SUGAR CONSUMPTION WITHIN SCHOOL FOOD ENVIRONMENT AMONG 5TH AND 6TH GRADE PRIMARY SCHOOL STUDENT IN RONGKWANG DISTRICT, PHRAE PROVINCE, THAILAND

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ABSTRACT

This study describes the levels of sugar consumption from snacks and beverages by 5th and 6th grade students in nine primary schools, at Rongkwang district, Phrae province, Thailand. Data were collected by students' self-report, structured questionnaire and observation by the researcher.

Seventy percent of students consumed high levels of sugar (>12 g/day). Average sugar consumption during school hours was 19.11 g/day. Amount of sugar from beverage consumption (12.50 g/day) was approximately 2 times higher than snack consumption (5.33 g/day). Cake/bread and milk (no sugar) were the most available snacks and beverages in school while candy, soft drinks and sweet milk were not found in every school. There was significantly different of sugar consumption among students from 9 schools. Sugar consumption by students in schools that sold fruit juice, syrup water, crispy snack, fruit or protein snacks was significantly different from students in schools that did not sell those types of snacks and beverages ($p<0.05$). The students who received high daily allowances tended to consume high levels of sugar; the results showed significantly different sugar consumption from those who received medium and low daily allowance ($p<0.05$).

Although schools have food policies to reduce sugar consumption, some sweet snacks and beverages were still found in school shops. The nutritional value of food sold in school and regulation of the school food environment, especially availability and accessibility to snacks and sweet beverages should be evaluated and implemented to reduce levels of sugar consumption. Stronger school food policies and partnership between schools, food shops, community and parents are needed to promote healthy school environment.

KEY WORD: SUGAR CONSUMPTION / SCHOOL FOOD ENVIRONMENT

118 pages.

การบริโภคน้ำตาลภายใต้สิ่งแวดล้อมด้านอาหารในโรงเรียนของนักเรียนชั้นประถมศึกษาปีที่ 5 และ 6 ในเขตอำเภอร้องกวาง จังหวัดแพร่ ประเทศไทย

SUGAR CONSUMPTION WITHIN SCHOOL FOOD ENVIRONMENT AMONG 5TH AND 6TH GRADE PRIMARY SCHOOL STUDENT IN RONGKWANG DISTRICT, PHRAE PROVINCE, THAILAND

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บทคัดย่อ

รายงานฉบับนี้ศึกษาระดับการบริโภคน้ำตาลภายใต้สิ่งแวดล้อมด้านอาหารในโรงเรียนของนักเรียนชั้นประถมศึกษาปีที่ 5 และ 6 โดยเก็บข้อมูลจากแบบบันทึกการบริโภคขนมและเครื่องดื่มของนักเรียนภายในโรงเรียน แบบสัมภาษณ์ และ การสำรวจข้อมูลสิ่งแวดล้อมด้านอาหารภายในโรงเรียน ผลการศึกษาพบว่านักเรียนส่วนมากบริโภคน้ำตาลในระดับสูง(71.25%) โดยได้รับน้ำตาลจากการดื่มเครื่องดื่มที่มีรสหวาน (12.50 กรัม/วัน) ซึ่งสูงกว่าขนม (5.33 กรัม/วัน) ประมาณ 2 เท่า นักเรียนบริโภคน้ำตาลในโรงเรียนโดยเฉลี่ยวันละ 19.11 กรัม จากการสำรวจข้อมูลสิ่งแวดล้อมด้านอาหารภายในโรงเรียน พบว่าน้ำผลไม้ และ น้ำหวาน มีจำหน่ายเกือบทุกโรงเรียน (88.88%) แต่ไม่พบการจำหน่ายลูกอม, น้ำอัดลมและนมหวานในแต่ละโรงเรียน นักเรียนแต่ละโรงเรียนมีการบริโภคน้ำตาลแตกต่างกันอย่างมีนัยสำคัญ โดยที่นักเรียนจากโรงเรียนที่ขายน้ำผลไม้, น้ำหวาน, ขนมกรุบกรอบ, ผลไม้ หรือ ขนมประเภทโปรตีน บริโภคน้ำตาลแตกต่างจาก นักเรียนจากโรงเรียนที่ไม่ขายขนมดังกล่าวอย่างมีนัยสำคัญ นอกจากนี้จำนวนร้านค้าในโรงเรียนและนอกโรงเรียนและจำนวนเงินที่นักเรียนได้รับในแต่ละวันที่แตกต่างกันมีผลต่อการบริโภคน้ำตาลของนักเรียนอย่างมีนัยสำคัญ

ถึงแม้โรงเรียนส่วนมากจะมีการกำหนดนโยบายเพื่อลดการบริโภคน้ำตาลของนักเรียน แต่จากการศึกษาพบว่านักเรียนยังบริโภคน้ำตาลในปริมาณสูง และมีการจำหน่ายขนมและเครื่องดื่มที่มีรสหวานในโรงเรียน ดังนั้นการจัดหาอาหารที่มีประโยชน์ให้แก่นักเรียนและ การควบคุมสิ่งแวดล้อมด้านอาหารภายในโรงเรียนโดยเฉพาะการเข้าถึงขนมและเครื่องดื่มที่มีรสหวานควรได้รับการดำเนินการ รวมทั้งนโยบายด้านอาหารที่มีในโรงเรียนควรได้รับการปรับปรุงให้ และเสริมสร้างความเข้มแข็งโดยการมีส่วนร่วมจากผู้ปกครองและชุมชน

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LIST OF ABBREVIATIONS

ANGELO	:	Analysis Grid of Environment Linked to Obesity
BMI	:	Body Mass Index
HDL	:	High Density Lipoprotein
LDL	:	Low Density Lipoprotein
WHO	:	World Health Organization
WHO-NCHS	:	WHO/National Center for Health Statistics
USDA	:	United States Department of Agriculture

CHAPTER I
INTRODUCTION

1.1 Rationale and justification of the study

Sugar is the most common food additives and is used to alter the flavor and properties of food and beverage. The levels of sugar consumption in developing countries have increased dramatically over the last twenty years. According to US Food supply data, American people increased their sugar consumption from 27 teaspoons per person per day in 1970 to 32 teaspoons per person per day in 1996. (1) Sugar consumption in Thailand was also rapidly grown over the past 20 years. According to the Nation Sugar Cane Committee of Thailand, Thai people consumed of 80 g/day of sugar that equal to 20 teaspoon/day and sugar consumption increased from 12.7 kg /person/year in 1983 to 29.9 kg/person/year in 2004.(2)

Health issues related to sugar consumption have been addressed by extensive research. Obesity and dental caries are commonly known results of sugar consumption, and the association between sugar and chronic disease such as diabetes and coronary heart disease are also well established. (3, 4)

Obesity is the result of an imbalance of energy homeostasis. Refined sugar, and sugars in simple carbohydrates like white flour bread, account for most of the weight gain people experience. For people who have low levels of physical activity and high levels of sugar consumption, sugar is definitely a major cause of excess weight.In the United States, the National Health and Nutrition Examination Survey I indicated that increasing carbohydrate intakes is a major cause of obesity. Since the proportion of energy consumption from carbohydrate has increased and the proportion from fat has decreased while the obesity has still increased, this shown that obesity may correlated with sugar consumption more than fat consumption. (5)

Sugar is also known as the cause of tooth decay, and is the major health problem associated with sugar consumption. Oral bacteria living in dental plaque can metabolize sugar into lactic acid which causes oral acidosis. Frequent sugar consumption provides the acidosis condition in oral cavities which contribute to demineralization of tooth surfaces that result in dental caries. (6) The American Dental Association has defined that tooth decay is caused by starchy foods (such as breadsticks, cereals and potato chips) that linger on teeth and prolong acid production. (5)

Sugar consumption causes in increase LDL which is bad cholesterol and decrease HDL or good cholesterol. Sugar also causes hardening of the arteries which contributes directly to heart disease. (7) Furthermore, sugar consumption may play a role in developing Type 2 Diabetes. The studies of the health effect of sugar are also discussing to a role of sugar in developing others health problem like kidney disease, metabolic syndrome, hyperactivity including mental problem such as depression or mood swing. Too much sugar may also lower immune response, which may increase the likelihood of infection. (8)

Currently, the health effect of sugar intake in children is considering. Many chronic diseases in adults have their origins during childhood. Obese children may become obese adults and obese adult are considered a risk group for chronic diseases like diabetic mellitus or coronary heart disease, and those non-communicable diseases can lead to future morbidity and mortality. (9)

Nutrition status is another important health issue related to sugar consumption by children. The National Health and Nutrition Examination Survey III (NHANES III) of 1999–2000 reported that 30% of children aged 6–19 years were overweight or at risk of becoming overweight. The rate of overweight children increased almost three times since the first survey (1971–1974). (10)

Currently, the nutrition status of school – age children in Thailand reveal problems with both over nutrition and under nutrition. According to the Nutritional

Division, Ministry of Public Health, Survey 2005, obesity among primary school students was 13.42% and under nutrition was 9.21% which exceeded target goal of the 9th Nation Economic and Social Development Plan (2002-2005) that aimed to reduce obesity and under nutrition in primary school children to 10% and 8%, respectively. (11)

The food industry expansion in Thailand is one of factor affecting sugar consumption by Thai people. Currently snacks and sweet beverages play a significant role in food consumption of Thai children. A study by the Thailand Health Promotion Fund reported that Thai children spend more than 100,000 million baht on snacks per year. (12)The study about soft drink consumption by 1,582 Thai children from 24 provinces found that the average of soft drink consumption was 211.5 cc /person/day, and that the range of consumption frequency was one to three times per day. (13)

Children always like to have snacks. Moreover, some snacks are nutritional supplements to main meals. A study of snack and beverage consumption in Thai students indicated that the most popular snack of Thai children contained high sugar, starch and fat (11). A study of snack consumption in Thai children in 1995 showed that 36.6% of children consumed sweets, salty and oily snacks, while 12.6 % of children consumed cookies, biscuits or wafers and 12.4% preferred to have candy. (14) A study of sugar consumption among Thai children aged 3-12 years (2005) reported that the children consumed 29.83 g of sugar or 7.5 teaspoons within 24 hours with most of sugar consume in the form of soft drink. (14)

There are many factors associated with eating behavior. Family factors in terms of family meal patterns, and parental role modeling, are shown in many studies to be important influences on children's eating patterns. However, there are some distal factors that also influence children's eating behavior, such as social norms, media messages friend modeling, availability, and accessibility of food. Since school age children spend a substantial amount of time in school. The school food environment is a potential factor that may influence eating behavior. (15) There is evidence that food environment has an impact on American secondary school

students' food choices. According to the previous study, 35% to 40% of children receive main daily energy at school. (16) Recently, research has found that most primary schools sell snacks and sweet beverages to their students although the same schools have regulations or policies to limit unhealthy food in school. (17)

In the USA, the National School Lunch Program was conducted in secondary schools to reduce high fat, sugar and sodium food consumption in school. The Ministry of Public Health of Thailand launched the "Health Promoting School" program and the "Maikinwan Network" to promote a healthy food environment and food policy in primary, secondary and high schools in Thailand. (18, 19) According to previous program and Maikinwan Network, the school food environment might change and influence eating pattern and food choice of the students to differ from the previous time.

Despite the potential impact of the school food environment on students eating behavior were reported, there is little research about sugar consumption levels within primary school students. The aim of this study, therefore, ascertain the levels of sugar consumption by primary school children in Rongkwang district, Phrae province, characterize the school food environment and also described sugar consumption of students by schools food environments.

1.2 Research Questions

1. What is the levels of sugar consumption by primary school students in Rongkwang District, Phrae province?
2. What are the characteristics of the school food environment in primary schools in Rongkwang District, Phrae province?
3. What are the factors relating to sugar consumption by primary school students in Rongkwang District, Phrae province?

1.3 Research Objectives

1.3.1 General objective

To study the levels of sugar consumption within the school food environment by 5th and 6th grade primary school students in Rongkwang.

1.3.2 Specific objectives

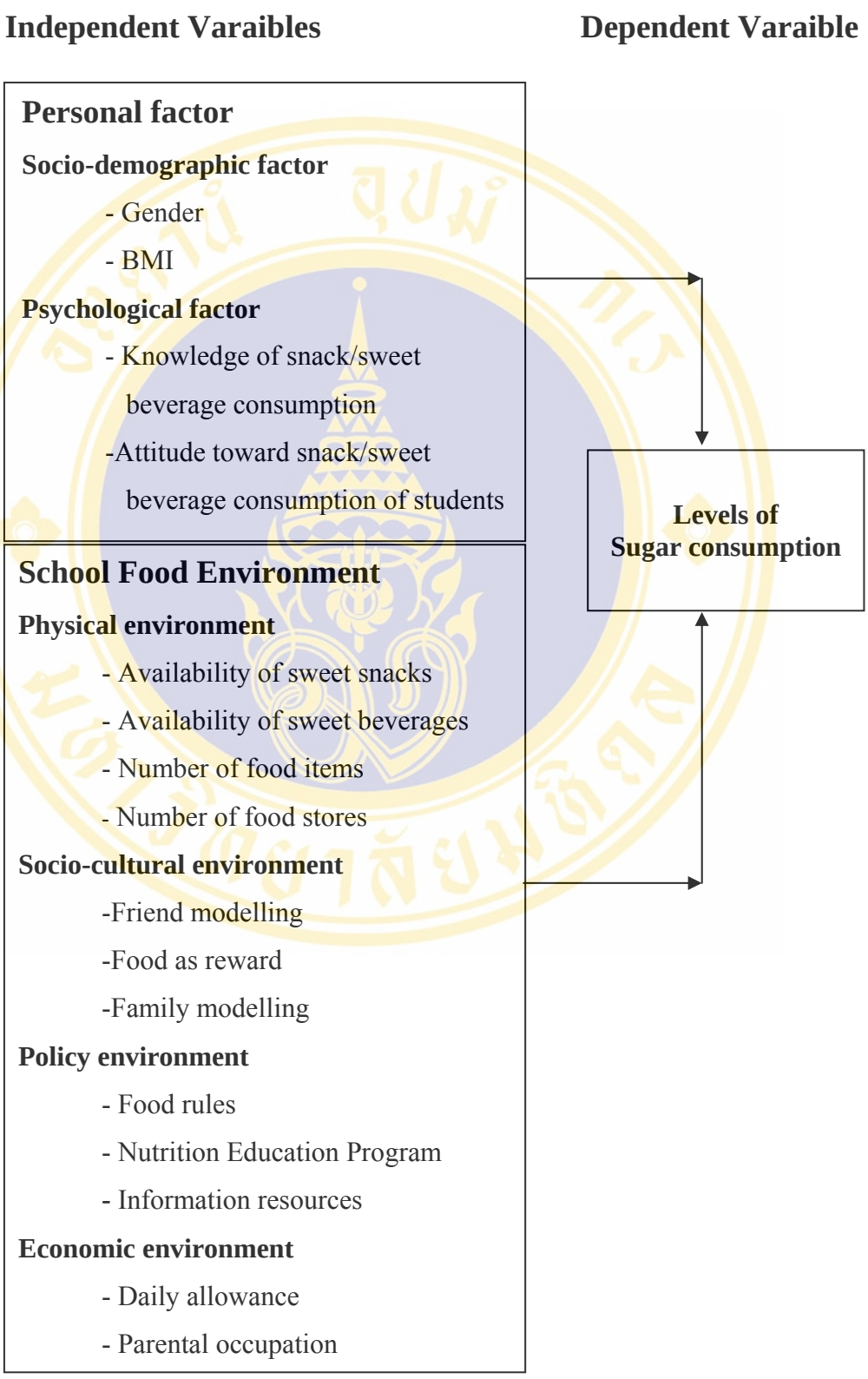
1.3.2.1 To determine the levels of sugar consumption by primary school students in Rongkwang District, Phrae Province;

1.3.2.2 To identify the personal factors of school children in term of gender, body mass index, knowledge and attitude toward snack and sweet beverage consumption**;**

1.3.2.3 To identify the school food environment in terms of the physical, political, socio-cultural and economic environment of the school**;**

1.3.3.4 To describe the sugar consumption by personal factor, physical, political, socio-culture and economic environment;

1.4 Conceptual framework



1.5 Operational definitions

1.5.1 Sugar consumption refers to amount of sugar that student consumed from snacks and beverages during school time. Each items of snacks and sweet beverages which were collected from self-report of food intake by the students were identified the amount of sugar based on sugar index by Maikinwan Network, nutrition fact, and food recipe. Then, amount of sugar were calculated to summarize the average amount of sugar intake in unit gram/day in school. The averages of sugar consumption were categorized into 2 groups: high and low levels of sugar consumption.

