulating the capacity to conduct various activities.

Inadequate knowledge particularly of nutrition will lead to the improper conduct of food consumption such as the purchase of foods contained inadequate essential nutrients, the unconcern of beneficial or harmful effect on food choices.

In this study was found that most of mothers had wrong practice on child feeding. It was indicated from more than half (57.50 %) of them feed their children more than three times everyday, more than half (58.00 %) pressured their children to eat more, majority of them (85.00 %) allowed their child to skip their breakfast, most of them (87.5%) think that fast food are better than cooked foods at home, most of them (93.0%) feed western food to children between two meals, most of them (70.0 %) sometimes feed their children snack between meals everyday and the rest most of them (67.5 %) always buy cooked foods from market as meals for their children.

5.5 Limitation of the study

There were several limitations in this study, firstly this study is a cross sectional study, so it only identifies the factors related to obesity and non causal inference could be obtained. On the other hand the cross sectional design mean that only a description of the pattern of obesity in Watsaneha primary school could be made rather than establishing definite causal relationships.

Secondly, concerning about the accuracy of the measurement, in this study measures of parental obese status were based on self reported. Thus the parents perhaps did not know exactly about their weight and height. It's as leading to underestimation or overestimation of their body mass index.

Thirdly, the food frequency questionnaire was the most practical in term of cost and acceptability, however the measurement was limited in term of measurement errors could have occurred, such as respondent bias through misunderstanding the instruction to fulfills the questionnaire. The nature of food intake complicates the measurement when they're eating many kinds of food with small portion. This system

of eating makes very difficult to determined the amount of frequency that has been consumed.

Fourthly, in this study results represent an estimate of carbohydrate, fat, vegetable and fruits usual intake. It did not support the qualitative measurement of carbohydrate, fat, vegetable and fruits intake regarding belief that excessive food intake in term of high fat and carbohydrate intake low vegetable and fruit intake leads to excess weight in children. Therefore, the result can not reflect the real energy intake.

Fifthly, using self administered questionnaire demands a certain level of knowledge and skill on the part of the respondent. In this study most of parents were completed in education at primary school level. On the other hand they belonged to the low level group. It is also susceptible to respondent bias.

Regarding physical activity, the assessment of physical activity was through physical activity questionnaire. In this study result represent an estimate of physical activity usual perform. It's not distinguish physical activity level (PAL) as inactivity/sedentary (will have PAL values around 1.4), Limited activity (will have PAL 1.55 – 1.60), physically active (will have PAL values of 1.75 or more). Therefore, the result of physical activity can not express the energy expenditure.

CHAPTER VI
CONCLUSION AND RECOMMENDATION

6.1 Conclusion.

A cross sectional study was conducted at Watsaneha primary school, Maung District, Nakhon Pathom province, Thailand during January 2004. The main objective of this study was to identify prevalence of obesity among primary school children and its related factors. The information was collected by a self-administered questionnaire for parents and anthropometric data were obtained by measuring the weight and height of the children.

The variables included in this study were children's characteristics consisted of socio demographic, genetic factors as parent's obesity and other family members obese, children's behavior consisted of eating habits, daily activity and exercise, parent's characteristics consisted of age, occupation, education level and family income, maternal knowledge and practice on child feeding.

This study revealed that the prevalence of obesity in this study area was 26.00 %. From these results it can be said that in the study area more than one fourth of the children were obese.

Age of children in this study, average of them was equal to 9 years old (SD: $\pm$ 1.69). The youngest was 6 years and the oldest was 12 years old. Majority of them (63.00 %) were female.

Regarding the genetic factors, the prevalence of obese children in father who were obese was 37.14 % higher than that of father who did not obese. However the prevalence of obese children in mother and other family who were obese was low.

Majority of children (70.00%) had three meals per day and more than half of them (51.50%) consumed snack one time per day. To drinking such as soft drink, more than fifty percent drink one time per day. The children preferred to spend their pocket money for snack found to be more than half (59.50 %).

Two-thirds of children (60.50 %) were get up everyday at below 6.30 am. Most of them (81.00%) took time for sleeping more than 8 hours everyday. Majority of the children (85.93 %) went to school by parent's car. Half of them (51.60%) spent time for watching television everyday less than 2 hours. More than half of them (63.00%) did their homework or reading take time 1 hour. Almost half of them (51.00 %) spent time for playing indoor games take time 2-3 hours per day. They spent time for playing out door more than 3 hours everyday account 9.00%. Majority of them (80.00%) participated in any type of sports and half of them (58.60%) spent time more than 30 minutes in this sports.

Majority of fathers' children (52.51%) were found belonged to the age group 30-39 years old. Majority of mothers' children were found belonged to the same group with average 38.70 years old. Majority of fathers and mothers who work as labor accounted 56.76 % and 43.15%. Most of fathers and mothers were complete primary school education. Nearly half of them (48.22%) had a total family income belonged to group 5,000 – 10,000 baht per month with the mean average 9,557 baht (SD = $\pm$ 7,190).

Concerning the level distribution of mothers according to their knowledge score on child feeding, almost of them (71.50%) was fair. Concerning the level distribution of maternal practice almost of them (62.50%) was also fair.

Among potential related factors, from the result of bivariate analysis, it was found that children's age (p value = 0.0131), sex (p value < 0.001), father's obese (p value = 0.013), frequency of meals (p value = 0.018), frequency of consume snack (p value = 0.047), and frequency of consumed fried food (p value = 0.001) have

significant relationship with obesity status. On the other hand, the other factors did not show any relationship with obesity status.

6.2 Recommendation

6.2.1 For action

From the results of this study, it was revealed that the prevalence of obesity in the primary school children in the study area was higher compared to the other urban studied and also higher than National Nutritional survey in 1995. Emerging of obese children was an important health problem and the problems of present this situation were genetic factors and inadequate dietary.