According to the National School Lunch program in Thailand project, it reported that 40% of total daily energy required was consumed from school. This study collected data of sugar consumption only during school time; therefore, 40% of maximum sugar consumption recommendation was set cut off point of high and low levels of sugar consumption. The appropriate sugar consumption for whole day should not be more than 6 teaspoons or 30 g recommended by Nutrition Division Ministry of public health. (14) Therefore, 12 g is estimated value as a standard of sugar consumption in school time.

1.5.2 Personal factors

1.5.2.1 Socio-demographic factors includes gender, body mass index.

Gender refers to category of male or female by physical characteristic.

Body mass index (BMI) is analysis of the weight to height of children as (kg/m^2) to estimate how much body fat they have. The BMI of children aged 10 to13 years old is categorized according WHO-NCHS graphs, as follows. (22)

≤ 5 Percentiles curve from growth chart	Underweight
> 5 to 85 Percentile curve from growth chart	Normal
> 85 to 95 Percentiles curve from growth chart	At risk overweight
> 95 Percentile curve from growth chart	Overweigh

1.5.2.2 Psychological factors

Knowledge refers to understanding about the advantages and disadvantages of snacks and sweet beverages consumption related to health. The knowledge of students also includes the content of snacks and sweet beverages and the appropriate amount or healthy amount that can be consumed.

Attitude refers to the opinion or idea of the students about the preference on snack and sweet beverage, effect of snack and sweet beverage consumption on their health, and whether they concern on food selection.

1.5.3 School food environment

School food environment comprises the factors in school and around the school which influence the sugar consumption behavior of students. The school food environments were classified by the ANGELO framework into four groups; physical, socio-cultural, political and economic environment that were measured by interview using structured questionnaire and observation.

1.5.3.1 Physical environment refers to the accessibility and availability of snacks and sweet beverages inside and around the school. The physical environment were observed by the researcher and recorded to school food environment data. In this study the physical environmental factors consist of four factors; availability of snack, availability of beverage, number of food items and number of food stores.

Availability of snacks means the capability of students to obtain the snacks within school and during school time. This study categorized snacks into 8 groups: candy, chocolate, traditional Thai sweets, crispy snacks, cakes, jelly, protein snacks and fruit. These snack items were defined as available, when the researcher observed that they were stocked in school shops.

Availability of beverages means the capability of the students to obtain sweet beverages during school time. This study categorized beverages into 6 groups as fruit juice, milk yogurt, milk, sweet milk, soft drink and syrup water. These sweet beverage items were defined as available when the researcher observed that they were stocked in the school shops.

The number of food items means the number of sweet snacks and beverages items sold by school shops.

The number of food stores in school means the number of food shops, or stores located in school that sell sweet snacks or beverages to the students.

The number of food stores around school means the number of food shops, stores, or supermarkets located in school that sold snacks or beverages to students during school time.

1.5.3.2 Socio-cultural environment means the subjective and descriptive social and cultural norms which influence sugar consumption by students.

Friend modeling means the pattern of snack and sweet beverage consumption by friends who the students perceive the models.

Food as reward means the experience of students that the teacher rewards them with food when they or their friends have done something good. Food as a reward is also including offering food as a gift for special events.

Family modeling means the perception of students regarding parental behavior toward sweet food.

1.5.3.4 Political environment

Food rules mean the rules and regulations in school that the students perceive may influence food choice or availability of snacks and sweet beverages in school.

Nutrition education program refers to any education programs or activity conducted in the school involving food and nutrition, healthy and unhealthy food, and food selection.

Information sources refers to the information or the characteristics of snacks and sweet beverages that the students acquire from any kind of media within school which may influence students' food choices.

1.5.3.5 Economic environment refers to factors that influences the opportunity to purchase snacks or sweet beverages which may be related to sugar consumption behavior. The economic environment includes daily allowance and parents' occupation.

Daily allowance refers to the daily or weekly money that the parents give students to purchase food at school.

Parents' occupation refers to an activity of the parent that serves as their regular source of income or livelihood. The socio-economic status may be estimated from the occupation of parent.

1.6 Limitations of the study

1. Self-report of food intake by students may lead to over or under estimation of sugar consumption.

2. The calculating sugar consumption was estimated, the result may not represent an accurate amount of sugar consumed.

3. Students experience from national and provincial surveys about food and soft drink behavior may lead to response bias.

CHAPTER II
LITERATURE REVIEW

2.1 ANGELO FRAMEWORK

This research focused on school environment as factor influence sugar consumption by primary school children. The analysis grid for environments linked to obesity (ANGELO) framework was followed to classify the environment determinant.

The ANGELO framework was developed by Swinburn et al. in 1999 to conceptualize health behavior environments and enable the identification of potentially successful interventions and strategies. The aim of ANGLEO framework was to understand how the environment affects obesity. The ANGELO framework treated the environment as having two dimensions: size and type of environment on the other axis. The size of environment consisted of the micro and macro environmental settings. Types of environment comprise with physical environment, political environment, socio-cultural environment and economic environment. (20)

2.1.1 Micro Environment setting

The micro environment setting is where groups of people gather for specific purposes which involve food or physical activity, or both. The micro environment is distinguished by geographic factors, usually small, and influenced by individuals. Examples of micro environmental settings are the home, school or neighbourhood. (20)

2.1.2 Macro Environment setting

The macro environment setting is a group of large organizations, industries, and service or supporting infrastructure which influence the food eaten and physical activity. Macro environmental settings are common to large populations and operate at regional, national or international levels. Example of macro environmental settings is food production, food manufacturing, transportation system, food advertising, or health system. (20) Environmental type is classified into four groups as following.

2.1.3 Physical Environment

Physical environment refers to "what is available" and included both visible and less tangible factors such as the availability of food, food shops, and vending machines or the availability of sports facilities, training opportunities or technological innovation. In this study related to sugar consumption, physical environment refers to the availability of sweet food, snacks and sweet beverages shops, and includes the variety of food in those shops. (20)

2.1.4 Economic Environment

Economic environment refers to the cost related to food. In related to food, the major economic influences are the cost of food, or the factors that increase opportunities in food purchasing, such as income, or daily allowances. The economic environment may also be presented in terms of socioeconomic status, education levels and occupation. (20)

2.1.5 Political Environment

Political environment refers to the rules related to food and food activity and included regulations or policies both formal and informal Rules affect food choice

and physical environment. The political environment will influence school meal option and food served at school. At the macro environmental levels government food and nutrition policies, regulations, laws and food industry standards are relevant. (20)

2.1.6 Socio-cultural Environment

Socio- cultural environment refers to community and society beliefs, and attitudes concerning to food and physical activity. These social norms have a powerful effect on the behavior of individual community members. A micro setting in the socio-cultural environment is various explanations as the "culture", "ethos" or "climate" of home, school or workplace. "Health promoting school" is the example of school ethos. Teacher can act role models for the students by food selection, food as reward, and physical activities, all of which can influence students' attitudes, beliefs and values which in turn can result in changed behavior. (20)

Table 1 Example of Micro environmental Settings and Macro environmental Sector

Micro environmental Settings	**Macro environmental Sector**
- Homes, Neighbourhoods - Workplace, Schools - Universities - Community groups (e.g., clubs, churches) - Food marketing (e.g., fast food - Community places (e.g., parks advertising) - Institutions(e.g., hospitals, Shopping malls)	- Technology/design - Media (e.g. magazine,) - Food production/importation - Food manufacturing - Food distribution (e.g., wholesalers) - Sports/leisure industry (e.g., instructor training programs) - Health system (e.g., Ministry of Health, paths, street safety)

Table 2 Analysis Grid for Environments Linked to Obesity (ANGELO)

	Micro Environment (School)	**Macro Environment**
Physical	- Availability of snacks, beverages or fruit - Availability of food shop in school and around school	Availability of certain food in country
Socio-cultural	- Family modeling - Friend modeling -Teacher practice (food as reward)	The culture regarded as appropriated food.
Political	- Family/school food rules - Educational programs - Information source	National school food policies
Economic	- Daily allowance - Family income	Food price policies

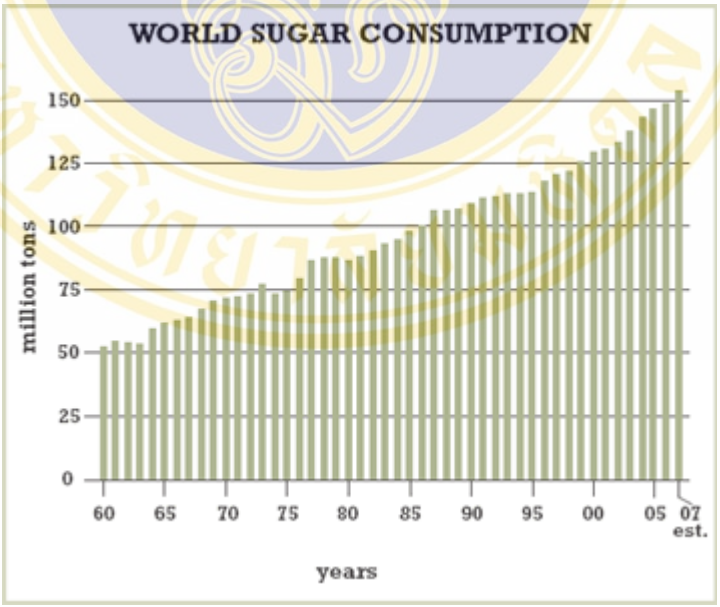
2.2 Sugar consumption

Sugar is a basic carbohydrate existing naturally in foods such as honey and fruit. Sugar is also added in the preparation process for flavour, properties changing and preservative of food and beverages. Sugar exists in most food that people consume especially in desserts, sweet beverages, snacks, soft drinks and sweet fruit. There are various types of sugar depending on the food containing them. The most common are monosaccharide or disaccharide which includes sucrose, lactose,

maltose, and fructose. However the term “sugar,” most people refers to refined sugar which is “Sucrose” or white sugar. (21)

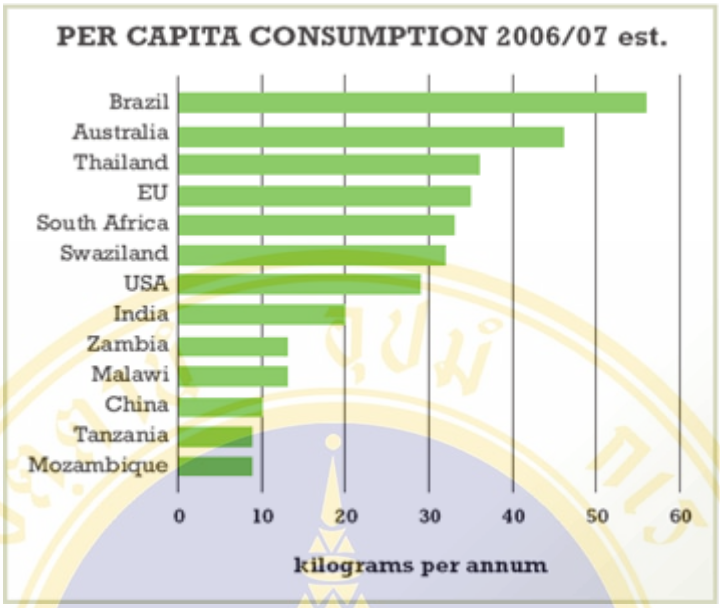
Sugar is necessary for body nutrition as an energy resource especially glucose which necessary for brain function. However inappropriate sugar consumption is one factors causing wide spread disease. For example, frequent sugar consumption causes dental caries, and high of sugar consumption can lead to obesity which is high risk of diabetes or other chronic diseases. (3, 4)

American people increased their sugar consumption from 27 teaspoons per person per day in 1970 to 32 teaspoons per person per day in 1996. (5) The Consumer Health Organization of Canada has reported that the average sugar consumption per person per day increased from 15 pounds per year in 1816 to120 pounds per year in 1955; and in 1990 it was about 180 pounds per person per year. (8)



Source: International sugar statistic

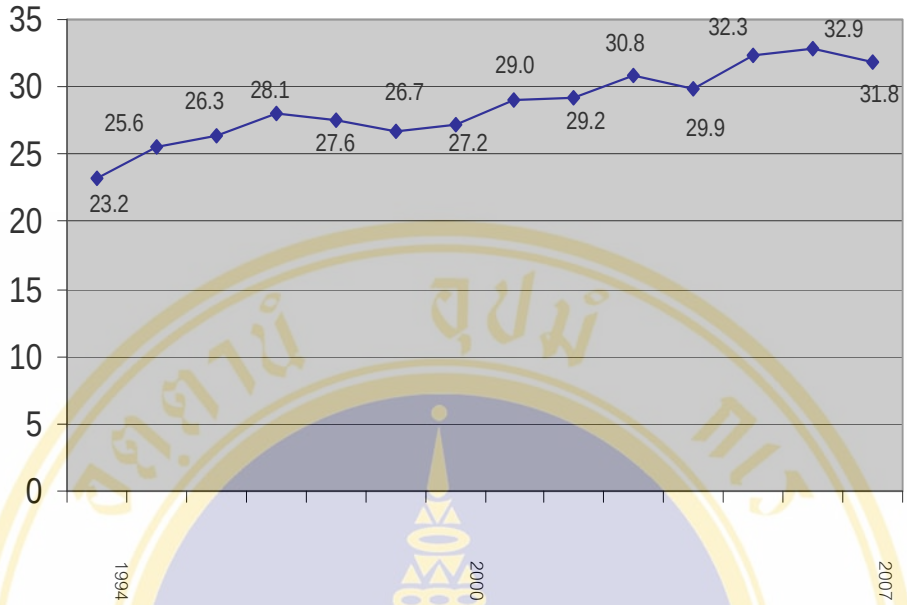
Figure 1 Global sugar consumption continues to increase by about 2% per annum, and in 2006/07 is expected to reach almost 154 million tons.



Source: International sugar statistic

Figure 2 Per capita sugar consumption in sugar producer countries (2006/7)

The Nation Sugar Cane Committee of Thailand reported that the average sugar consumption of Thai people in 2005 was 32.3 kg/person/years or 88 g/day and equal to 22 teaspoons/day. This was very high when compared with the WHO recommendation that appropriate sugar consumption per day should not more than 10% of total daily energy. (22) Sheiham reported under 30 gram of sugar per day should be consumed to prevent dental caries in preschool and primary school children. (3) The Maikinwan Network recommends that Thai children that should not consume more than 6 teaspoons/ day of sugar. (23)



Source: Nation Sugar Cane Committee of Thailand

Figure 3 Sugar consumption of Thai people (1994 – 2007)

The study of snacks and beverages consumption by children aged 3-12 years old in 24 provinces of Thailand by Prasertsom et al. in 2005 found that children have opportunities to consume high amount of sugar from snacks and beverages, especially soft drinks. This result of this study reported that the average sugar consumption from beverages was 6.96 tsp/person/day with most of sugar coming from soft drinks. The average amount of sugar consumed from snacks was 2.82 teaspoons/person/day, and the total of sugar consumption from all snacks and beverages was 10.2 teaspoons/person/day, a very high amount for children. (14)

Eating behavior develops in children at a very young age. Humans naturally tend to prefer sweet food. (3) A study of snacks and beverages behavior of children aged 10 to 12 years old in Nakornprathom province found that the eating behavior of parents and caregivers related to children eating behaviour. (11) Even though sugar is not addictive, long period of high sugar consumption leads to a condition of “sugar dependency”. (24)

2.2.1 Sugar consumption and obesity

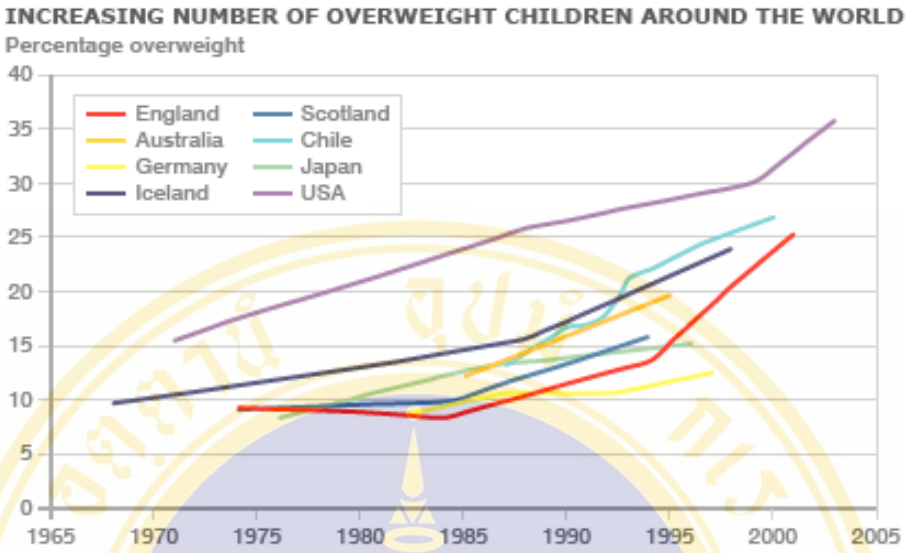
Prevalence of obesity in the United States has increased dramatically in the last 30 years. (1) The observed increase has been reported in all age groups, including children. Even of 2- to 5-year-old children, the prevalence of overweight has increased 2times, from 5% in 1980 to 10.4% in 2000, with the highest prevalence (11.1%) reported of Mexican Americans. (1)

Overweight children are at increased risk for many health problems including diabetes, abnormal glucose tolerance, high blood pressure, and altered lipid profiles as well as psychosocial consequences (3, 4, 7). In addition, overweight children are at significantly increased risk for adult obesity (3).

Overweight occurs when there is an imbalance between energy consumption and energy expenditure. In the United States, dietary consumption patterns of children have changed dramatically since the 1970s, with increased consumption of energy-dense foods. Today, the daily food consumption of children is excessively high in added sugar and discretionary fat, accounting for 40% of total energy consumption. (31) Sugar-sweetened beveragess such as soft drinks and fruit drinks are the primary source of added sugar in a child's daily diet. (30) In fact, total energy consumption of 2- to 18-year-old children was ~10% greater of children who consumed soft drinks than those who did not. (9)

The rate of sugar-sweetened soft drink consumption by children has increased in parallel with child obesity in the past 30 years. (30) Furthermore, soft drinks contributed a higher proportion of energy for overweight than for non-overweight children. Even the 2 to 5 year old children, soft drinks contributed 3.1% of energy consumption in overweight children compared with 2.4% of non-overweight children. (70)

A 2002 study carried out by the Asian Food Information Center in Malaysia, Thailand, the Philippines and Hong Kong found that one in four kids aged 10-12 was overweight or obese. In Thailand, the rate of obesity in kids between 5 and 12 rs years old rose from 12 to 16 percent in just two years.(12)



Source: Government office for sciences

Figure 4 In 2007, an estimated 22 million children under the age of 5 years were overweight throughout the world. (WHO)

2.2.2 Sugar consumption and dental caries

Oral bacteria ferment carbohydrates and produce acid, which dissolves tooth enamel during the dental caries process; thus, sweetened foods are likely to increase risk of dental caries. (3)

Eating patterns and food choices of children and adolescence are important factors that affect how quickly youngsters may develop tooth caries. This reason is a sticky film of bacteria, called “plaque” that constantly forms on the teeth and gums. Each and every time bacteria come in contact with attacks the teeth for 20 minutes or more. This eventually can result in tooth caries. (23)

The USDA’s Dietary Guidelines encourage consumer to limit consumption of beverages and food high in added sugars that may crowd out other health foods from their daily diet. Many studies identifies soft drink as a major source of added sugar.(13,14,43) American people drink more than 53 gallons of soft drink per person in 2000.(29) This amount was higher than all other beverages.

Although there are few studies reported in scientific literature that specifically evaluate the role of soft drinks in the development of tooth caries. There is a positive association between consumption, especially heavy consumption, of sugar-containing soft drinks and risk of developing tooth caries. (75)

Ismail et al. (76) reported a strong association between caries experience and soft drink consumption during meals in 9- to 29-year-olds participating in the National Health and Nutrition Examination Survey I. Caries experience was also associated with an increased soft drink to energy ratio in 5- and 13-year-old but not 9-year-old children.(77) Caries presence in the upper anterior teeth of 2-year-olds was associated with increased frequency of sugary snacks, particularly sweetened beverages.(78) Conversely, Gibson et al.(79) did not find an association between caries experience and soft drinks in 1.5- to 4.5-year-old children participating in the British National Diet and Nutrition Survey. Caries experience of 5- to 14-year-old school children was not associated with consumption of either soft drinks or liquids with a high content of fructose and/or sucrose. (80) In a study of competitive athletes, caries experience was not associated with sports drink consumption. (81)

2.3 Maikinwan Network

Maikinwan Network an organization established in 2003 by a dentists, pediatrics, dietetics and scholars which was concerned with the effect of high sugar consumption in children. Information and knowledge about sweet snacks and beverages consumption, including their impact on child health in the dental caries and obesity, as distributed to the public by this organization in order to force the formulation of a public health policy for solving the health problems of Thai children cause by sugar consumption. The Maikinwan Network was supported by the Thailand Health Promotion Fund and coordinated with other agencies such as the Nutritional Division which works under the supervision of the Ministry of Public Health. (18)

In addition to public motivation about the sugar effect, the Maikinwan Network also supported research related to sugar consumption its effect on health. A study of snacks consumption by Thai children aged 3 to15 years old was undertaken in 2004 to describe snacks consumption behavior and assess the amount of sugar consumed from snacks by Thai children. Maikinwan Organization also provided the data base of sugar contain in snacks including candy, soft drink, ice cream, sweet beverages and milk. According to sugar index of Maikinwan Network that divided all sweet items into 9 groups, currently they report sugar index of more than 1,000 items through www.maikinwan.com that continuously update the data. (18)

The amount of sugar contained in snacks and sweet beverages based on the Maikinwan Network sugar index was calculated to find out the sugar consumption of primary school students in Rongkwang, Phrae province.

2.4 Personal factors

2.4.1 Socio - demographic characteristics

Eating behavior of different socio-demographic groups has varied food consumption habit. The different of food consumption across the variation of gender, age, household size, family income, and education levels were reported in many studies. (25)

Gender

Studies of gender related to food consumption have highlighted different eating behaviors in terms of type of food and attitude to food consumption. It is widely argued that eating behavior is a gender role for females in western society. The high calories of sweet food and fat which lead to weight gain cause women to be more likely to have low food consumption than male. (26) The gender factors have also been observed in children: boys similarly tend to have higher energy consumptions from fat and protein while girls are more likely to consume fruit and vegetables. (27)

BMI

BMI is defined as an individual's body weight divided by the square of their height. The universal formula used in unit of measure of kg/m^2. BMI is used to assess how much an individual's body weight departs from the desirable norm for a person of his or her height. The excess weight may be accounted for by body fat. Human BMI rank along the index from15 to 40 and could categories to be underweight, normal weight, overweight, obesity and morbidity obese. The BMI index is different for children. It is calculated in the same way as for adults but assess by WHO – NCHS classification graph. (28)

≤ 5 Percentiles curve from growth chart	Underweight
> 5 - 85 Percentile curve from growth chart	Normal
> 85 - 95 Percentiles curve from growth chart	At risk overweight
> 95 Percentile curve from growth chart	Overweight

Obese and overweigh children are serious public health problem. Although the cause of the obesity epidemic is like to be multi-factorial, the consumption of sugar sweetened beverages has been identified as a major contributor to this problem.(29) Ludwig et al. reported that children who drink sugar sweetened every day were 6 times more or risk to obesity than those who did not drink. Malik et al. reported a greater consumption of sweet beverages is associated with weight gain and obesity. (30)

In the short term, most people effectively compensate for excess energy consumption by eating less at main meals. But in the long term, changes in bodyweight lead to physiological adaptations, including hunger and metabolism rate. There is no clear evidence that sugar consumptions affected food consumption causes obesity. However, a meta-analysis of the available research suggests that compensation at main meals for energy consumption inform of a liquid were less complete than solid from of food. The role of sugar consumption in the development of obesity has received attention by politicians and scientists.

Measuring body weight was applied to examine the long term effects of sugar-sweetened consumption. (29)

Recently, an investigation or sweet beverages consumption and weight gain has come to a different conclusion. A current meta-analysis found that sweet beverages consumption had little effect on weight gain in children. (30) The study in the United States found that relationship between sugar consumption from sweet beverages and the BMI of children and adolescents was near zero, which is not statistically significant. (31)

2.4.2 Psychological factors

Knowledge of snacks and sweet beverages consumption

There have been several studies about knowledge and eating behavior, Kolodinsky et al. in 2007 reported examined the relationship between self-reported eating behaviors and nutrition knowledge in 200 college students, and concluded that increased knowledge of dietary guidance is related to meeting the *Dietary Guidelines for Americans 2005*.(32) Other studies have reported the different results, Pirouznia in 2001 reported that there was no correlation between nutrition knowledge and food choices in sixth-grade male or female students. However, a study of American students found that there was a correlation between nutrition knowledge and food choices for girls in the seventh and eighth grades. In addition, there was a correlation between nutrition knowledge and food choices for boys in the seventh and eighth grades.(33) Jamkrathuk studied in factors related to fast food eating behavior of high school students, and found that there was no relationship between nutritional knowledge and eating behaviour.(11)

Therefore, is controversial in the relationship between knowledge of food and nutrition and eating behaviour. However, most school food policies include the nutritional education as the important strategy.

Attitude toward snacks and sweet beverages consumption

Many studies have examined the relationship between attitude towards food and eating behavior. A study of the factors related to snacks and sweet beverages consumption behavior of primary school children aged 10 -12 years old in Nakornprathom province by Buathong 2007(11), revealed that there is an association between attitude towards snacks and sweet beverages consumption by the primary school students and their eating behavior. Klazine van der Horst et al. 2008 studied the school food environment and factors related to snacks and soft drink consumption among 1293 adolescents aged 12–15 years old. The results showed positive associations between students' cognitions and soft drink and snacks consumption. The previous study also indicated that association of such cognitions, were stronger than environmental factors. (34)

2.5 School Food Environment

Even though individual factors have a major effect on diet behavior, the environment also plays a role in influencing eating habits. The school food environment was mentioned as the potential impact on student's food choice and dietary quality. Schools can provide healthy food and nutritional education programs to decrease consumption of unhealthy food, such as food high in fat of sugar and soft drinks. (35)

The aim of researcher was to describe sugar consumption by students in the school food environment which by focusing on potential impact environment to levels of sugar consumption. According to the ANGELO frame work the school food environment is classified as physical, political, socio-cultural and economic type of environment. (20)

2.5.1. Physical environment

Availability of snacks and sweet beverages

French et al. in 2003 studied the food environment in secondary school in Minnesota, U.S.A. and described that high availability of and ready access to snacks, soft drinks or high fat/sugar food sends the message that these foods are acceptable and may encourage students to choose these foods instead of school meals. (33) However, a study of the school food environment and soft drink/snacks consumption by Rotterdam school children by Klazine van der Horst et al. in 2008 indicated that there is little evidence for associations of environmental factors in the school environment with soft drink and snacks consumption. (34)

In this study, the availability of food was divided in to snacks group and sweet beverages groups. A study of snacks and beverages consumption by children aged 3-12 years old in 24 provinces of Thailand by Prasertsom et al. in 2005 found that most sugar consumption came from beverages. (14)

Number of food shops

The environmental factor that affects eating behavior is the opportunity to access food including convenience to consume. The nutritional environment influences both healthy and unhealthy dietary behaviour. (36) Normally, primary school students do not select food based on nutritional value but rely on their preference. For this reason, students will probably consume healthy food if a school provides proper healthy food environment and closely supervision the school canteen and school store. (11) The role of the school neighbourhood environment for students food consumption is increased being recognized.(37) Food stores affect eating behaviour was described in previous study that too many food shops influenced inappropriate eating behavior of the students. (38) Overcrowding is a characteristic of disadvantaged neighbourhoods and has been shown to have an association with a variety poor health behavior. The study by Angela et al. 2007 revealed that food stores environment was related to obesity risk. As expected, obesity is more common in areas with grocery and convenience stores. (37)

However, the study by Putthachad et al. indicated that the eating behavior of overweight students in primary school in Bangkok was not significantly associated with food resource. In addition, there was an inverse association between the distance to the nearest store, and the number of small food stores, with soft drink consumption. (11)

The present study observed food shops that sold snacks or beverages that locate in and around schools. Students could access to food shops by walking within 10 minutes from school.

2.5.2 Political Environment

The School Lunch Programs shows concerning about nutrition and food in school meals. According to the Health Promoting School project that was launched in primary schools by the Ministry of Public Health in collaboration with Ministry of Education, food safety is one policy to improve the quality of food in schools. (39) Cassady et al. in 2006 reported that, increased the amount of fruit and vegetables in snack menus or food programs related to increased fruit consumption of students. (40)

The present study included food rules, nutrition education programs and information source about snacks and beverages as aspects of the political environment, and described the role and impact of each variable on sugar consumption in school.