Age, sex, father obese, frequency meals per day and frequency consume snack per day were related to obesity in primary school children found in this study. To reduce the prevalence of obesity is to conduct an intervention and prevention not only for obese children in this area but alsoto the community as a whole, to control and prevent further incidence of obesity in future.

It is well known that obesity is a result of gene environment interactions [3]. Parents of children anyway are providing both the genes and the environment. Parents are creating starts the choice of a children feeding method. The choice of the feeding method that parents use can have major impact on the child's acceptance of foods. We already mentioned in the former chapter even mother knowledge on child feeding quit good however in the practice they still give the unhealthy food as meal, as the provider of the food the children to eat, mother knowledge and practice on child feeding have an important role. Therefore this intervention and prevention should be a part of an integrated school and family based approach, these following activities should be emphasis as:

1. Conduct nutrition education training for parents and children to promote good practice on child feeding emphasis eating behavior and control weight gain. Follow activity above by monthly meeting with the parents

and should be done as a longitudinal and continuously process because it seemed to be difficult to modify their appropriate eating behavior within a short time period.

2. Creating the weight control program in the school consists of dietary counseling and individual visits by the nutritionist and pediatrician.
3. Promoting healthy behaviors by social marketing through distribution booklet for the parents to encourages, motivate and enable individuals to lose weight such as :
   - Avoid feed the children more than three times a day,
   - Avoid to pressure the children to eat more,
   - Avoid between meals snacks; try to eat more fruits and vegetables,
   - Avoid western food, and fried foods,
   - Avoid when the children was watching television eats, and
   - Avoid food purchased outside the home because has a higher caloric content than food prepared in the home and portion sizes tends to be substantially larger.

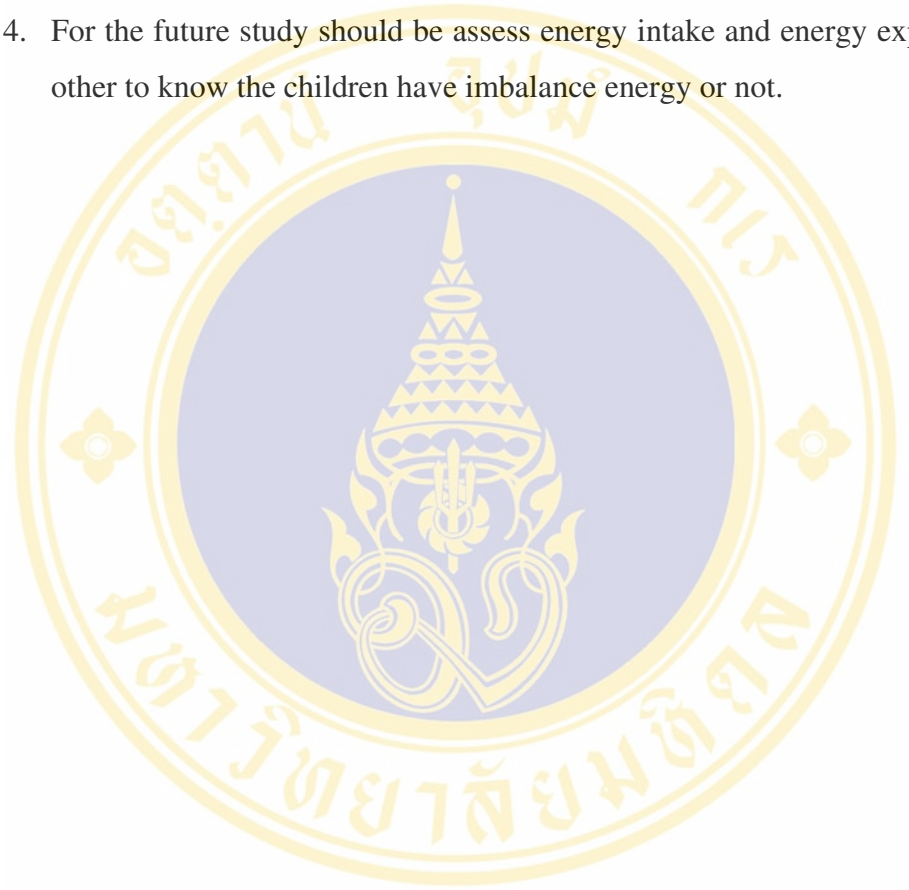
6.2.2 For further study.

1. According to the conclusion, it is clear that factor related to obesity in this study is genetic factors and inadequate dietary. Therefore, the further studies in the factors related to obesity in primary school should be emphasized on details of parental environments such as food consumption behavior, cooking pattern etc.

2. A self-administered questionnaire is appropriate to be used in the adult. However, this should be validated to check for accuracy by interviewing. The interviewer reviewed the questionnaire for completeness and clarification. This validation would indicate the direction of any bias and thus provide an adjustment factor for the analysis.

3. Concerning accuracy measurement for food intake, it will be obtained by make the record of the actual food consume by the children over three days according to the kinds or types of item and its description by the household measure or amount of the food by using figures of portion of service size.

4. For the future study should be assess energy intake and energy expenditure in other to know the children have imbalance energy or not.



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APPENDIX

Appendix A

Self administered parental questionnaire

QUESTIONNAIRE

Respondent Information

Name of Child :…….

Identification number :…….

Grade :…….

Name of mother :…….

Name of father :…….

Date of today :…….

Guide :

Please put your answer in the blank column or tick mark [V] in the bracket which is appropriate answer according to you.

- I would like you (the parent), together with your child to fill out the following question. Please complete this questionnaire. This will be treated with confidentiality.

Part 1: Characteristic of child.

1. Age of child :……..years old
   (Birthday : month……day……year…….)
2. Sex : [ ] 1. Male [ ] 2.Female
3. Weight : ……..kg
4. Height : ……..cm

Part 2 : Children's Behaviors.

I. Eating Habits.

1. How many meals does your child usually have per day?
   a. Two meals (lunch and dinner)
   b. Three meals (Breakfast, lunch, and dinner)
   c. Four meals (Breakfast, lunch dinner and late meals before go to sleep)
   d. More than four. (Specify,……..times)
2. Does your child usually have breakfast before going to school?
   a. Yes b. No.
3. From no 2, If no, Why?.....
   ……...
   ……...
4. What time does your child have the last meals?
   a. Before going to sleep. b. At 8 pm.
   c. At 6 pm d. At 4 pm.
5. How often does your child consume snack food such potato chips, pop corn, crackers and instant food per day?
   a. One times per day b. 2-3 times per day
   c. more than 3 times per day d. don't know .
6. How often does your child drink such as soft drinks (e.g.: Coca cola, Sprite, Fanta etc. Sweet cool drinks (e.g.: juice, lemon tea, etc) and ice cream per day?
   a. Never. b. one times per day
   c. 2-3 times per day d. more than 3 times per day.
7. Which kind of food does your child prefer to spend your pocket money?
   a. Snack b. beverages.
   c. Sweet/candies d. Others specify……..

8. How often does your child eat following kind of food?

Food Items	Never	Everyday	5-6 day/week	3-4 day per week	1-2 day per week	2 day per month	1 day per month
Carbohydrate							
1. Rice.							
2.Stickyrice							
3.Bread							
4.Cereal							
5.Noodles							
6.Sugar							
7.Other,…..							
8…….							
Fat							
1.Fatty meats							
2.Skin of pork or poultry.							
3.Meat without skin							
4.Sausage,bacon							
5.Oil/fried food							
6.Food with coconut milk							
7.Other,…….							
8…….							
Vegetable							
1.Cucumber							
2.Cabbage							
3.Tomato							
4.Long bean							

Food Items	Never	Everyday	5-6 day/week	3-4 day per week	1-2 day per week	2 day per month	1 day per month
5.Soyabean							
6.Pumpkin							
7.Bean sprouts							
8.Bamboo shoot							
9.Other,…….							
10……..							
Fruits							
1.Oranges							
2. Guava.							
3. Pineapples.							
4.Watermellon							
5.Grapes.							
6.Banana.							
7.Durian.							
8.Papaya							
9.Riped mango							
10.Other,……							
11……..							

II. Daily Life activity.

A. Every day.

9. What time does your child usually get up in the morning?.....

10. What time does your child going to school?.....

11.How does your child go to school (walk, ride bicycle, school bus, parent's car)?.....

12.How long does your child take time from your house to school?.....

13.How long does your child spend time for watching TV per day?.....

14.How long does your child spend time for doing home work or reading a book?.....

……

15.How long does your child spend time for playing in door?.....

16.How long does your child spend time for playing out door?.....

17.What time does your child usually go to bed?.....

B. Holiday

18.What time does your child usually get up in the morning?.....

19.How long does your child spend time for watching TV per day?.....

20. How long does your child spend time for doing home work or reading a book?.....

……...

21. How long does your child spend time for playing in door?.....

22. How long does your spend your time for playing out door?.....

23. What time does your child usually go to sleep?.....

III.Exercise.

24. Does your child usually participate in any type of sport, exercise or physical activities ?

[ ] 1. No (if no, please go to question 16).

[ ] 2. Exercise,(if yes, please specify…….)

[ ] 3. Sport, (if yes, please specify…….)

[ ] 4. Other physical activity, (if yes, please specify…….)

25. What is the average length of time does your child spends in these sports, exercise and other activities each time?

[ ] 1. < 30 minutes.

[ ] 2. ≥ 30 minutes

26. On average, how many times per week does your child participate in these sports, exercise and other activities.

[ ] 1. one time per week

[ ] 2. two times per week

[ ] 3. three times per week

[ ] 4. four times per week

[ ] 5. five times per week

[ ] 6 six times per week

[ ] 7 seven times per week

Part 3 : Characteristic of parent

27. What is the parent's height ?

Father : ……cm

Mother : ……cm.

28. What is the parent's weight?

Father : ……kg

Mother : ……kg.

29. Age of parents ?

Father : ……years old

Mother : ……years old.

30. What is your occupation?

Occupation	Father	Mother
1.Government employee	[ ]	[ ]
2.Company employee.	[ ]	[ ]
3.Trade/small business.	[ ]	[ ]
4.Professional.	[ ]	[ ]
5.Unemployed (including house work)	[ ]	[ ]

31. What your highest education level?

Education level	Father	Mother
1.Illiterate.	[ ]	[ ]
2.Primary school	[ ]	[ ]
3.Secondary school	[ ]	[ ]
4.College/University and higher.	[ ]	[ ]

32. Total income of family?.....bath/month.

33. What is the number of your family members living with you now?.....persons

34. At present, a person whom take care the child?.....

35. Who is responsible to take care for the food?.....

36. Any obese in your family?.....persons.

37. Does your child have any disease, specify?

Disease	Yes	No
1.Diabetes Mellitus 2.High blood pressure 3.High cholesterol 4.Cardiovascular disease 5.Sleep apnoe		

Part 4. Maternal Knowledge

Statement	true	false
1. Obesity means excess weight		
2. Major causes of obesity were due to the excess energy intake.		
3. The obese child is healthy		
4. Over food consumption is good for children		
5. Consumption of high carbohydrate and fat food could cause obesity		
6. The five food groups which we ate in daily consist of meat, starch ,fat, vegetables, and fruits		
7. The obese pupils should increase their regular exercises because these could eradicate the excess body fat.		
8. Fat (cooking oil, butter, coconuts milk, etc) is one of the essential nutrients for children		
9.Carbohydrate (rice, noodle, bread, etc) intake is necessary to produce the energy for body		
10. Protein (egg, meat, fish, milk, bean, etc) intake is necessary to the growth of child.		
11. To prevent Obesity, we have to skip breakfast.		
12. Obesity can affect children's health such as diabetes mellitus, CVD in adult.		
13.Eat before sleep could cause obesity.		
14. Western food for example KFC, Mc Donald is good for child because it contains high protein and energy.		
15.Vegetables and fruits are good for only child's obese		

Part 5: Maternal practice on child feeding.