Food rule

In U.S.A., Nutritional research on the role of school food policies for obese students showed that increased access to low nutrition food and beverages sold in school is associated with increased consumption of these items. (41)

Dainne Neumark-Sztainer et al. 2008 found that decreased access to high fat and sugar food was associated with less frequent purchase of these

items by high school students.(42) Carine Vereecken1 et al. 2008 studied the school food policies at primary and secondary schools in Belgium-Flanders, and how they influence young people's food habits. That study indicated that restriction of food items in school can make a difference to the consumption of unhealthy food, and that restricted consumption of sweet beverages is associated with lower soft drink consumption. (43)

The descriptive study by Neumark – Sztainer et al., 2005, reported decreasing access to food high in fats and sugar school food policy was association with less frequent consumption of these items by high school students. (42) The school environment can provide daily healthy snacks with the intention of increasing student's familiarity with nutritious food and helping them to develop eating beharvior by oral encouragement. (44) Taste preference is one of the strongest predictors of food in consumption by childhood. (45)

However, there are the studies about food rules in family environment, which suggest a negative association between food rules and food consumption by children. Parental pressure to eat fruit has been found to discourage consumption of fruit of girls. (46) Brown and Ogden reported that parent attempts to control children's food consumption had a negative impacted consumption of unhealthy and healthful snacks. (46)

Restricted access to vending machine was not related to sweetened beverages consumption in secondary school. Moreover school food policies in elementary school had no significant association with sweetened beverages consumption obtained at school. (47)

Nutrition education programs

The goal of nutrition education programs in schools is to motivate students to adopt a healthy diet, including physical activity. The outcomes of good nutrition education programs are not only better physical health and reduced susceptibility to disease but also enhanced cognitive development.(45) The innate

preference of children for sweet tastes lead to the risk of health problems.(48) Children need to be introduced to a variety of nutritious foods in a positive manner. Effective nutrition education helps to assist students in develop how to select healthy diets. The study in 1st grade students after implementation Nutri-Active Healthy Experience programs in school, the group showed 25.70% improvement in choosing more healthful snacks and the comparison group show 18.20% decline. (50)

Most schools that have implemented the health promoting school project include nutrition education programs to increase knowledge or encourage good attitudes of students toward snacks and sweet beverages consumption.(39) Even some previous study has shown the low potential of nutrition education programs on eating behavior, many recommendation for school base healthy eating programs still added nutrition education programs toward food nutrition and in guideline.(39) Vereecken et al. 2008 conducted a study of food consumption by preschool children. The result revealed that there was no association between food consumption and education programs for the preschoolers. (51)

Sources of information about snacks and beverages

Current research suggests an association between healthy eating behavior and sources of information like family, parents, peers, education material and media. The family was identified as a common potential source of information which can encourage both healthy and unhealthy food habits.(52) Nowadays, advertising media are also considered as the important information sources that affect children's food choices, especially regarding snacks and beverages that are high in fat, sodium or sugar**.** A reported in 2003 indicated that advertising affects children's food and beverages preferences, purchase requests, and short-term consumption. (53) However, the children understood the purpose of advertising media and identified positive and negative nutrition attributes of foods, but they were equally influence by information about taste of food and interested premium. (54)

Teachers and friends were not the main source of information for food and nutrition, but friends were considered to be facilitators of student's food

choices. Peers tend to encourage unhealthy food habits through pressure from friend groups. Previous study has shown the association between healthy eating behaviors and information from leaflets and health education in school of 1st year Mahidol University students. Furthermore, a study of adults aged 18 to 55 years showed that relatives, friends and health professionals were more trusted sources of healthy eating information than advertisements. (55)

2.5.3 Socio-cultural Environment

Social influences on food consumption referred to the impact that one or more persons have on the dietary behavior of others, either directly or indirectly. Even when eating alone, food choice is influenced by social factors because attitudes and habits develop through interaction with others. (47) People eat more with friends and family than alone, and the quantity of food increases as the number of fellow diners grows. (56)

Parents and teachers are important constituents of the school community. Teaches and other caregivers are important for the development of children's food habits. (57) A study of the opinion of parents and teachers toward school food environment found that most teachers believed that it was important to have a written nutrition policy. They also recognized the school environment related to healthy food choices for students. (58)

Food as reward

The use of food as a reward is common in many cultures and may contribute to a preference for such food. Zimmerman, and Hind, 1980, investigated the effect of social context on child food preference. They found that when both sweet and non sweet food was given as a reward by adult, the preference for that food was showed. (59)

Since parents and teachers play a role in the development of students' food habits, when they attempted to influenced the students food with rules

especially for elicit desired performance (e.g. “You will get a snacks if you finish your work early”), this restriction or rules might affected child behavior and belief. The impact of these rules on eating behavior has important implications for parents and teachers who try to develop students’ eating behaviours. (46)

A study of family food rules found that the respondents who remembered that their behavior had been control through reward or punishment, had higher rates of binge eating.(60) The similarity was found by Brink et al. that reported dieters recalled food being used as a reward or punishment.

Using food as a reward to influence children’s desired behavior is an effective strategy that parents and teachers have traditionally used. Moreover, media advertising also promotes the use of food to make children feel better and encourages parents to express their love through sweets. The study showed that offering sweets or dessert as a reward is an effective way to convince children to eat novel foods, and their preference for certain foods increased when the same foods was used as rewards. (60)

Unfortunately while food could reinforce a child’s behavior in the short term, their practice can also play a role in establishing their child’s preference for unhealthy foods, and may communicate a mixed message to children about role of such food. While parents or teachers encourage children to eat healthy food, children simultaneously learn to consume unhealthy food by being good. (60)

Family model

Many factors influence children eating behavior. External factors or environmental factors and their roles, have been described in several scientific studies. The varied element of the food environment around children, including family, relatives, friends, teachers, communities and schools have both negative and positive impacts on children’s food habits.(61)

Families and parents are particularly significant because they are simultaneously part of physical and social environments. They also influence children's behaviors, habits, and attitudes through socialization processes and modelling. According to the ANGELO classification, the family is involved in all aspects of a students' microenvironment setting. (20)

Parents can provide access to food and can restrict or reduce access to particular kinds of food. Although parents cannot control all aspects of a child's day, they can moderate type and availability of food feeding practices. Parental modelling of eating habits can shape children's value beliefs and behavior that might be also influences their eating pattern in school. (62)

Friend Model

The factor that may influence youth's eating behavior is the social environment. Friend model was identified as powerful factors to encourage food acceptance during preschool lunch.(63) Peers are part of the social environment that affected eating behavior. Adolescent girls eat twice as much in the presence of overweight peers than in the presence of leaner peers was. Young children are not capable of planning their well-balanced diet, for them eating is a social response. Eating the same food as their peers helps them make friends easily. (64)

A study of Australia children indicated that peer pressure was a major barrier to eating healthy food. However peers could facilitate either healthy or unhealthy consumption behavior. (65) When children start going to school, they expand their society to include their school and friends, which became more influence on their life styles including their food choices. When the students have lunch or eat between meals with their friends, they learn new pattern of eating behavior from their peers. (64)

2.5.4 Economic Environment

Daily allowance

Almost all students receive money for purchasing food at school; the amount of money depends on parental or family income. The daily allowance affects the opportunity and potentiality to buy favourite food during school day. The national school lunch programs provide a main meal at lunch time for all students. Daily allowance was pay for food between meals that mostly were snacks or beverages. Buantong reported that 40% of students pay money for beverages and 37.50% pay for candy and sweet gum. (11)

Puthachat reported that daily allowances ranged from 20 – 30 baht per day and were used for purchasing lunch and snacks or beverages. Since students had an independent ability to purchase with their own money, students who received high daily allowance had more chance to consume both healthy and unhealthy food. The study of high school students found that there was a relationship between the daily allowance and dietary behavior during lunch time. (11)

However, some studies reported different results, and even the students have different daily allowances, their eating behavior was not different. (11) A similar result was found by Sawang .

Parental occupation

Parental occupation in this study was used to estimate socio-economic status of family. According to the ANGELO frame work, socio-economic norm needed was included in economic environment. The economic environment is not only important in term of cost, income, the factors that have effect to income such as education, occupation were also considered as determinant of food consumption and food choice. In developed country higher socioeconomic status, education levels, and occupations tend to have associated with a lower prevalence of obesity. (20)

The relationship between socio-economic status and poor health is complicated and is influenced by others factors such as gender, age, culture, environment, social and community networks, individual lifestyle factors and health behaviour. (66) Population studies in Europe have shown that socioeconomic status affects food consumptions. Low-income groups in particular, have a greater tendency to consume unbalanced diets and have low consumptions of fruit and vegetables. (2) This leads to both under-nutrition and over-nutrition of community members. The disadvantaged also develop chronic diseases at an earlier age compared with higher socio-economic groups usually identified by educational and occupational levels.

Parental occupation has been found to affect the food consumption of children. The quality of food and frequency of food consumed by children whose mother worked nearby or at home were better than the quality of food and frequency of food consumed by children whose mother worked further away. (11) However, the parental occupation was also found to be not related to food consumption by the students. (11)

CHAPTER III
RESEARCH METHODOLOGY

3.1 Study design

This study used a cross-sectional descriptive design to study the levels of sugar consumption within school food environment among 5th and 6th grade students at Rongkwang district, Phrae province Thailand

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3.2 Study population

The study population includes the 5th and 6th grade students in primary school in Rongkwang district, Phrae province. Samples were selected from students in 5th and 6th grade according to criteria as follow.

1. The student who can read and write Thai language and record the self-report of food consumption completely.
2. The student who willing to participate in this study by sign in participation information sheet and inform consent form.
3. The student who has the permission from his/her guardian to participate in this study, and guardian has signed in the participation information sheet and informed consent form.

3.3 Sample Size

In 2008 there are 32 schools primary school in Rongkwang district, Phrae province and the total number of students in 5^{th} and 6^{th} are 1,204 students.

To determining the sample size, the following Yamane formula was used

$$n = \frac{N}{1+ N (e)^2} = 300$$

n = Estimate sample size

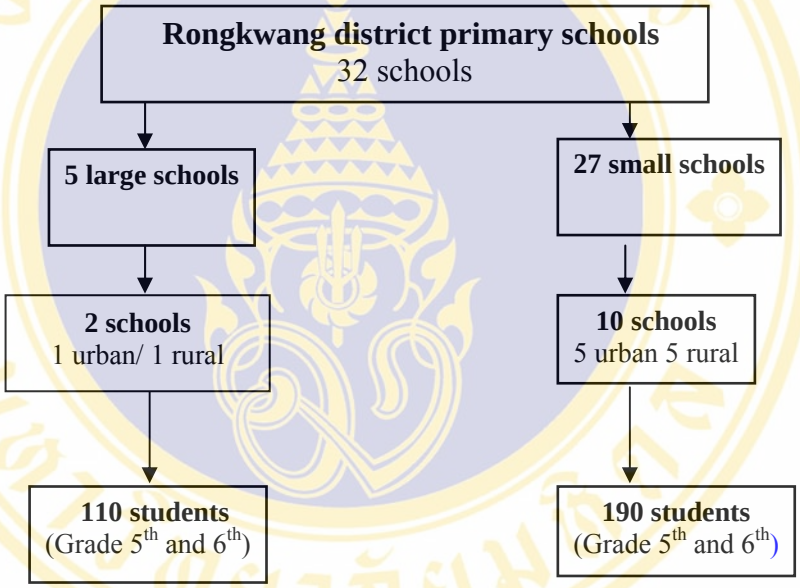
N = Total number of population (1,204)

e = degree of variation, maximum is 5%

According to the above calculation, the required sample size should not less than 300.

3.4 Sampling Technique

For the data collection, the 32 primary schools in Rongkwang were stratified into large school and small school. The large school refers to primary school that number of the students was equal to or more than 200 students and small school refers to primary school that number of the students is less than 200 students. Each stratum was then divided into school in rural area and urban area by random sampling. The sampling frame shown as below



3.5 Research instrument

The instruments used in this study were self- reports of food intake, structured questionnaire, and observational checklist for the school food environment.

3.5.1 Self – report of food consumption

"Self – report of food consumption were given to students who participate in the study and requested them to record type, trade name, number and size of the snacks and beverages they consumed during school time. School time were divided into 3 times; morning (before class), lunch (after had lunch), and after school hours

(after class/before went back home). The students reported their food consumption for three days; Tuesday, Wednesday and Thursday in the same week.

The amount of sugar consumption was assessed by Maikinwan sugar index to identify the amount of sugar that students consumed. For snacks and beverages that could not find in Maikinwan sugar index, the food recipe and nutrition fact that showed on food package were used to estimate amount of sugar of those snacks and beverages. The maximum of appropriated sugar consumption for school time in this study was 12 g / day in school. Sugar consumption was classified to be high and low level by using 12 g/day as the cut off point.

3.5.2 Questionnaire

A structured questionnaire was developed by the researcher and was used as the research instrument for data collection. Preliminary, the questionnaire were developed in English, and then translated to Thai. The questions were divided into 4 parts as follows:

Part I. : The socio – demographic characteristic. (11 questions)
Part II. : The knowledge on snacks and sweet beverages consumption. (13 questions)
Part III : The attitude on snacks and sweet beverages consumption. (13 questions)
Part IV : The school food environment on students' perception. (27questions)

Socio – demographic

This part included students' age, body weight and height, number of family, grade, gender, religion, parent's occupation and present disease were obtain.

Knowledge about snacks and sweet beverages consumption

It consisted of 13 questions about effect on health and ingredient of snacks and beverages. The score was given for each question according to the answers; 1 for correct answers and 0 for incorrect answer. The students' knowledge was divided into 2 groups: good and poor knowledge by using mean of knowledge score as the cut of point.

Attitude toward snacks and sweet beverages consumption

There were 13 questions which involve the attitude toward snacks and sweet beverages consumption of students in the school. The score was given as followed.

Positive statement		Negative statement	
Agree	score 3	Agree	score 1
Undecided	score 2	Undecided	score 2
Disagree	score 1	Disagree	score 3

Total score ranged from 13 - 39. The students' attitude toward sweet snacks and beverages were classified to be 3 groups: positive, neutral and negative attitude by using quartile 1 and 3 as the cut of point.

Socio-cultural environment

Friend modelling

This part consists of 10 questions which asked about having friend modelling and asked about frequency of friend modelling. Having friend modelling was asked by Yes or No questions, "Yes" answer, and "No" answer were score by 1 and 0 respectively. Total score then range from 0-5. The students were classified to 2 groups: have friend modeling and not have friend modeling according to median of total score as the cut of point.

Food as reward

The question for food as reward variable consists of 2 questions. The answers for food as reward were “always” or “sometime” or “never”. The “always” answer was scored by 3, “sometime” was scored by 2 and “never” was scored by 1 and total score could be ranged from 2-6. The students who have experience of food as reward or students who did not have experience of food as reward were categorized by median of total score.

Family modelling

The family modelling variable was asked by 3 questions about family practice. The answers for family practice were “always” or “sometime” or “never”. The “always”, “sometime”, “never” were scored by 3, 2 and 1 respectively. The total score ranged from 3-9. The family modelling was categorized by using median of total as cut of point for students who have family practice or did not have family practice on sugar consumption.

Political Environment

Food rules

The questions of food rules consist of 3 questions. The answer for each question could be “Yes” or “No” which “Yes” answer was scored by 1 and “No” was scored by 0, total score ranged from 0-3. According to Best rating criteria, total score was categorized to 2 groups as follows

≥2 Have awareness on school food rules

<2 Do not have awareness on school food rules

Nutrition Education program

The nutrition education programs were measured by 4 questions base on Health Promoting School guideline. The answer could be “Yes” or “No” which “Yes” answer was score by 1 and “No” was score by 0, total score ranged from 0-4. The students were classified to be 2 groups. Students who answer “Yes” to

all questions referred to" Received all of nutrition education programs". Students who answer "Yes" to some question and were defined as "Received some of nutrition education program".

Information about snacks and beverages

This part consists of 2 questions. The answer for receiving information about snacks and sweet beverages from school was "Yes" or "No". The students who selected "Yes" had to continue on the next question that asked for source of information about snacks and beverages. There were 11 choices for source of information that the students could choose more than 1 choice.

Economic environment

The economic part included daily allowance. The questions for daily allowance of the students data was "How much daily allowance you received from your parent?" in unit baht/day. The daily allowance were categories into three group: Low, Medium, and High by using quartile as the cut of point

3.5.3 Observation of Physical environment

Availability of snacks

According to Maikinwan sugar index, snacks were categories into 8 groups: candy, chocolate, Thai dessert, cake or bread, crispy snacks, ice cream, and protein snacks. The availability of snacks was recorded as absence or presence in school, and numbers of snack items of each category were also recorded.

Availability of sweet beverages

7 Items of beverages were observed in school: fruit juice, milk (no sugar), milk yogurt, sweet milk, syrup water, and soft drink. The availability of beverages was recorded as absence or presence in school, and numbers of beverage items of each category were also recorded.

Number of food store.

The total numbers of food store in school and around school were recorded by researcher, and the total numbers were then categorized into 2 groups by using median as the cut of point.

3.6 Data Collection Method

After received the permission from Ethics Committee of Mahidol University, and the permission from all people including principal of primary school, the students and their guardians the data collection was then took place with the self - report of food consumption distributed to all participants before they went back home in order to record their snacks and beverages consumption during school hour. This procedure was conducted for three times in the same week (Tuesday, Wednesday and Thursday). Four interviewers then interviewed students by using structured questionnaire about snacks and sweet beverages consumption in separated room for 20 minutes. The observation of school food environment performed in the last step.

3.7 Data Analysis

Descriptive statistic was used to describe the socio-demographic, attitude and knowledge about snacks and sweet beverages consumption of the students, physical, socio-cultural, political and economic environment, and sugar consumption. Inferential statistics: both parametric and non parametric technique were used to describe the different of sugar consumption between groups of school, gender, availability of snacks and beverages, number of sweet snacks items, and number of beverages items, number of food shops, and level of daily allowances.

CHAPTER IV
RESULTS

The results of the study were described in 4 parts as follows:

1. Description of levels of sugar consumption of the students.
2. Description of personal factor
   - Socio-demographic factors
   - Psychological factors
3. Description of environmental factors
   - Physical environments
   - Political environments
   - Socio-culture environments
   - Economic environments.
4. Description of sugar consumption by school food environment

4.1 Levels of sugar consumption

Table 3 Sugar consumption levels of the students (g/day in school)

Sugar consumption Levels	**n**		**(%)**
High (>12)	228		71.25
Low (≤12)	92		28.75
Mean = 19.11	SD = 16.71	Min. = 0	Max. = 101.73

Table 3 showed that most students (71.25%) consumed high levels of sugar. Mean of sugar consumption in school was 19.11 g/day and the maximum sugar consumption in school was 101.73 g/day. A higher proportion of female student (57.61%) consumed low levels of sugar than that of male (47.81%). There was no significant different between sugar consumption of female and male students.

Table 4 Amount of sugar consumption from snack and beverage (g/day in school)

Food	**Median**	**SD**	**Min**	**Max**
Snack	5.33	7.631	0.00	39.58
Beverage	12.50	12.96	0.00	83.53

Table 4 showed that majority of sugar intake came from sweet beverages. Amount of sugar from beverage consumption in school was approximately (12.50g/day in school) 2 and a half times higher than snack consumption (5.33/day in school).

Table 5 Sugar consumption of 9 school (g/day in school)

School	**n**	**Median of sugar consumption**
A	33	15.57
B	42	28.32
C	48	19.13
D	59	24.48
E	30	9.00
F	28	13.09
G	46	18.23
H	20	27.75
I	14	12.50

Table 5 showed that the students in school B consumed highest amount of sugar (28.32 g/day in school) followed by school H (27.75 g/day in school) and school D (24.48 g/day in school), while students in school E consumed the lowest amount of sugar (9.00g/day in school).

4.2 Personal factor

4.2.1 Socio - Demographic Characteristic.

Table 6 Distribution of student's socio-demographic characteristic (n=320)

Socio - Demographic	n	(%)
Gender		
Female	162	(50.63)
Male	158	(49.37)
Age (years)		
11	92	(28.75)
12	180	(56.25)
13	48	(15.00)
Grade		
5th	123	(38.44)
6th	197	(61.56)
Religion		
Buddhist	319	(99.69)
Muslim	1	(0.31)
Family member		
2-4	204	(63.75)
>4	116	(36.25)
BMI		
High	32	(12.19)
Normal	251	(78.14)
Low	30	(9.30)

The result of socio-demographic characteristic was showed in Table 6. Among 320 students, majority were 12 years old. (56.25%) Proportion of male was slightly greater than female. There was about 2 times more students attended grade 6th

(61.56%) than that of grade 5th. Almost all was Buddhists (99.69%) with only one Muslim student. Two third of them were from small size family. (63.75%) Majority of students had normal body mass index (78.44%), 12% were over weight and 9% were underweight.

Table 7 Body mass index (BMI) of students (n=320)

BMI levels	**Female**	**Male**	
	n (%)	**n (%)**	**Total**
High	24(61.54)	15 (38.46)	39(100.00)
Normal	123(49.00)	128(51.00)	251(100.00)
Low	15 (50.00)	15 (50.00)	30(100.00)
Median = 17.73	SD= 3.13	Min= 8.25	Max= 30.74

Table 7 showed that Female students had higher proportion of high BMI students than male.

Table 8 Body mass index (BMI) of students by school (n=320)

		(BMI) n (%)		
School	**n**	**High**	**Normal**	**Low**
A	33	2(6.06)	26(78.79)	5(15.15)
B	42	4(9.52)	35(83.33)	3(7.14)
C	48	5(10.42)	39(81.25)	4(8.33)
D	59	8(13.56)	44(74.58)	7(11.86)
E	30	4(13.33)	23(76.67)	3(10.00)
F	28	6(21.43)	22(78.57)	0(0.00)
G	46	6(13.04)	37(80.43)	3(6.52)
H	20	0(0.00)	18(90.00)	2(10.00)
I	14	4(28.57)	7(50.00)	3(21.43)

More than 75% up to 90% of student in 8 schools had normal body mass index only in school I that had only 50%. The small proportion of overweight and underweight students was shown in Table 8. School H seemed to be the most successful school interms of BMI, there was no overweight student and only 10% underweight.

4.2.2 Psychological factors

Table 9 The student's correct answer knowledge about snack and beverage

Knowledge	Correct n=320(%)
Effect on health	
- Snack is food that can eat at any time	145(45.31)
- Monosodium glutamate in snack is harmful to health	251(78.44)
- It is harmful to your health if color in snack and sweet beverage are collected in body.	246(76.88)
- Eating ice cream regularly is the cause of obesity.	213(66.56)
- Caffeine in soft drink can increase heart rate.	144(45.00)
- Drinking pure milk is free risk to dental caries.	224(70.00)
- Routine drinking milk yogurt is risk to dental caries and obesity.	96(30.00)
- Routine drinking sweet milk is risk to dental caries and obesity.	198(61.88)
Ingredient	
- Main ingredients of crispy snack are starch, sugar and fat	238(74.38)
- Nutrition label on snack package indicate the content of snack	264(82.50)
- Candy and gum contain high sugar.	270(84.38)
- Syrup water and fruit juice contained high amount of sugar.	159(49.69)
- Soft drink contains water, sugar and carbonate gas.	267(83.44)

For knowledge about snack on health, eating he effect o three quarter of the students had knowledge that monosodium glutamate and colour in snack was harmful to their health (78.44% and 76.88% respectively). Two third of the students

(66.56%) knew that eating ice cream could cause obesity. For knowledge about beverage, most of the students (70.00%) knew that drinking pure milk had not harmful to dental health as well as drinking sweet water had risk to dental caries and obesity. However, only 30.00% of them knew that drinking milk yogurt was also affected to dental health.

Half of the students (49.69%) knew that syrup water and fruit juice contained high amount of sugar. For knowledge about ingredient of snack and beverage, more than three quarter of students demonstrate that they had good knowledge about ingredient in crispy snack that contained starch, sugar, and fat and ingredient in candy and gum that contained high amount of sugar. Soft drink also contained sugar and carbonate gas. However, the knowledge that syrup water and fruit juice contained high amount of sugar was known by only 45% of the students.

Table 10 Attitude toward snacks and beverages of the students (n=320)

Statement	Agree n (%)	Disagree n (%)	Undecide n (%)	Mean
- You think that colorful snack or beverage look delicious.	161 (50.31)	96 (30.00)	63 (19.69)	2.20
- Premium in snack package can motivate you to buy it.	159 (49.69)	102 (31.88)	59 (18.44)	2.17
- You think that the snack and beverage in modern package is more interesting than simple package.	132 (41.25)	101 (31.56)	87 (27.19)	2.09
- You feel fresh when you drink sweet beverage.	126 (39.38)	107 (33.44)	87 (27.19)	2.05

Table 10 Attitude toward snacks and beverages of the students (n=320) (Cont.)

Statement	Agree n (%)	Disagree n (%)	Undecide n (%)	Mean
- You think that life would be dull if there is no sweetness.	108 (33.75)	149 (46.56)	63 (19.69)	1.87
- You think that there is fun, if there are snacks or sweet beverage.	119 (37.19)	107 (33.44)	94 (29.38)	2.03
- You think that snack and sweet beverage is bad for health.	256 (80.00)	37 (11.56)	27 (8.44)	2.68
- You think that it is important that snack and sweet beverage I eat keep me healthy.	268 (83.75)	32 (10.00)	20 (6.25)	2.73
- You think that snack and sweet beverage causes obesity.	252 (78.75)	45 (14.06)	23 (7.19)	2.64
- You think that avoidance of sweetness is beneficial.	180 (56.25)	91 (28.44)	49 (15.31)	2.27
- You feel interested in learning information about food and health.	275 (85.94)	17 (5.31)	28 (8.75)	2.80
- You think that it is important to pay attention to nutrition labels of snack and sweet beverage.	260 (81.25)	27 (8.44)	33 (10.31)	2.72
-You feel confident to eat snack or beverage that have nutrition label.	212 (66.25)	56 (17.50)	52 (16.25)	2.48

Attitude toward the usefulness of information about nutrition and nutrition label were higher than all others. The mean score were ranged from 2.48 to 2.80. In terms of attitude toward the effects of snack and beverage on health, the students demonstrated lower attitude mean score than the previous categories. The mean scores of the effects of snack and beverage on health were 2.68 and 2.64, respectively.

The student's revealed moderate attitude toward snack and beverage in terms of packaging. It tempted students' attention motivate them to buy and aroused their intention at mean score 2.09, 2.17 and 2.20, respectively.

Attitude in terms of students' feeling toward snack and sweet beverage were lower than all others. The mean score were ranged from 1.87 to 2.05.

Table 11 Knowledge and Attitude about snacks and beverage of the students (n=320)

Personal factor	**n**	**%**
Knowledge		
Poor (0-8)	156	48.75
Good (9-13)	164	51.25
Median=9.00	Min = 1.00	Max = 13.00
Attitude		
Negative (13-26)	52	16.25
Neutral (27-31)	165	51.56
Positive (32-39)	103	32.19
Median= 29	Min = 19	Max = 39

The students were divided by their knowledge of snack and sweet beverage into 2 groups; poor and good with approximately equal proportion (48.75% and 51.25% respectively). The attitude toward snack and sweet beverage consumption was categorized into 3 groups; negative, neutral, and positive. Half of the students (51.56%) had neutral attitude. The proportion of positive attitude students (32.19%) was 2 times higher than negative attitude (16.25%).

4.3 School food environment

4.3.1 Physical Environment

Table 12 Availability of snack and beverage in school. (n =9)

Snack	Number of school	Beverage items	Number of school
1. Cake/bread	7	1. Milk (no sugar)	9
2. Crispy snack	5	2. Fruit Juice	8
3. Ice cream	5	3. Syrup water	8
4. Fruit	5	4. Milk yogurt	2
5. Thai dessert	4	5. Sweet milk	0
6. Protein snack	4	6. Soft drink	0
7. Chocolate	2		
8. Jelly	1		
9. Candy	0		

The result in Table 12 revealed that the most available snack in school were cake/bread. The next three most available were crispy snack, ice cream, and fruit. For the beverages, milk (no sugar) was available in every school. Fruit juice and syrup water were the second most available items. Noticeably, there were no candy, sweet milk and soft drink sold in every school.

Table 13 Frequency distribution of physical environment in school (n=9)

Variables	n	%
Number of sweet snacks items		
≤2	3	33.33
>2	6	66.66
Number of sweet beverages items		
2	1	11.11
3	7	77.11
4	1	11.11
Number of food shop in school		
1	8	88.88
2	1	11.11
Number of food shop around school		
<4	5	55.55
≥4	4	44.44

Table 13 showed that proportion of school that sold snacks more than 2 items of sweet snack (66.66%) was 2 times higher than school that sold snacks less than or equal 2 items(33.33%). For beverages 3 groups of schools classified by number of beverages sold in school. Most school (77.77%) have 3 items of beverage sold in schools, and only one school that have 2 or 4 items of beverage in school.

Table 13 showed that most schools had one food shop (88.88%) and the less was 2 food shops (11.11%). There were 5 schools that had less than 4 food shops around schools and 4 schools that had equal or more than 4 food shops around school.

4.3.2 Political Environment

Table 14 Frequency distribution of students in political environment (n=320)

Political environment	n	%
School food rules		
Not allow to buy food outside school during lunch time	306	95.63
Restricted food advertisements	215	67.19
Prohibited selling soft drink and sweet snack	264	82.50
Nutrition Education issues		
Food/Nutrition	299	93.44
Food selection	304	95.00
Effect of food to health	280	87.50
Food learning activity	249	77.81

The result in Table 14 revealed that almost all students aware that they were not allowed to buy food outside school during lunch time and 82% aware the prohibition of selling soft drink and sweet snack in the school. Two third of students had awareness on restriction of snack and beverage advertising in school.

Table 14 showed a very high proportion of students who learned about food selection and food nutrition from school education programs (95.00% and 93.44% respectively). Effect of food to health and food learning activity were also learned at high levels (87.5% and 77.82% respectively)

Table 15 Source of information about snacks and beverages in school (n=283) ****

Source of information	n	%
Teacher	212	74.39
Book	142	49.82
News paper	125	43.86
Friend	115	40.35
Radio	113	39.65
Internet	102	35.79
TV	96	33.68
Magazine	48	16.84
Leaflets	31	10.88
Notice board	28	9.82

****Multiple answers

Two hundred and eighty three students had received information from school. Teachers (74.39%) were the major source of information in school. Information from book, newspaper, and friend were 49.82%, 43.86%, and 40.35%, respectively. There were less received information from notice board (9.82%) and leaflets (10.88%).

Table 16 Frequency of student by category of political environments (n=320)

Political environment	n	%
Food rules		
Do not have food rules	32	10.00
Have food rules	288	90.00
Nutrition education program		
Receive some of Nutrition education program	32	10.00
Received all Nutrition education program	288	90.00
Received information		
Yes	283	88.44
No	37	11.56

The students were classified in 2 groups according to political variable as shown in Table 16. Ninety percent of the students were defined as having awareness on school food rules or received all nutrition education programs. Most students received information about snacks and beverages in schools.

4.3.3 Socio-culture Environment

Table 17 Friend modelling on food practice (n=320)

Statement	n	%
Closed friend drink Sweet beverage		
(The prevalence of close friends that consume sweet beverage)		
All of them	136	48.57
Most of them	63	22.50
Few of them	81	28.93
None of them	40	12.50
Closed friend eat snack		
(The prevalence of close friends that consume snack)		
All of them	193	62.46
Most of them	63	20.39
Few of them	53	16.56
None of them	11	3.44
Friend influence food choice		
(The frequency that your friends have an influence on your food decision making)		
Every time	17	5.31
Most of the time	32	10.00
Sometime	118	36.87
Not at all	153	47.81
Choosing food as same as close friend		
(The frequency that you choose the food as same as your friends choose)		
Every time	5	1.56
Most of the time	35	10.93
Sometime	137	42.81
Not at all	143	44.68

Table 17 Friend modelling on food practice (n=320) (Cont.)

Statement	n	%
Feel inferior to friend who drinks soft drink		
(The frequency that you feel inferior to your friends who drink soft drink)		
Every time	7	2.19
Most of the time	15	4.69
Sometime	65	20.31
Not at all	233	72.81

Friend influenced on students drinking, and eating pattern was presented in Table 17. The result revealed that there was small proportion of students whose friends did not drink sweet beverages (12.50%) or consume snacks (3.44%), and most students did not feel inferior to friends who drink soft drink (72.81%)

However, nearly half of students were not influenced by closed friend (47.81%) on their food choice, and they did not chooses their food as same as friends (44.68%).