Statement	Yes	No
1. You always pay attention to the nutrients in daily meals such as pay attention to dietary allowances for your child.		
2. You feed your children more than three times everyday.		
3. You always try to feed nutritious food (consist of meat, starch, fat and vegetables or fruits) to your child.		
4. Fast foods are better than cooked foods at home.		
5. You feed western food to children between two meals.		
6. You usually feed your child instant food as a meal.		
7. You sometimes feed your child snack between meals every day		
8. You or other family members usually cook meal at home for your child		
9. You always buy cooked foods from food shops as meals for your child		
10. You allow your child to skip their breakfast.		
11. You allow your child eating when he or she is watching television.		
12. You feed your child meals at fixed time everyday		
13. You pressure your child to eat more.		
14. You pressure your child to do exercise		

Thank you very much for your kind cooperation and complete the above questions.

Appendix B

Score: Maternal Knowledge

Statement	true	false
1. Obesity means excess weight	1	0
2. Major causes of obesity were due to the excess energy intake.	0	1
3. The obese child is healthy	0	1
4. Over food consumption is good for children	0	1
5. Consumption of high carbohydrate and fat food could cause obesity	1	0
6. The five food groups which we ate in daily consist of meat, starch ,fat, vegetables, and fruits	1	0
7. The obese pupils should increase their regular exercises because these could eradicate the excess body fat.	1	0
8. Fat (cooking oil, butter, coconuts milk, etc) is one of the essential nutrients for children	1	0
9.Carbohydrate (rice, noodle, bread, etc) intake is necessary to produce the energy for body	1	0
10. Protein (egg, meat, fish, milk, bean, etc) intake is necessary to the growth of child.	1	0
11. To prevent Obesity, we have to skip breakfast.	0	1
12. Obesity can affect children's health such as diabetes mellitus, CVD in adult.	1	0
13.Eat before sleep could cause obesity.	1	0
14. Western food for example KFC, Mc Donald is good for child because it contains high protein and energy.	0	1
15.Vegetables and fruits are good for only child's obese	0	1

APPENDIX C

Reference scale for assessing the nutritional status of Thai Children

1. Weight for Height. (Male)

Height (cm)	Weight (Kg)					
	<-2 S.D	-2 SD - + -1.5 SD	-1.5 SD - + 1.5 SD	>+1.5 SD - + 2 SD	> + 2 SD - + 3 SD	> + 3 S.D
85	9.9	10.0-10.3	10.4-13.9	14.0-14.7	14.8-16.2	16.3
86	10.1	10.2-10.5	10.6-14.1	14.1-14.9	15.0-16.4	16.5
87	10.3	10.4-10.7	10.8-14.3	14.4-15.1	15.2-16.6	16.7
88	10.5	10.6-10.9	11.0-14.6	14.7-15.4	15.5-16.9	17.0
89	10.8	10.9-11.3	11.4-15.0	15.1-15.7	15.8-17.1	17.2
90	11.0	11.1-11.5	11.6-15.2	15.3-15.9	16.0-17.3	17.4
91	11.2	11.3-11.7	11.8-15.5	15.6-16.2	16.3-17.6	17.7
92	11.4	11.5-11.9	12.0-15.8	15.9-16.5	16.6-17.9	18.0
93	11.6	11.7-12.1	12.2-16.0	16.1-16.8	16.9-18.3	18.4
94	11.9	12.0-12.4	12.5-16.4	16.5-17.2	17.3-18.7	18.8
95	12.1	12.2-12.6	12.7-16.7	16.8-17.5	17.6-19.1	19.2
96	12.3	12.4-12.8	12.9-17.0	17.1-17.8	17.9-19.4	19.5
97	12.5	12.6-13.0	13.1-17.3	17.4-18.1	18.2-19.7	19.8
98	12.7	12.8-13.2	13.3-17.6	17.7-18.4	18.5-20.1	20.2
99	13.0	13.1-135	13.8-18.2	18.3-19.0	19.1-20.7	20.8
100	13.2	13.3-13.7	13.8-18.2	18.3-19.0	19.1-20.7	20.8
101	13.4	13.5-13.9	14.0-18.4	18.5-19.3	19.4-21.1	21.2
102	13.7	13.8-14.2	14.3-18.7	18.8-19.6	19.7-21.4	21.5
103	13.9	14.0-14.5	14.6-19.0	19.1-19.9	20.0-21.7	21.8
104	14.1	14.2-14.7	14.8-19.4	19.4-20.3	19.5-22.2	22.3
105	14.4	14.5-15.0	15.0-19.7	19.8-20.6	20.7-22.5	22.6
106	14.5	14.6-15.2	15.3-20.1	20.2-21.0	21.1-22.9	23.0
107	14.8	14.9-15.5	15.6-20.5	20.6-21.4	21.5-23.4	23.5
108	15.0	15.1-15.7	15.8-20.8	20.8-21.7	21.8-23.7	23.8
109	15.3	15.4-16.0	16.1-21.1	21.2-22.1	22.2-24.2	24.3
110	15.6	15.7-16.3	16.4-21.6	21.7-22.7	22.8-24.8	24.9
111	15.9	16.0-16.6	16.7-22.0	22.1-23.1	23.2-25.2	25.3
112	16.1	16.2-16.8	16.9-22.3	22.4-23.5	23.6-25.7	25.8
113	16.4	16.5-17.1	17.2-22.8	22.9-24.0	24.1-26.3	26.4
114	16.7	16.8-17.4	17.5-23.3	23.4-24.5	24.6-26.9	27.0
115	17.0	17.1-17.8	17.9-23.8	23.9-25.0	25.1-27.4	27.5
116	17.3	17.4-18.1	18.2-24.2	24.3-25.5	25.6-28.1	28.2
117	17.6	17.7-18.4	18.5-24.8	24.9-26.1	26.2-28.8	28.9

Height (cm)	Weight (Kg)					
	<-2 S.D	-2 SD - + - 1.5 SD	-1.5 SD - + 1.5 SD	>+1.5 SD - + 2 SD	> + 2 SD - + 3 SD	> + 3 S.D
118	18.0	18.1-18.8	18.9-25.2	25.3-26.6	26.7-29.4	29.5
119	18.3	18.4-19.1	19.2-25.8	25.8-27.2	27.3-30.1	30.2
120	18.6	18.7-19.4	19.5-26.4	26.5-27.9	28.0-30.8	30.9
121	18.9	19.0-19.7	19.8-26.9	27.0-28.5	28.6-31.6	31.7
122	19.3	19.4-20.1	20.2-27.5	27.6-29.1	29.2-32.3	32.3
123	19.6	19.7-20.4	20.5-28.1	28.1-29.7	29.8-3.0	33.1
124	20.0	20.1-20.8	20.9-28.7	28.9-30.4	30.5-33.9	34.0
125	20.3	20.4-21.2	21.3-29.3	29.4-31.0	31.1-34.5	34.6
126	20.7	20.8-21.6	21.7-29.9	30.0-31.7	31.8-35.3	35.4
127	21.1	21.2-22.0	22.1-30.7	30.8-32.6	32.7-36.3	36.4
128	21.4	21.5-22.4	22.5-31.3	31.4-33.3	33.4-37.1	37.8
129	21.8	21.9-22.8	22.9-32.1	32.2-34.1	34.2-38.1	38.2
130	22.1	22.2-23.2	23.3-32.9	33.0-35.0	35.1-39.2	39.3
131	22.5	22.6-23.7	23.8-33.7	33.8-35.9	36.0-40.3	40.4
132	23.0	23.1-24.2	24.3-34.6	34.7-36.8	36.9-41.4	41.5
133	23.4	23.5-24.6	24.7-35.4	35.5-37.8	37.9-42.5	42.6
134	23.8	23.9-25.1	25.2-36.2	36.3-38.7	38.8-43.6	43.7
135	24.3	24.4-25.6	25.7-37.1	37.2-39.6	39.7-44.7	44.8
136	24.7	24.8-26.0	26.1-37.9	38.0-40.5	40.6-45.7	45.8
137	25.2	25.3-26.5	26.6-38.8	38.9-41.4	41.5-46.8	46.9
138	25.6	25.7-27.0	27.1-39.6	39.7-42.4	42.5-47.8	47.9
139	26.1	26.2-27.5	27.6-40.4	40.5-43.2	43.3-48.7	48.8
140	26.5	26.6-28.1	28.2-41.2	41.3-44.1	44.2-49.8	49.9
141	27.0	27.1-28.6	28.7-42.0	42.1-44.9	45.0-50.7	50.8
142	27.5	27.6-29.1	29.2-42.8	42.9-45.7	45.8-51.5	51.6
143	28.0	28.1-29.6	29.7-43.5	43.6-46.5	46.6-52.5	52.6
144	28.5	28.6-30.2	30.3-44.3	44.4-47.3	47.4-53.4	53.5
145	29.1	29.2-30.8	30.9-45.2	45.3-48.2	48.3-54.4	54.5
146	29.6	29.7-31.3	31.4-45.9	46.0-49.0	49.1-55.3	55.4
147	30.2	30.3-31.9	32.0-46.7	46.8-49.9	50.0-56.2	56.3
148	30.8	30.9-32.5	32.6-47.6	47.7-50.8	50.9-57.2	57.3
149	31.4	31.5-33.2	33.3-48.4	48.5-51.6	51.7-58.0	58.1
150	32.0	32.1-33.8	33.9-49.1	49.2-52.4	52.5-58.9	59.0
151	32.7	32.8-34.5	34.6-49.9	50.0-53.2	53.3-59.7	59.8
152	33.2	33.3-35.1	35.2-50.7	50.8-54.0	54.1-60.5	60.6
153	33.9	34.0-35.9	36.0-51.5	51.6-54.8	54.9-61.3	61.4
154	34.5	34.6-36.5	36.6-52.3	52.4-55.6	55.7-62.1	62.2
155	35.2	35.3-37.2	37.3-53.1	53.2-56.4	56.5-62.9	63.0
156	35.9	36.0-38.0	38.1-54.0	54.1-57.2	57.3-63.6	63.7
157	36.6	36.7-38.7	38.8-54.8	54.9-58.0	58.1-64.3	64.4
158	37.3	37.4-39.5	38.6-55.6	55.7-58.8	58.9-65.1	65.2
159	38.0	38.1-40.2	40.3-56.5	56.6-59.7	59.8-66.0	66.1
160	38.6	38.7-41.0	41.1-57.3	57.4-60.4	60.5-66.7	66.8