Table 18 Food reward as classified by food offering for good performance and food present on special event (n=320)

Food as reward	n	Percent
Experience of offering food as a reward for good performance		
When performed a good academic performance or a good behaviour the teacher gave the students a snack or sweet beverage as reward		
Always	16	5.00
Sometime	197	61.56
Never	107	33.44
Food present in special event		
Received sweet food or snack as a gift in special event such as "Children day" or "New Year cerebration"		
Always	79	24.69
Sometime	201	62.81
Never	40	12.50

Table 18 showed that the proportion of students who had experienced receiving food as reward for being good students (66.56%) was two times more than the students who never had such this experience (33.44%). Nearly two third (62.81%) of students knew that school sometime presented food or snacks in special occasion, while 12.50% of them answered that school never done so.

Table 19 Family modelling (n=320)

Food Practice	n	Percent
Add sugar in food		
Always	44	13.75
Sometime	226	70.63
Never	50	15.63
Have sweet or dessert after meals		
Always	50	15.63
Sometime	187	58.44
Never	112	35.00
Have sweet beverage as usual drink		
Always	20	6.25
Sometime	124	38.75
Never	176	55.00

Table 19 showed that small proportion of students had sweets tooth family. The small frequency of the students came from family that always add sugar in food and had sweet or dessert after meals. Most of them were from families that sometime (70.63%) add sugar or had sweet after meals (58.44%). Half of student's families (55.00%) never had sweet beverage as a usual drink.

Table 20 Frequency of student by Categorises of socio-cultural environment

Socio-cultural environment	n	%
Friend modelling		
Do not have friend modelling	92	28.75
Have friend modelling	228	71.25
Food reward		
Do not have experience about food as reward	105	32.81
Have experience about food as reward	215	67.19
Family modelling		
Do not have family modelling	192	60.00
Have family modelling	128	40.00

Table 20 showed that most of the students were classified as having friend modelling on food choices (71.25%). Two third of students (67.19%) had experienced in teacher offered food as a reward (67.19%). However, less than half of the students (40.00%) were classified as having family modelling.

4.3.4 Economic environment

Table 21 Economic environments.

Economic environment	n	%
Daily allowance		
Low	63	19.69
Medium	161	50.31
High	96	30.00
Median = 4 Min = 4 Max = 120		
Father		
Labor/wager	250	78.13
Government officer	18	5.63
Own business	52	16.25
Mother		
Labor/wager	260	78.13
Government officer	4	1.25
Own business	56	17.50

Table 21 showed that half of the students received medium levels of daily allowance. The proportion of the students who received high levels of daily allowance was 30.00%. The median of daily allowance was 15 baht per day.

Table 21 the majority of both father and mother were labor or wager (father 78.13%, mother 71.25%), followed by parent's who have their own business (father 16.25%, mother 17.50%). Very small proportion of government officer was found (father 5.63%, mother 1.25%).

4.4 Sugar consumption described by personal factor and school food environments

Table 22 Sugar consumption levels described by personal factors

	Sugar consumption Levels		
	High	Low	
Variables	**n (%)**	**n (%)**	**Total**
Gender			
Female	109(67.28)	53(32.71)	162(100.00)
Male	119(75.31)	39(24.69)	158(100.00)
BMI levels			
High	26 (66.67)	13 (33.33)	39(100.00)
Normal	180 (71.71)	71 (28.29)	251(100.00)
Low	22 (73.33)	8 (26.67)	30((100.00)

Table 22 showed that proportion of the overweight students who consumed high levels of sugar was 2 times higher than overweight students who consumed low sugar levels. However, among the normal weight and under weight students, those who consumed high levels of sugar were also approximately 3 times than those who consumed low levels of sugar.

Table 23 Sugar consumption levels described by personal factors knowledge and attitude levels

Personal factor	Sugar consumption levels		Total
	High	Low	
	n (%)	n (%)	
Knowledge			
Poor (0-8)	108 (69.23)	48 (30.77)	156(100.00)
Good (9-13)	120 (73.17)	44 (26.83)	164(100.00)
Median=9.00	Min = 1.00	Max = 13.00	
Attitude			
Negative (13-26)	36(69.23)	16 (30.77)	52(100.00)
Neutral (27-31)	119(72.12)	46 (27.88)	165(100.00)
Positive (32-39)	73 (70.87)	30 (29.13)	103(100.00)
Median= 29	Min = 19	Max = 39	

Good and poor knowledge students were relatively similar in sugar consumption at high levels (73.17% and 69.23% respectively). The result also showed in appendix Table 35 that there was no significant different between sugar consumption between good and poor knowledge students.

Approximately similar proportion of students consumed high sugar levels among negative, neutral, and positive students were shown in Table 23, and there was no significant different of sugar consumption between those 3 groups of attitude toward snacks and beverages consumption.

Table 24 Sugar consumption levels described by physical factors

Number of Sweet items	Sugar consumption		Total
	High (%)	Low (%)	
Sweet snacks			
≤2	40(62.50)	24(37.50)	64(100.00)
>2	188(73.44)	68(26.56)	256(100.00)
Sweet beverages			
<3	70(66.67)	35(33.33)	105(100.00)
≥3	158(73.49)	57(26.51)	215(100.00)
Inside school			
1	192(69.06)	86(30.94)	278(100.00)
2	36(85.71)	6(14.29)	42(100.00)
Around school			
<4	76(60.80)	49(39.20)	125(100.00)
≥4	152(77.95)	43(22.05)	195(100.00)

Among students in school that had beverage items less than 3, the proportion of students who consumed high levels of sugar (66.67%) was 2 times higher than students who consumed low levels of sugar (33.33%). The higher proportion of students consumed high levels of sugar was found in school that had more beverage items.

The proportion of students consumed high levels of sugar in school with 2 food shops (85.71%) was greater than 1 food shop (69.01%). Higher proportion of students who consumed high levels of sugar was showed in school that had food shop around school equal or more than 4 (77.95%).

Table 25 Sugar consumption described by political environment and (n=320)

Variables	Sugar consumption levels		Total
	High n (%)	Low n(%)	
Food rules			
Do not have food rules	25 (78.13)	7(21.88)	32(100.00)
Have food rules	203(70.49)	85(29.51)	288(100.00)
Nutrition education program			
Receive some of Nutrition education program	24(75.00)	8(25.00)	32(100.00)
Received all Nutrition education program	204(70.83)	84(29.17)	288(100.00)
Received information			
Yes	200(70.67)	83(29.33)	283(100.00)
No	28(75.68)	9(24.32)	37(100.00)

*Significant ($p<0.05$, Mann-Withney test)

The result showed in Table 25 that the students who did not have awareness of school food rules (78.13%) had slightly greater proportion of high sugar consumption students than those who did (70.49%). The students who received some of nutrition education programs (75.00%) were slightly greater proportion of students with high levels sugar consumption than those who received all of nutrition education programs (70.83%).

However, the result of receiving information about snacks and beverages in school showed that students who did not receive that information in school were higher in proportion of high levels sugar consumption students than those who received information in school.

Table 26 Sugar consumption levels described by socio-cultural environment

Socio-cultural environments	Sugar consumption levels		Total
	High n (%)	Low n(%)	
Friend modelling			
Do not have friend modelling	67(72.83)	25(27.17)	92(100.00)
Have friend modelling	161(70.61)	67(29.39)	228(100.00)
Food reward			
Do not have experience about food as reward	76(72.38)	29(27.62)	105(100.00)
Have experience about food as reward	152(70.70)	63(29.30)	215(100.00)
Family modelling			
Not have family modelling	130(67.71)	62(32.29)	192(100.00)
Have family modelling	98(76.56)	30(23.44)	128(100.00)

The students were divided into 2 groups according to socio-cultural variables as showed in Table 26. Among students who had family modelling, the proportion of students who consumed sugar in high levels was 3 times greater than sugar consumption in low levels. The students who were classified as having family modelling had higher proportion of high levels of sugar consumption than who did not have family modelling.

For friend modelling, the students who were classified as have and did not have friend modelling were equal proportion of students consumed high levels of sugar. The equal proportions were also found with food as reward variable.

Table 27 Sugar consumption levels described by economic environment

Economic environment	Sugar consumption levels		Total
	High n(%)	Low n(%)	
Daily allowance levels			
Low	33(52.38)	30(47.62)	63(100.00)
Medium	118(73.29)	43(26.71)	161(100.00)
High	77(80.21)	19(19.79)	96(100.00)
Father occupation			
Labor/wager	179(71.60)	71(28.40)	250(78.13)
Government officer	13(72.22)	5(27.78)	18 (5.63)
Own business	36(69.23)	16(30.77)	52(16.25)
Mother occupation			
Labor/wager	183(70.38)	77(29.62)	260(78.13)
Government officer	2(50.00)	2(50.00)	4(1.25)
Own business	43(76.79)	13(23.21)	56(17.50)

Among students who received high daily allowance, 80% of them had consumed sugar at high level, while the students who received low daily allowance, nearly half of them consumed sugar at low levels.

Approximately 70% of students from almost all groups of father's and mother's occupation consumed sugar of high levels. Only students whose mother works as government officer that half of them consumed sugar of high levels.

Table 28 Comparison the average of sugar consumption between personal factor variables.

Variable	Median of Sugar consumption	(P-value)
BMI		
High	17.17	0.675
Medium	19.67	
Low	19.25	
Knowledge		
Good	18.62	0.719
Poor	21.73	
Attitude		
Positive	17.08	0.348
Neutral	19.67	
Negative	22.05	

*Significant (p-value < 0.05, Kruskal Wallis)

There was no significantly different of sugar consumption among students who had high, medium, and low BMI. Good and poor knowledge students were not significant differed in sugar consumption and they were also not found significantly different in sugar consumption among the level of students' attitude

Table 29 Comparison of median of sugar consumption between 9 schools.

School	Number of students	Median	P- value
A	33	15.577	< 0.001***
B	42	28.325	
C	48	19.133	
D	59	24.483	
E	30	9.000	
F	28	13.090	
G	46	18.230	
H	20	27.750	
I	14	12.50	

***Significant (p- value < 0.05, Kruskal-Wallis Test)

Table 29 revealed that there was significantly different of sugar consumption among students from 9 schools.

Table 30 Comparison the average of sugar consumption between availability and not availability of snacks and beverages in school

Food	Not Available	Available	p-value
	Mean	Mean	
Snacks			
Chocolate	23.19	20.89	0.371
Cake/bread	19.60	23.33	0.131
Thai dessert	22.09	23.49	0.456
Ice cream	22.35	22.99	0.757
Crispy snack	18.84	23.73	**0.035***
Jelly	22.14	25.45	0.167
Protein snack	19.37	24.89	**0.004***
Fruit	17.86	25.14	**0.000***
Beverages			
Fruit juice	12.52	23.81	**<0.001***
Milk yogurt	23.33	19.60	0.13
Syrup water	12.52	23.81	**<0.001***

* Significant ($p<0.05$, T-test)

The result in Table 30 showed that mostly average sugar consumption in school that sold snack was higher than in the schools that snacks were not available. Only availability of chocolate in school that showed lower average of sugar consumption than schools that chocolate did not available. Table 16 also showed that average sugar consumption of students in school that have crispy snack, or protein snack or fruit was significantly difference from students in school that those types of snack were not available.

Higher average of sugar consumption of students in school that sold fruit juice or milk yogurt or syrup water than school that did not sold those type of beverages. The averages of sugar consumption of students in school that sold fruit

juice or syrup water were also found evidently different from students in school that these 2 types of beverage were not available.

Table 31 Comparison the average of sugar consumption between number of food items, and number of food shops in and around school

Variable	Mean	SD	p-value
Sweet snacks items			**0.035***
≤2	18.8	16.3	
>2	23.7	16.3	
Sweet beverages items			0.08
<3	23.18	18.87	
3-4	22.54	15.59	
Food shops inside school			**0.004***
1	21.5	16.1	
2	30.8	18.9	
Food shops around school			**0.014***
<4	23.8	18.9	
≥4	22.5	16.1	

* Significant (p-value<0.05, T- test)

Table 31 showed that average of sugar consumption of students in school that sold snacks less than or equal 2 items was significantly different from students in school that sold snacks more than 2 items. The average of sugar consumption between students from 1 food shop and 2 food shops in school was significantly different. The result also found significantly different of sugar consumption between students in school that had less than 4 and more than or equal 4 food shops around school. However, there was no significantly different of sugar consumption between students in school that had food shops around school less than 4 and more than or equal to 4.

Table 32 Comparison the average of sugar consumption between groups of political environment variables.

Political environment	Mean	SD	p-value
School food rules			0.106
Have awareness on school food rules	22.1	15.9	
Did not have awareness on school food rules	28.8	22.1	
Nutrition education programs			0.930
Received all programs	22.7	16.5	
Received some programs	23.0	19.2	
Information about snacks and beverages in school			0.177
Received information	22.2	16.2	
Not received information	26.9	20.0	

*Significant ($p<0.05$, T- test)

There was no significantly different of sugar consumption between students who were classified in different groups of political environments: between students who had awareness and did not have awareness on school food rules, between students who received some and received all nutrition education programs and between students who received and not received information about snacks and beverages from school.

Table 33 Comparison the average of sugar consumption between groups of socio-cultural environments variables

Socio-cultural environments	Mean	SD	p- value
Friend modelling			0.47
Do not have friend modelling	23.9	18.8	
Have friend modelling	22.3	15.8	
Food reward			0.16
Do not have experience about food as reward	21.0	14.2	
Have experience about food as reward	23.6	17.8	
Family modelling			0.11
Not have family modelling	21.5	16.9	
Have family modelling	24.5	16.4	

*Significant ($p<0.05$, T- test)

Table 33 showed that Students who had friend modelling and did not have friend modelling on their food choice were not found significantly different in sugar consumption. There was no statistically different between sugar consumption of students who had family modelling and did not have family modelling. The similar result also found with students that had experience about food as reward and did not have experience about food reward.

Table 34 Comparison the average of sugar consumption between groups of economic environments variables

Economic environment	Means	SD	p-value
Daily allowance			
Low	16.03	15.33	**<0.001***
Medium	22.75	16.20	
High	27.16	17.12	
Father			0.8
Labor/wager	250	78.13	
Government officer	18	5.63	
Own business	52	16.25	
Mother			0.8
Labor/wager	260	78.13	
Government officer	4	1.25	
Own business	56	17.50	

*Significant ($p<0.05$, T- test)

Table 34 showed that there were significantly different of sugar consumption between groups of daily allowances levels. However, there were not significantly different between students whose parents' has different occupation.

CHAPTER V
DISCUSSION

5.1 Sugar consumption

According to WHO recommendations, a healthy diet should reduce consumption of refine simple carbohydrate or white sugar as much as possible. The maximum consumption should not be more than 10% of the total daily energy. (22) However in the United States (1994-1996), The Continuing Survey of Food Intakes by Individuals(CSFII) reported that mean intakes of added sugar for children aged <12 years old were 19% of energy and increased to 20% for adolescents.(29)

In 2005, The Maikinwan Network reported that Thai children aged 1-5 years old consumed on average 40.4 g/day of sugar equally to 10 teaspoons/day (3), and recommended that Thai children should not consume more than 6 teaspoons of sugar or 24 g/day. (23) This study used 12 g/day in school as cut off point of low and high levels of sugar consumption. The result showed that most students consumed high levels of sugar (71.25%) with no significant different of sugar consumption between male and female students. The average of sugar consumption was 19.11 g/ day in school or 5 teaspoons/day in school which less than the study in Rajaburee province that reported 9.4 teaspoons/day of sugar consumption in school. (3) However, this study was conducted with a different age of respondents and different time from the previous study. In addition, the results of this study come from reporting sugar intake during school hours only and did not included sugar intake at home. Therefore, the result revealed a lower amount of sugar than the previous study.