Height (cm)	Weight (Kg)					
	<-2 S.D	-2 SD - + - 1.5 SD	-1.5 SD - + 1.5 SD	>+1.5 SD - + 2 SD	> + 2 SD - + 3 SD	> + 3 S.D
161	39.4	39.5-41.8	41.9-58.2	58.3-61.2	61.3-67.4	67.5
162	40.1	40.2-42.5	42.6-59.0	59.1-62.0	62.1-68.1	68.2
163	40.8	40.9-43.3	43.4-59.8	59.9-62.8	62.9-68.8	68.9
164	41.5	41.6-44.0	44.1-60.6	60.7-63.6	63.7-69.6	69.7
165	42.2	42.3-44.8	44.9-61.5	61.6-64.4	64.5-70.2	70.3
166	43.0	43.1-45.6	45.7-62.3	62.4-65.2	65.3-71.0	71.1
167	43.7	43.8-46.3	46.4-63.1	63.2-66.0	66.1-71.7	71.8
168	44.4	44.5-47.1	47.2-63.9	64.0-66.8	66.9-72.5	72.6
169	45.0	45.1-47.8	47.9-64.7	64.8-67.6	67.7-73.3	73.4
170	45.7	45.8-48.5	48.6-65.5	65.6-68.3	68.4-73.8	73.9
171	46.4	46.5-49.3	49.4-66.3	66.4-69.1	69.2-74.6	74.7
172	47.1	47.2-50.0	50.1-67.0	67.1-69.8	69.9-75.3	75.4
173	47.9	48.0-50.8	50.9-67.7	67.8-70.5	70.6-75.9	76.0
174	48.6	48.7-51.5	51.6-68.5	68.6-71.1	71.2-76.5	76.6
175	49.4	49.5-52.3	52.4-69.2	69.3-71.8	71.9-77.2	77.3
176	50.1	50.2-53.0	53.1-69.9	70.0-72.5	72.6-77.9	78.0
177	50.9	51.0-53.8	53.9-70.6	70.7-73.2	73.3-78.6	78.7
178	51.7	51.8-54.6	54.7-71.2	71.3-73.8	73.9-79.1	79.2
179	52.5	52.6-55.4	55.5-71.9	72.0-74.5	74.6-79.8	79.9
180	53.3	534-56.1	56.2-72.4	72.5-75.0	75.1-80.2	80.3

2.Weight for age (Female)

Height (cm)	Weight (Kg)					
	<-2 S.D	-2 SD - + - 1.5 SD	-1.5 SD - + 1.5 SD	>+1.5 SD - + 2 SD	> + 2 SD - + 3 SD	> + 3 S.D
85	9.7	9.8-10.1	10.2-13.5	13.6-14.2	14.3-15.6	15.7
86	9.9	10.0-10.3	10.4-13.8	13.9-14.5	14.6-15.9	16.0
87	10.1	10.2-10.5	10.6-14.0	14.1-14.7	14.8-16.0	16.1
88	10.3	10.4-10.7	10.8-14.3	14.4-15.0	15.1-16.4	16.5
89	10.5	10.6-10.9	11.0-14.6	14.7-15.3	15.4-16.7	16.8
90	10.7	10.8-11.2	11.3-14.8	14.9-15.5	15.6-16.8	16.9
91	10.9	11.0-11.4	11.5-15.1	15.2-15.8	15.9-17.1	17.3
92	11.1	11.2-11.6	11.7-15.4	15.5-16.1	16.2-17.5	17.6
93	11.3	11.4-11.8	11.9-15.7	15.8-16.4	16.5-17.8	17.9
94	11.5	11.6-12.0	12.1-16.0	16.1-16.7	16.8-18.1	18.2
95	11.7	11.8-12.2	12.3-16.2	16.3-17.0	17.1-18.5	18.6
96	12.0	12.1-12.5	12.6-16.5	16.6-17.3	17.4-18.8	18.9
97	12.2	12.3-12.7	12.8-16.9	17.0-17.7	17.8-19.2	19.3
98	12.4	12.5-12.9	13.0-17.2	17.3-18.0	18.1-19.6	19.7
99	12.6	12.7-13.2	13.3-17.6	17.7-18.4	18.5-20.0	20.1
100	12.9	13.0-13.4	13.5-17.9	18.0-18.7	18.8-20.4	20.5
101	13.1	13.2-13.7	13.8-18.2	18.3-19.1	19.2-20.9	21.0
102	13.3	13.4-13.9	14.0-18.5	18.6-19.4	19.5-21.2	21.3
103	13.4	13.5-14.1	14.2-18.9	19.0-19.8	19.9-21.7	21.8
104	13.7	13.8-14.4	14.5-19.2	19.3-20.1	20.2-22.0	22.1
105	13.9	14.0-14.6	14.7-19.6	19.7-20.5	20.6-22.4	22.5
106	14.2	14.3-14.9	15.0-20.0	20.1-20.9	21.0-22.9	23.0
107	14.4	14.5-15.1	15.2-20.3	20.4-21.3	21.4-23.4	23.5
108	14.7	14.8-15.4	15.5-20.7	20.8-21.7	21.8-23.8	23.9
109	14.9	15.0-15.6	15.7-21.1	21.2-22.2	22.3-24.3	24.4
110	15.2	15.3-15.9	16.0-21.5	21.6-22.6	22.7-24.7	24.8
111	15.4	15.5-16.2	16.3-21.9	22.0-23.1	23.2-25.4	25.5
112	15.7	15.8-16.5	16.6-22.3	22.4-23.5	23.6-25.8	25.9
113	16.0	16.1-16.8	16.9-22.8	22.9-24.0	24.1-26.4	26.5
114	16.3	16.4-17.1	17.2-23.2	23.3-24.5	24.6-27.0	27.1
115	16.6	16.7-17.4	17.5-23.7	23.8-25.0	25.1-27.6	27.7
116	16.8	16.9-17.6	17.7-24.3	24.4-25.6	25.7-28.3	28.4
117	17.1	17.2-17.9	18.0-24.7	24.8-26.1	26.2-28.9	29.0
118	17.4	17.5-18.3	18.4-25.3	25.4-26.7	26.8-29.6	29.7
119	17.7	17.8-18.6	18.7-25.8	25.9-27.4	27.5-30.4	30.5
120	18.1	18.2-19.0	19.1-26.5	26.6-28.1	28.2-31.3	31.4
121	18.4	18.5-19.3	19.4-27.1	27.2-28.7	28.8-31.9	32.0
122	18.7	18.8-19.6	19.7-27.7	27.8-29.4	29.5-32.8	32.9
123	19.0	19.1-19.9	20.0-28.4	28.5-30.2	30.3-33.8	33.9
124	19.4	19.5-20.4	20.5-29.1	29.2-30.9	31.0-34.7	34.8
125	19.7	19.8-20.7	20.8-29.8	29.9-31.8	31.9-35.7	35.8

Height (cm)	Weight (Kg)					
	<-2 S.D	-2 SD - + - 1.5 SD	-1.5 SD - + 1.5 SD	>+1.5 SD - + 2 SD	> + 2 SD - + 3 SD	> + 3 S.D
126	19.9	20.0-21.0	21.1-30.5	30.6-32.6	32.7-36.7	36.8
127	20.3	20.4-21.5	21.6-31.3	31.4-33.4	33.5-37.7	37.8
128	20.6	20.7-21.8	21.9-32.0	32.1-34.2	34.3-38.6	38.7
129	21.0	21.1-22.2	22.3-32.8	32.9-35.2	35.3-39.8	39.9
130	21.3	21.4-22.6	22.7-33.7	33.8-36.1	36.2-40.9	41.0
131	21.7	21.8-23.0	23.1-34.5	34.6-37.0	37.1-42.0	42.1
132	22.1	22.2-23.4	23.5-35.3	35.4-37.9	38.0-43.1	43.2
133	22.5	22.6-23.9	24.0-36.2	36.3-38.8	38.9-44.2	44.3
134	22.9	23.0-24.3	24.4-37.1	37.2-39.9	40.0-45.4	45.5
135	23.2	23.3-24.8	24.9-38.0	38.1-40.8	40.9-46.4	46.5
136	23.7	23.8-25.3	25.4-38.9	39.0-41.8	41.9-47.6	47.7
137	24.1	24.2-5.8	25.9-39.8	39.9-42.7	42.8-48.6	48.7
138	24.6	24.7-26.3	26.4-40.6	40.7-43.6	43.7-49.6	49.7
139	25.1	25.2-26.9	27.0-41.6	41.7-44.6	44.7-50.7	50.8
140	25.7	25.8-27.5	27.6-42.4	42.5-45.5	45.6-51.8	51.9
141	26.1	26.2-28.1	28.2-43.4	43.5-46.6	46.7-52.9	53.0
142	26.7	26.8-28.7	28.8-44.3	44.4-47.5	47.6-53.8	53.9
143	27.3	27.4-29.4	29.5-45.2	45.3-48.4	48.5-54.7	54.8
144	28.0	28.1-30.1	30.2-46.1	46.2-49.3	49.4-55.7	55.8
145	28.6	28.7-30.7	30.8-47.0	47.1-50.3	50.4-56.8	56.9
146	29.3	29.4-31.5	31.6-47.9	48.0-51.2	51.3-57.7	57.8
147	30.1	30.2-32.3	32.4-48.8	48.9-52.1	52.2-58.6	58.7
148	30.8	30.9-33.0	33.1-49.7	49.8-53.0	53.1-59.5	59.6
149	31.4	31.5-33.8	33.9-50.5	50.6-53.8	53.9-60.3	60.4
150	32.2	32.3-34.6	34.7-51.4	51.5-54.7	54.8-61.2	61.3
151	33.0	33.1-35.4	35.5-52.2	52.3-55.5	55.6-62.0	62.1
152	33.7	33.8-36.1	36.2-53.0	53.1-56.3	56.4-62.8	62.9
153	34.5	34.6-36.9	37.0-53.8	53.9-57.1	57.2-63.6	63.7
154	35.2	35.3-37.6	37.7-54.6	54.7-57.9	58.0-64.4	64.5
155	35.9	36.0-38.3	38.4-55.4	55.5-58.7	58.8-65.2	65.3
156	36.6	36.7-39.1	39.2-56.2	56.3-59.4	59.5-65.8	65.9
157	37.3	37.4-39.8	39.9-56.9	57.0-60.1	60.2-66.4	66.5
158	38.0	38.1-40.5	40.6-57.6	57.7-60.8	60.9-67.1	67.2
159	38.7	38.8-41.2	41.3-58.3	58.4-61.4	61.5-67.7	67.8
160	39.4	39.5-41.9	42.0-59.0	59.1-62.1	62.2-68.4	68.5
161	40.0	40.1-42.6	42.7-59.7	59.8-62.7	62.8-68.8	68.9
162	40.7	40.8-43.3	43.4-60.3	60.4-63.3	63.4-69.3	69.4
163	41.4	41.5-44.1	44.2-61.1	61.2-64.0	64.1-69.8	69.9
164	42.0	42.1-44.8	44.9-61.7	61.8-64.6	64.7-70.3	70.4
165	42.7	42.8-45.5	45.6-62.3	62.4-65.1	65.2-70.6	70.7
166	43.5	43.6-46.3	46.4-63.0	63.1-65.6	65.7-71.0	71.1

Height (cm)	Weight (Kg)					
	<-2 S.D	**-2 SD - + - 1.5 SD**	**-1.5 SD - + 1.5 SD**	**>+1.5 SD - + 2 SD**	**> + 2 SD - + 3 SD**	**> + 3 S.D**
167	44.2	44.3-47.1	47.2-63.6	63.7-66.2	66.3-71.4	71.5
168	45.0	45.1-47.9	48.0-64.2	64.3-66.7	66.8-71.6	71.7
169	45.8	45.9-48.7	48.8-64.9	65.0-67.3	67.4-72.1	72.2
170	46.7	46.8-49.7	49.8-65.5	65.6-67.7	67.8-72.3	72.4