Noticeable, the average sugar consumption during school hours from this study was very close to maximum sugar consumption for whole day or 6 teaspoons/ day.

Presumably, the sugar consumption by students in this study might be higher than standard levels of Maikinwan Network. Since, information was obtained from individual food records, the bias may have occurred because the accuracy is subjected to short term memory and size of food estimation. According to many studies that used self-reports to estimate food intake of respondents, sometime individuals selectively underreport their food intake, particularly of high fat and sugar food. (29)

The finding showed that the amount of sugar from drinking sweet beverages (12.50g/day) was higher than having snacks (5.33g/day). The result was supported by the study of snacks and beverages consumption of Thai children aged 3-12 years. It indicated that most high sugar consumption came from sweet beverages especially soft drinks. (23)

5.2 Socio-demographic factors

5.2.1 Gender

The study of health inequalities suggested that it is particularly important to compare women and men eating behavior. As reported in previous studies, women’s diets conform more to the dietary guideline than men's. The reasons suggested the possibilities of women's preventive health behavior and health consciousness include concern for their appearance. (69)

Not only different eating behavior regarding male and female revealed in adolescence and adult group, but also the study in children. Boys had significantly higher intakes of energy, protein, cholesterol, while girls had significantly higher intakes of carbohydrates, fibres, vitamin C, and vitamin A. (26)

The gender effects were also indicated in the National Health and Nutrition Examination Survey III, United States. It reported girls had significantly higher intakes of carbohydrates, vitamin A, and vitamin C. (69)

However, this study found no significantly different in sugar consumption between boys and girls, that may be explained the reasons that there were similar in levels of education, opportunity to access to food and information affected their food choice and eating behavior. A similar result was reported by Cusatis et al. in 1995. It found no significant association between gender and food intake in terms of type of food and frequency. (70) The study conducted with students of Mahidol University also found that male students practiced healthy eating as well as female students. (55)

5.2.2 BMI

The role of sugar consumption in the development of obesity has received attention from the politicians and scientists. Ludwig D. et al. reported that children who drink sugar sweetened beverages every day were 6 times more at risk of obesity than those who do not. (4) Malik et al. reported that greater consumption of sweet beverages is associated with weight gain and obesity. (31)

However, the finding showed that there was no significantly different of sugar consumption between students who were normal, high and low BMI. Since the present study was not concerned with students physical activity as confounding factor and moreover, self – reported measurement have a limited validity and reliability. These reasons might responsible for no statistically different of sugar consumption between overweight, normal and underweight students. A study of New Zealand children using self – reporting of food intake also found that high fat and added sugar food were selective underreported, particularly by obese adolescent and adults.(70) The analysis of dietary data might cause underreporting of sugar consumption and lead to underreporting of food intake.

This finding was also consistent with the study by Phillip SM et al. (2004) of non-obese 8-12 year old girls over a 4 year period, which found no association between BMI or percentage of body fat and consumption of energy dense food including soft drink. Vartanian LR et al. reported that there was a small association between sweet beverages consumption and weight gain for children. (31)

Even though, there was no clear evidence that sugar consumption causes obesity, obese and overweight children are a serious public problem, and BMI measurement was needed to determine long term effects of sugar consumption. (29)

5.3 Psychological Factors

5.3.1 Knowledge

More than 70% of students knew about the ingredients of snacks and beverages. However, less than 50% of the students knew about the health effects of drinking milk yogurt. Milk yogurt contains as much sugar as other sweet beverages which cause obesity and dental caries. (6) It might be possible that the students might mistakenly included milk yogurt with milk which is a healthy beverages. The lack of knowledge of health effect from sweet beverages might lead to higher sugar consumption as compared with snacks.

The finding also showed that students who had good knowledge about snacks and sweet beverages tended to have normal levels of sugar consumption (41.46%), while students with poor knowledge tended to consume sugar in high levels (46.15%). However, there was no significantly different between sugar consumption of poor and good knowledge students.

The result was inconsistent with the study of Srisuda V. 1998, which revealed that the knowledge on food and nutrition including appropriated amount of food that body required had influence on eating behavior. (11)

5.4 Physical Environment

5.4.1 Availability of snacks and beverages in school

The result of this study showed that the most popular snacks and beverages were cake/bread and fruit juice, and most of the students could access to fresh fruit in school while, soft drink, sweet milk, and candy were not available in any school. It was difference from a study in United States which reported that most school stores were the main source of high fat and added sugar food. A relationship between sweet beverages drinking and availability of sweet beverages was found. The studies reported that snacks and sweet beverages sold in school stores were low in nutrients.(47) Marianne et al. reported that 150 snacks were sold in school stores and 88.5% of them were high in fat or sugar (> 20g). Sugar candy was a popular item, and fresh fruit or vegetables were not sold at store. (67)

The finding revealed that there was a significantly different of sugar consumption between school that sold and did not sold protein snack or fruit or crispy snack in school. Although protein snacks contained low amounts of sugar, they were found high in levels of sodium or salt. (75) Having salty and dry snacks could induce a thirsty feeling, the high levels of sugar consumption related to the availability of protein snacks might be a result of drinking sweet water. Fruit was also found to have a positive relationship with the levels of sugar consumption which is inconsistent with the study of nutrient analysis in snacks by Sirijukrawan. (76) It revealed that snacks and fast food consumption was decreased when fruit was available in school. However, this study did not identify the prevalence of students who consumed fruit sold in school. Although fruit was available in school, it was possible that students might not consume it. Moreover, fruit was always found in schools where many items of snacks were also available. This might affected by the students' food choice.

Sugar consumption by students in schools that sold fruit juice and syrup water was found significantly different from schools that fruit juice and syrup water not available. These 2 types of beverages were found in almost all school which was

prepared by food staff or students under supervision of their teacher. Although they tried to reduce the sweetness of the beverages, the amount of sugar contained in these beverages was still high. However, the study of school in Amsterdam reported that there was no significant association between snacks and beverages intake and availability of product in school canteen, but the association between school neighborhood factor and soft drink consumption was described.

5.4.2 Number of food shops

According to the observation, the researcher found that majority schools had only one food shop in school, and only one school had 2 food shops. School food shops were commonly administered by teachers and provided food by followed school food rules or the Health Promoting School project that recommended healthy food for school lunch including snacks and beverages in school food shops. However, requirement for the revenue from school food shops that useful for school activities might result in low potential school food policy.

The result showed the significantly different of sugar consumption of students between numbers of food shops around school. This result was consistent with the study of snacks and beverages consumption that students exposed to numerous types of snacks and beverages in school and found more likely to consume high amount of sugar than those who were not exposed. (26)

This result was consistent with the study of school food environment by Van der Horst K et al. in 2008. They found that number of vending machine was associated with students' soft drink purchasing.(34) Food shops were an important source of competitive food, especially food shops around school. Normally all type of snacks and beverages items were sold in the food shop around school. (37) In the present study, it found the higher number of food shops around a school the more students consumed high levels of sugar consumption.

5.5 Political Environment

5.5.1 Food rules

School food policies were commonly recommended by many studies and several organizations to improve the school food environment. (29, 34, 35) The implementation of food rules is an important strategy to reduce availability of unhealthy food in school, especially high fat food and sugar contained in snacks and beverages.(34, 35, 46) Many studies found the relationship between food rules and eating behavior, including food intake of students. (35, 46) Students attending schools without stores or snacks bars selling beverages were estimated to reduce sugar consumption from beverages at school by 22 kcal per day. (47)

Almost all primary schools in Rongkwang district, Phrae province have been participating in the Health promoting school project and Maikinwan Network, and participating schools had implemented school food policies to provide a healthy food environment and reduced the availability of unhealthy food in school. The result of this study showed that almost 90% of the students had awareness on school food rules, and only few students were not sure about food rules in school. This study found no significantly different of sugar consumption between students who have awareness on school food rules and those who did not have awareness.

Although food rules were common in primary schools in Rongkwang district, the food items defined as unhealthy food for the students focused only on soft drink and sweet candy. Other sweetened snacks and beverages were still found in some schools. In addition, a school food policy could prohibit selling snacks and beverages only in school food shops but food stores around school could not be controlled by school food rules. Students may access sweet snacks and beverages in food shops around the school before, during and after school time, this might be the reason that no different of sugar consumption between schools that have and not have school food rules. Simon A et al. reported that school food policy might be

incompatible with school food practice. Further study about school food practice and school food policy needs to identify their relationship. (16)

5.5.2 Information sources

Most students received information about snacks and beverages from school and teachers. Television was known as an important source of information through food advertising; the advertisements were predominantly for foods with a high sugar, fat or salt content. (71) The low prevalence of receiving information from television in school was shown in this study; the result might be different, if the study had been conducted in a home setting.

However, the sugar consumption between students who received and did not receive information from school was no significantly different. This result was consistent with the study by Badrialaily 2008 who reported that information about healthy eating was not related to nutritional status of elementary school students, and Suthera K in 2008 also found that eating behavior of primary school students was not related to food and nutrition information.(11,28)

In the questionnaire used in this study, the questions about the snacks and sweet beverages information students received from school provided 2 choices for the respondents; Yes or No, answer referred to received or not received information from school. The questionnaire did not require the detail and type of information such as name, prices, incentive, taste, advantage, disadvantage, and health effect. Therefore the answers in general fashion might be explained by the high proportion of the students who had received information (90%) and this showed no significantly different of sugar consumption.

5.5.3 Nutrition education program

The finding revealed that most nutrition education issues that students received were food and nutrition and food selection which conformed to the knowledge of students that high proportion of students had knowledge about food ingredients. Effect of food to health was also at high proportion and followed by food learning activity. These nutrition education issues commonly were included in Nutrition education program of school and most students in this study had received all of these issues. However, there was not significantly different in sugar consumption between students who received all nutrition education issue and those who received some of nutrition education issues. The result of Maikinwan Network project that nutrition education program had no impact on eating behavior of the students.

The reason for this result may explain by the unequal implementation of nutrition education programs. Some nutrition education issues or activities were not conducted with all students in school. Although students knew that their school implemented such nutrition education programs, but they might not be participated in those programs. Moreover, the same nutrition education program that conducted in difference school might contribute the varied result.

However, the nutrition and food education were recommended to introduce the healthy food to young students. They were expected to plan or select food properly.(29,41) According to CDC recommendation, integration of school food service and nutrition education was included the aspects of in school-based healthy eating program.(72)

5.6 Socio-culture Environment

5.6.1 Family modeling

This study showed that students were come from sweets tooth family, most of their family sometime added sugar or had sweet after meals, while half of student's

families never had sweet beverage as a usual drink. The students who were classified as having family modelling had higher proportion of high levels of sugar consumption than who do not have family modelling. However, the finding showed that there was no significantly different of sugar consumption between these 2 groups.

The inverse result might be explained by the question about family food practice answered by too young respondents. They might not know about the detail of family food practice, or they had low attention in parent's food practice. Most of the students answered "sometime" for the question. The meaning may be they were not sure about family practice, while many studies had collected data directly from parents which might have more accuracy. (6, 11, 23, 61)

Many studies reported that parents were defined as the major food provider for children. Nutrient selection and food preparation depended on their food preferences which be the modeled of child eating behavior. Many studies shown that eating pattern at home or could influence students' food choices at school. Most of the studies reported a significant association between parents' eating behavior and children behavior. (11, 61)

5.6.2 Friend modelling

This study found most students have friend who consumed sweet snacks and beverages. More than half of them also had the influence from closed friend on their food choice, and they were chosen their food as same as their friends did.

According to Social Cognitive Theory described by Bandura, 1997, friend modelling was expected to be the important agent influence food acceptance.(63) Although the association between friend modelling and food consumption has been shown in several studies, few studies explained rules or mechanism of friend modelling related to eating behavior. Conceivably, people used type and amount of food eaten by friends as an indication of what is an appropriate

food to eat. (64) The previous study showed that individuals will conform or match how much they eat to the amount of food eaten by others around them. (56)

However, this study found that there was no significantly different of sugar consumption between students who was defined as did not have friend modelling and have friend modelling. The result was inconsistent with several other studies, which found peers influence on food intake of children and adolescent. (64, 73)

The study of pre-adolescent children found that obese girls ate significantly more in the presence of overweight peers than eating in the presence of underweight peers, but this finding was not shown with the lean girls. (64) This reflected that social influence did not affect food intake in the same way if there are different groups of body weight. In addition, overweight girls had more responsive to external factor or peers modelling than normal-weight girls. (73) According to majority of the students in this study, they were normal BMI and only few were overweight. This might explain the low response to friend modelling of the students in this study.

5.6.3 Food as reward

This study found that most students had experience that teacher offered food as reward for good performance and sometime prepared sweet snacks and beverage in special event. However, the result from this study showed that there was no significantly different of sugar consumption between students who were defined as having experience on food as reward and students who did not have this experience. The use of food as a reward is common in many cultures including Thai people. Offering sweet snacks as a reward was an effective way to convince children to be good performance. Since Maikinwan Network has been motivated school to reduce sugar consumption of the students. This health promotion might have risen up awareness of teachers in offering sweetened snacks and beverages to the students.

The outcome evaluation of the school food improvement in Rajburee Province suggested that the cooperation of principal, teacher and food staff in school and their attention about food environment in schools had influenced on campaign successful. (68)

5.7 Economic environment

5.7.1 Daily allowance

An average of daily allowance for 9-12 years old children of 23.2 baht/day was reported in a study of eating snacks behavior of Thai children aged 3-15 years old in 2003. (74) The result in this study showed that the average daily allowance for students was 15 baht/day which was less than that in the previous study. The target schools in this study were mainly located in rural areas and the students' socio-economic status might have been lower than that of the students from previous studies which were conducted in both rural and urban areas.

The students who received high daily allowances were more likely to consume higher levels of sugar from snacks and beverages than students who received lower daily allowances. The finding in this study revealed that sugar consumption of high daily allowance students was significantly difference from sugar consumption of low and medium daily allowance students. This result was inconsistent with reported in the study by Anukul P. that found an association between eating behavior and daily allowance in high school students. (75)

But a different result was obtained in the study of 5^{th} and 6^{th} grade primary school students which found that the daily allowances of the students could not explain the degree of sugar consumption by those students. (11) Chayanit also found that students that different daily allowances did not affect food intake habit. (10)

5.7.2 Parental Occupation

According to the proposed research methodology, a part of the economic environment was intended to identify parental income. Moreover, a limitation of this study was the respondents aged 11- 13 years old and might be too young to know the accurate data of their parents' income. Following the ANGLEO framework, parent's occupation could represent the socio- economic status of the students, the researcher then included parent's occupation in economic environment.

However, students' sugar consumption from different parental occupation was found no significantly different in this study. Parental occupation might not completely represent socio-economic status because there was variation of income in the same occupation. However, many studies showed that family or parental income could not explain the food intake of children because high income families might not pay very much money to their children. (11, 28, 55)

CHAPTER VI
CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This cross-sectional descriptive study was conducted to determine the levels of sugar consumption in school and school food environment. The respondents were 320 students who attended 5th and 6th grade in primary school at Rongkwang district, Phrae province.

Personal factors in this study comprised with socio-demographic factors (gender and BMI) and psychological factors (knowledge and attitude toward snack and sweet beverage). School environment factors referred to physical environment (availability of snack and beverage, number of food shop in school and around school), socio-culture environment (friend modelling, family modelling, food as reward), political environment (food rules, nutrition education program, information about snack and beverage) and economic environment (daily allowance and parent's occupation). The methods to collect data were individual food reporting by students, interviewing students, and observation food environment by researcher.