APPENDIX D

FACTORS RELATED BETWEEN BIVARIATE

Table D1. Number and percentage of children who did exercise by sex

Sex	Exercise				χ^2 (df)	p value
	No		Yes			
	N	(%)	N	(%)		
Male	10	13.51	64	86.49	4.557	0.033
Female	33	26.40	92	73.60	(1)	

Table D2. Number and percentage of children who did exercise by age

Age (years)	Exercise				χ^2 (df)	p value
	No		Yes			
	N	(%)	N	(%)		
6-9	24	24.00	76	76.00	0.679	0.410
10-12	19	19.19	80	80.81	(1)	

Table D3. Number and percentage of children who did exercise by frequency meals

Frequency meals	Exercise				χ^2 (df)	p value
	No		Yes			
	N	(%)	N	(%)		
2	9	27.3	24	72.7	3.279	0.194
2-3	30	32.6	62	67.4	(2)	
>3	4	14.8	23	85.2		

Table D4. Number and percentage of children who did exercise by consume snack

Consume snack	Exercise				χ^2 (df)	p value
	No		Yes			
	N	(%)	N	(%)		
≤ onetime per day	25	22.3	87	77.7	0.077	0.781
> one time per day	18	20.7	69	79.3	(1)	

Table D5. Relationship between Sex of children and frequency consume sugar per week

Sex	Frequency consume sugar						χ^2 (df)	p value
	Everyday		Several day		Never			
	N	(%)	N	(%)	N	(%)		
Male	42	56.7	21	28.5	11	14.8	0.254	0.881
Female	67	53.2	38	30.1	21	16.7	(2)	

Table D6. Relationship between Sex of children and frequency consume fatty meat per week.

Sex	Frequency consume Fatty meat						χ^2 (df)	p value
	Everyday		Several day		Never			
	N	(%)	N	(%)	N	(%)		
Male	23	32.4	28	39.4	20	28.1	1.120	0.571
Female	33	26.2	50	39.7	43	34.1	(2)	

Table D7. Relationship between Sex of children and frequency consume fried food per week.

Sex	Frequency consume fried food						χ^2 (df)	p value
	Everyday		Several day		Never			
	N	(%)	N	(%)	N	(%)		
Male	42	56.8	21	28.3	11	14.9	0.254	0.881
Female	70	55.6	53	42.0	3	2.4	(2)	

Table D8. Relationship between age of children and frequency consume sugar per week

Age (years old)	Frequency consume sugar						χ^2 (df)	p value
	Everyday		Several day		Never			
	N	(%)	N	(%)	N	(%)		
6 - 9	46	45.5	31	30.7	24	23.8	10.785	0.005
10 – 12	63	63.6	28	28.3	8	8.1	(2)	

Table D9. Relationship between age of children and frequency consume fatty meat per week

Age (years old)	Frequency consume fatty meat						χ^2 (df)	p value
	Everyday		Several day		Never			
	N	(%)	N	(%)	N	(%)		
6 - 9	32	32.0	33	33.0	35	35.0	3.240	0.198
10 – 12	26	26.3	45	45.5	28	28.2	(2)	

Table D10. Relationship between age of children and frequency consume fried food per week

Age (years old)	Frequency consume fried food						χ^2 (df)	p value
	Everyday		Several day		Never			
	N	(%)	N	(%)	N	(%)		
6 - 9	49	48.5	46	45.5	6	6.0	6.395	0.041
10 – 12	63	63.6	28	28.3	8	8.1	(2)	

Table D11. Relationship between Age of children and frequency meals

Age (years old)	Frequency meals per day						χ^2 (df)	p value
	2		2-3		>3			
	N	(%)	N	(%)	N	(%)		
6 - 9	16	15.8	74	73.3	11	10.8	1.394	0.498
10 – 12	17	17.2	66	66.7	16	16.1	(2)	

Table D12. Relationship between Age of children and frequency consume snack

Age (years old)	Frequency consume snack/day				χ^2 (df)	p value
	≤ onetime		> onetime			
	N	(%)	N	(%)		
6 - 9	60	59.4	41	40.6	0.961	0.327
10 – 12	52	52.5	47	47.5	(1)	

Table D13. Relationship between the children who have father obese and frequency consume sugar per week

Father obese	Frequency consume sugar						χ^2 (df)	p value
	Everyday		Several day		Never			
	N	(%)	N	(%)	N	(%)		
No	55	55.0	29	29.0	16	16.0	0.361	0.835
Yes	39	55.7	22	31.4	9	12.9	(2)	

Table D14. Relationship between the children who have father obese and frequency consume fatty meat per week

Father obese	Frequency consume fatty meat						χ^2 (df)	p value
	Everyday		Several day		Never			
	N	(%)	N	(%)	N	(%)		
No	29	29.0	42	42.0	29	29.0	0.351	0.839
Yes	23	32.9	27	38.6	20	28.5	(2)	

Table D15. Relationship between the children who have father obese and frequency consume fried food per week

Father obese	Frequency consume fried food						χ^2 (df)	p value
	Everyday		Several day		Never			
	N	(%)	N	(%)	N	(%)		
No	55	55.0	39	39.0	6	6.0	0.254	0.881
Yes	37	52.9	26	37.1	7	10.0	(2)	

Table D16. Relationship between the children who have father obese and frequency consume snack

Father obese	Frequency consume snack/day				χ^2 (df)	p value
	≤ onetime		> onetime			
	N	(%)	N	(%)		
No	60	60.0	40	40.0	1.670	0.196
Yes	35	50.0	35	50.0	(1)	

BIOGRAPHY

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