The result showed that there was significantly different in sugar consumption among 9 schools, and the average of sugar consumption was 19.11 g/day in school. Most of students consumed sugar in high levels, and majority of sugar consumption came from beverage. To indicate high or low levels of sugar consumption, the recommendation by Nutrition Division Ministry of public health Thailand and Food Quantity Conversation and INMUCAL food code to estimated the cut off point.

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Most of the students had normal BMI and there were not different in sugar consumption among BMI group. Students had good knowledge about ingredient of snacks and beverages, however, few of students knew about the sweet beverage affecting dental health. The proportion of students who had good and poor knowledge was relatively equal and they were no significantly different in sugar consumption.

The most popular snack and beverage found in school were cake/bread and milk (no sugar) respectively. Crispy snack, fruit juice and non carbonated sweet water were also high frequency items that available in school. The unavailable items for all students were candy, sweet milk and soft drink. Normally students could access one food store in school. Only 13% of them could access two food stores in school. However, the food stores around school were more than 4 shops.

There was significantly different in sugar consumption between students who study in school that sold fruit or crispy snack or protein snack and those schools that did not sold. The same result was also found by availability of fruit juice and syrup water in school and number of sweet snacks items sold in school. Students who study in different groups of number of food shops both in and around school were also found significantly different sugar consumption.

Most of the students knew that they were not allowed to buy food outside school, and their schools prohibited selling sweet snack and soft drink. The common nutrition education issues were food/nutrition and food selection. Almost all students received information about snack and beverage in school, and teachers was the main source of that information followed by friends, while few students received information of snacks and beverages from television. There was no statistically different of sugar consumption between students who have and did not have awareness on school food rules. The similar results were also found with others political environment variables; nutrition education program and source of in formation.

Majority students had friends that consumed sweet snack and beverage. More than half of them chose their food as same as close friend. Few students had

sweets tooth family; the small frequency of the students came from family that always add sugar in food and had sweet or dessert after meals. More than half of the students have experience that the teacher sometime gives food as reward, and sometime school prepared food present for special event. The result was not found significantly different of sugar consumption between students who have and did not have friend modeling. The significantly different was not found between students who have family modeling and who did not have.

Average daily allowance of the students was 15 baht/day. The students that had daily allowance 10 – 20 baht/day was highest frequency. Majority of father and mother occupation was labor. Eighty percent of students who received high daily allowance were high sugar consumption.

6.2 Recommendation

The finding showed that most students consumed high amount of sugar in school time. The students in different school food environment were found significantly different in sugar consumption. More interventions concerning the improvement of school food environment and students food choice were recommended as following.

6.2.1 Recommendation for principal of the school

1. School board and staff should identify the nutrition value of all snacks and beverages sold in school. The definition of sweet snack and beverage should be clear, for example, food sold in school should not more than 35% added sugar by weight (United way recommendation), and sweet snack and beverage should not be focusing only candy and soft drink.

2. Reducing sugar consumption, the stronger school food policies should require. School food policy should be informed to school board, food staff, students and their parent. Principal and school board should attend to monitoring the policy to

be sure that it is being followed and consider if there are any problems or misunderstand with the policy rules and regulation.

3. Regulation of food shop around school is also important for decreasing the sugar consumption of the students. Therefore, the partnership among school, food shops, community and parent is need for food environment improvement.

4. Nutrition education program implementation is still important policies. Knowledge about effect of sweet snack and beverage on health is important issue for introducing healthy food to students. Revising the nutrition education program to develop students' knowledge and program evaluation should be provided.

6.2.3 Recommendation for health care provider

Improving nutrition standard in school require technical support from health care provider and supervision to continuously carry out an intervention program for healthy school food environment. Health care provider should clearly inform teachers, parent and students for the definition of high sugar contained in foods, the effected of sweet food to their health and the appropriated amount of sugar for students. Health care provider also should encourage school to provide low sugar snack and sweet beverage.

6.2.4 Recommendation for further research

1. There are some snacks and beverage that amount of sugar was not showed in Maikinwan sugar index. Continuing survey for sugar contained in food will be helpful for the further study concerning sugar intake. Moreover, information of amount of sugar in food can be used as guideline for food selection.

2. This study was conducted in district levels which covers a small area of school location. The further study should be extending to provincial or national levels that may be found the varied school food environment for example price of food that

sold in school. Therefore, the study in higher coverage levels should concern about price of food that sold in and around school.

3. The study to determine the association between school food environments and sugar consumption should be continues to identified the important environmental factors in school that affect students' sugar consumption.

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APPENDIX

APPENDIX
QUESTIONNAIRES

SUGAR CONSUMPTION WITHIN SCHOOL FOOD ENVIRONMENT AMONG 5^{TH} AND 6^{TH} GRADE PRIMARY SCHOO STUDENTS IN RONGKWANG DISTRICT, PHRAE PROVINCE

ID.No. of questionnaire…….

This questionnaire is constructed for collecting data of socio-demographic characteristics, knowledge and attitude on snack and sweet beverage consumption and school food environment. The total data will be kept with the researcher and co-researcher only. Researcher aims to study the sugar within school food environment which every question is not right or wrong answer.

The important answer is your opinion or if you have any suspect please do not hesitate to ask. Our researcher team is very please to answer in any question.

The questionnaire is divided in to 4 parts

Part I: Socio-Demographic characteristics.

Part II: Knowledge on snack/sweet beverage consumption

Part III: Attitude on snack/sweet beverage consumption

Part IV: School food environment (socio-cultural, political, economic)

Part I. Students socio - demographic characteristic

Please fill in the blank or check (/) in the appropriate box to answer the question?

1. Birth date…….month……years
2. Age of students …… year…….month
3. Students is studying in grade □ 5^{th} □ 6^{th}
4. Gender □ male □ female
5. Religion……..
6. Number of family members……..(include respondent)
7. Students weight……
8. Students height ……
9. Father's occupation
   - □ Labor/Wager
   - □ Farmer/gardener
   - □ Government officer
   - □ Factory worker
   - □ Own business
   - □ Other (specific)……
10. Mother's occupation
    - □ Labor/Wager
    - □ Farmer/gardening
    - □ Government officer
    - □ Factory worker
    - □ Own business
    - □ Other (specific)……
11. Do you have any disease?
    - □ No □ Yes (specific) ……

Part II . Knowledge about snack and sweet beverage consumption.

For the following statements please specify that which is the best answer in each statement.

Statement	Right	Wrong	Not sure
12. Snack is food that can eat all the time 13. Main ingredients of crispy snack are starch, sugar and fat 14. Monosodium glutamate in snack is harmful to your health 15. Nutrition label on snack package indicate the content of snack 16. Candy and gum contain high sugar. 17. There are harmful to your health if color in snack and sweet beverage are collect in your body. 18. Soft drink contains water, sugar and carbonate gas. 19. Caffeine in soft drink can increase heart rate. 20. Sweet beverage and fruit juice contained high sugar contained. 21. Always eating ice cream is cause of obesity. 22. Drinking pure milk is free risk to dental caries. 23. Routine drinking milk yogurt is risk to dental caries and obesity. 24. Routine drinking sweet milk is risk to dental caries and obesity.			

Part III. Attitude about snack and sweet beverage consumption

Please select the only one best answer for the following statement according to your opinions

Statement	Agree	Disagree	Undecide
25. You think that colourful snack or beverage look delicious. 26. Premium in snack package can motivate you to buy it. 27. You feel fresh when you drink sweet beverage. 28. You think that life would be dull if there is no sweetness. 29. You think that there is fun, if there are snack or sweet beverage. 30. You think that snack and sweet beverage causes obesity. 31. You think that snack and sweet beverage is bad for health. 32. You think that the snack and beverage in modern package is more interesting than simple package. 33. You think that avoidance of sweetness is beneficial. 34. You feel interested in learning information about food and health. 35. You think that it is important to pay attention to nutrition labels of snack and sweet beverage. 36. You feel confident to eat snack or beverage that have nutrition label. 37. You think that it is important that snack and sweet beverage I eat keep me healthy.			

Part IV. School food environment

Please fill in the blank or check (/) in the appropriate box to answer the question.

Socio – cultural environment

Friend modelling

25. Do your closed friends consume sweet beverage?
    - □ Yes
    - □ No (skip to question 40)
26. How much of your friends that consume sweet beverage?
    - □ Most of them
    - □ Some of them
    - □ None of them
27. Do your closed friends consume snack?
    - □ Yes
    - □ No (skip to question 42)
28. How much of your friends that consume snack?
    - □ Most of them
    - □ Some of them
    - □ None of them
29. Whether your friends have an influence on your food decision making?
    - □ Yes
    - □ No (skip to question 44)
30. How often that your friends have an influence on your food decision making?
    - □ Every time
    - □ Sometime
    - □ Never
31. Do you feel inferior to your friends if you drink water instead of soft drink?
    - □ Yes
    - □ No (skip to question 46)

32. How often that you feel inferior to your friends if you drink water instead of soft drink?
    - ☐ Every time
    - ☐ Sometime
    - ☐ Never
33. Do you choose the food as same as your friends choose?
    - ☐ Yes
    - ☐ No (skip to question 48)
34. How often that you choose the food as same as your friends choose?
    - ☐ Every time
    - ☐ Sometime
    - ☐ Never

Please select the only one best answer for the following statement according to your opinions

Statement	Always	Sometime	Never
Food as reward			
35. The teacher usually gave the students a snack or sweet beverage as reward to when they do a good academic performance or a good behavior.			
36. In special event such as “Children day” or “New Year cerebration” you had received sweet food or snack as a gift.			
Family practice			
37. At home, your parent or food maker adds sugar in food.			
38. At home, you have dessert after meals.			
39. At home, you and your family have sweet beverage as usual drink			

Political environment

Food rules

40. Does not allow students to buy food outside school during school hours.

 Yes

 No

41. Restricts certain food and/or beverage advertisements on school grounds.

 Yes

 No

42. Prohibited selling sweet carbonate water or sweet snack in school.

 Yes

 No

Nutrition education programs

43. Does the school have class on food and nutrition?

 Yes

 No

44. Have you been taught to select proper food which good for your health?

 Yes

 No

45. Does the school give the lesson on the effect of healthy and unhealthy food to health?

 Yes

 No

46. Does school has any meeting or work groups on school nutrition?

 Yes

 No

Information source

60. Have you ever received information about snack and sweet consumption in the school?

 Yes

 No (skip to question 62)

61. What kind of media that you received information about snack and sweet consumption in the school? (Can choose more than one answer)

- □ Book
- □ News paper
- □ Magazine
- □ TV
- □ Radio
- □ Internet
- □ Leaflets
- □ Notice board
- □ Teacher
- □ Friend
- □ Others (specific)…….

Economic environment

Daily allowance

62. How much daily allowance you received from your parent?

……baht/day

ID.No. of questionnaire……Date ……/……./……..

Self – report of Food Intake

Sugar consumption within food environment among 5th and 6th grade primary school students in Rongkwang District, Phrae province,Thailand

Objective of the self – report

This report is constructed for collecting data of snack and beverage that participate eat during school hours by exclude every thing that they eat at home and main foods. These data will be calculated to find out total sugar consumption in g/day. The total data will be kept with the researcher and co-researcher only.
Researcher aims to study the sugar within school food environment which every question is not right or wrong answer.

The important answer is your opinion or if you have any suspect please do not hesitate to ask. Our researcher team is very please to answer in any question.
The report is consist of 2 parts

Part I: Snack intake report form

Part II: Beverage intake report form

Part I Snack intake report

Please report the snack items that you ate in school since you arrive school until now.
*For after school time, please report the snack you ate after school in yester day instead of today.

Snack Intake Report				
Time	Brand/ Name	Classified 1. Candy 6. crispy snack 2. Chocolate 7. jelly 3. bread/cake 8. nut 4. Thai dessert 9. fruit 5. ice cream 10 other (specific)…….	Number	Unit 1= seed 4=cup 2= pack 3= piece 7 = other (specific)
Morning				
Between Morning-lunch				
Lunch				
Between Lunch – Evening				
After school (yesterday)				

Part II Beverage intake report

Please report the beverage items that you drink in school hours since you arrive school until now. *For after school time, please report the beverage you drink after school in yester day instead of today.

Beverage Intake Form				
Time	Brand / Name	Classified 1. Fruit Juice 6 soft drink 2. Milk 7. herb juice 3. Milk yogurt 8. green tea 4 .sweet milk 5. Noncarbonated sweet drink 9. Other (specified)……	number	unit 1= box 5= can 2= glass 3= bottle 4= other
Morning				
Between Morning-lunch				
Lunch				
Between Lunch - After school				
After school (yesterday)				

The observation guideline of school food environment

School .....date.....

Part I available of snack

Snack			
Snack items	Available	Not Available	Note
1. Candy			
2. Chocolate			
3. bread/cake			
4. Thai dessert			
5. ice cream			
6. crispy snack			
7. jelly			
8. protein snack			
9. fruit			
10other (specific)…….			

Part II Availability of beverage

Beverage			
Beverage items	Available	Not available	Note
1. Fruit Juice			
2. Milk			
3. milk yogurt			
4 .sweet milk			
5. Noncarbonated sweet drink			
6 soft drink			
7. other (specified)……			

Part III Number of food shop

Number of food store in school.....

Number of food store around school.....

Number of food store sell snack in school.....

Number of food store sell snack around school.....

Number of food store sell sweet beverage in school.....

Number of food store sell sweet beverage in school.....

Number of food store in school managed by school/teacher.....

Number of food store in school managed by students.....

Number of food store in school manages by private sector.....

List of participating school

A = Baan Maesai school

B = Chantimakom school

C = Baan Maeyangpeaw school

D = Anuban Rongkwang school

E = Baan Maeyangyong school

F = Baan Tongsri school

G = Baan Maeyangrong school

H = Baan Paiyoi school

I = Baan Maeyangpo school

Table 35 Comparison average of sugar consumption between personal factor variables.

Variable	Sugar consumption Median	(p-value)
BMI		
High	17.17	0.675
Medium	19.67	
Low	19.25	
Knowledge		
Good	18.62	0.719
Poor	21.73	
Attitude		
Positive	17.08	0.348
Neutral	19.67	
Negative	22.05	

*Significant (p-value < 0.05, Kruskal Wallis)

Table 36 Knowledge of student by school

	Knowledge	
School	**Good**	**Poor**
AA	21(63.64)	12(36.36)
BB	10(23.81)	32(76.19)
CC	21(43.75)	27(56.25)
DD	40(67.80)	19(32.20)
EE	15(50.00)	15(50.00)
FF	15(50.00)	15(50.00)
GG	26(56.52)	20(43.48)
HH	5(25.00)	15(75.00)
II	7(50.00)	7(50.00)

Table 37 Comparison median of sugar consumption between 9 target school

School	n	Median	p- value	Significant different with schools
A	33	15.577	0.01	E
			0.031	H
B	42	28.325	0.018	C
			<0.001	E
			0.040	F
			0.002	G
			0.002	I
C	48	19.133	0.018	B
			0.003	E
			0.042	H
D	59	24.483	0.001	E
			0.026	F
			0.015	I
E	30	9.000	0.011	A
			<0.001	B
			0.003	C
			0.001	D
			<0.001	G
F	28	13.090	0.040	B
			0.026	D
G	46	18.230	0.027	B
			<0.001	E
			0.008	H
H	20	27.750	0.031	A
			<0.001	E
			0.004	F
			0.008	G
I	14	12.50	0.002	B
			0.015	D
			0.003	H

*Significant (p- value < 0.05, Mann Whitney - Test)

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