

# **Sugar consumption within school food environment among 5<sup>th</sup> and 6<sup>th</sup> grade primary school student in Rongkwang district, Phrae province, Thailand**

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## **ABSTRACT**

The sugar consumption of children in Thailand was high compared with the standard of appropriate sugar consumption (30g/day), and most of sugar consumes in the form of soft drink and snack. Children also spend a large amount of time in school, school food environments were then indicated as the important factor influencing children eating behavior. Sugar consumption was also related to the cause of many health problems: obesity, dental caries and some chronic disease. This study therefore focused to study on sugar consumption within school food environment of primary school student.

A cross-sectional descriptive study was conducted to determine sugar consumption from snacks and beverages within school food environment. The study conducted with 320 students who study in 5<sup>th</sup> and 6<sup>th</sup> grade of 9 primary schools, Rongkwang district, Phrae province, Thailand. Data were collected by self-report of food intake, questionnaire with interview administered, and observation from 8 January – 5 February 2009.

The result showed that 71.25% of students consumed sugar in school at high level (>12g/day) and sweet beverage was the main source of sugar intake. Although, every school had policies to limit sugar consumption, sweet beverages were still found in all school. The result also revealed that students from different physical and economic environment were found statistically different in sugar consumption ( $p$ -value<0.001), however, the different was not found with political and socio-cultural environment. There was also statistically different of sugar consumption among students from 9 schools ( $p$ -value<0.001). This finding suggests that identification of nutrition value in snacks and beverages and stronger school food policy is needed to improve school food environment and introduce healthy food for students.

**Keyword**    Sugar Consumption    School Food Environment

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## การบริโภคน้ำตาลภายใต้สิ่งแวดล้อมด้านอาหารในโรงเรียนของ นักเรียนชั้นประถมศึกษาปีที่ 5 และ 6 ในเขตอำเภอร่องขวาง จังหวัดแพร่ ประเทศไทย

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### บทคัดย่อ

การบริโภคน้ำตาลของเด็กในประเทศไทยมีปริมาณสูงเมื่อเทียบกับปริมาณน้ำตาลที่เหมาะสมต่อการบริโภคต่อวัน (30 กรัม/วัน) และปริมาณน้ำตาลส่วนใหญ่ได้รับจากการบริโภคเครื่องดื่มและขนม โดยทั่วไปเด็กใช้เวลาส่วนใหญ่ที่โรงเรียน สิ่งแวดล้อมด้านอาหารในโรงเรียนจึงเป็นตัวแปรที่สำคัญต่อพฤติกรรมการบริโภคของเด็ก อีกทั้งปริมาณการบริโภคน้ำตาลมีผลต่อปัญหาทางสุขภาพหลายชนิด เช่น โรคอ้วน ฟันผุ และโรคเรื้อรังบางชนิด ดังนั้นการศึกษานี้จะศึกษาเกี่ยวกับการบริโภคน้ำตาลภายในโรงเรียนของเด็กนักเรียนชั้นประถมศึกษา

การศึกษานี้รายงานการบริโภคน้ำตาลจากขนมและเครื่องดื่มที่มีรสหวานภายในโรงเรียน ของนักเรียนชั้นประถมศึกษาปีที่ 5 และ 6 จำนวน 320 คน จาก 9 โรงเรียนในเขตอำเภอร่องขวาง จังหวัดแพร่ โดยทำการเก็บข้อมูลจากแบบบันทึกการบริโภคขนมและเครื่องดื่มแบบสัมภาษณ์ และการสังเกตการณ์สิ่งแวดล้อมด้านอาหารภายในโรงเรียน ระหว่างวันที่ 8 มกราคม ถึง 5 กุมภาพันธ์ 2552

ผลการศึกษาพบว่า 71.25% ของนักเรียนบริโภคน้ำตาลในระดับสูง (12 กรัม/วัน) โดยได้รับจากเครื่องดื่มที่มีรสหวานมากกว่าจากอาหารหวาน และถึงแม้ว่าทุกโรงเรียนที่เข้าร่วมการศึกษา จะมีนโยบายควบคุมการบริโภคน้ำตาลในโรงเรียน แต่พบว่าทุกโรงเรียนยังมีการขายขนม และเครื่องดื่มที่มีรสหวาน และนักเรียนจากแต่ละโรงเรียนมีการบริโภคน้ำตาลที่แตกต่างกัน อย่างมีนัยสำคัญ ( $p\text{-value} < 0.001$ ) และนักเรียนจากโรงเรียนที่มีความแตกต่างของสิ่งแวดล้อม ด้านกายภาพและเศรษฐกิจ มีการบริโภคน้ำตาลแตกต่างกัน อย่างมีนัยสำคัญ ( $p\text{-value} < 0.001$ ) แต่ไม่พบความแตกต่างในกรณีที่มีความแตกต่างของสิ่งแวดล้อมด้านนโยบายและสังคม-วัฒนธรรมเกี่ยวกับอาหารภายในโรงเรียน

ผลการศึกษาแสดงให้เห็นว่าโรงเรียนควรมีการแสดงคุณค่าทางโภชนาการของขนมและเครื่องดื่มที่ขายในโรงเรียน รวมทั้งปรับปรุงนโยบายและสิ่งแวดล้อมทางด้านอาหารภายในโรงเรียน เพื่อให้เด็กได้รับอาหารที่มีประโยชน์จากโรงเรียน

**คำสำคัญ** การบริโภคน้ำตาล สิ่งแวดล้อมด้านอาหารในโรงเรียน

## INTRODUCTION

Sugar consumption in many countries has increased dramatically over the last twenty years. 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). In Thailand sugar consumption was also rapidly growth over the past twenty years (2). Thai people consumed about 80 g/day. A study of sugar consumption among Thai children aged 3-12 year in 2005 reported that the children consumed 29.83 g/day of sugar or 7.5 teaspoons with most of sugar consume in the form of soft drink (3). The previous research also reported that sweet snack and beverage play the significant role in sugar consumption in Thai children (4).

Obesity and dental caries are commonly known as the results of high sugar consumption, and sugar consumption causes chronic disease such as diabetes and coronary heart disease are also well established (5, 6). Refined sugar, and sugars in simple carbohydrates, account for most of the weight gain people experience (7). Frequent sugar consumption provides the acidosis condition in oral cavities which contribute to demineralization of tooth surfaces that result in dental caries (8).

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 (9, 10 and 11), and are important influences on children's eating patterns. Since school age children spend a substantial amount of time in school, and 35%-40% of children received main daily

energy at school, school food environments may influence eating behavior (12, 13, 14).

The Ministry of Public Health of Thailand launched the "Maikinwan Network" to promote a healthy food environment and food policy in primary, secondary and high schools in Thailand (15). Phrae province is one of province in Thailand that has been launched Maikinwan campaign. Many school in Phrae province have been done the various school food policies to improve school food environment and those polices were found the different implementation among primary school in Rongkwang district. However, almost all students in Rongkwang district still eat sweet snack (97.6%) and beverage (74.8%) at school (16).

Despite the potential impact of the school food environment on student eating behavior were reported, there is little research about sugar consumption levels within primary school students. The aims of this study, therefore, ascertain the level of sugar consumption from snacks and beverages, excluded the sugar consumption from main food by primary school children in Rongkwang district Phrae province, and characterize the school food environment.

## METHODOLOGY

The 32 primary schools in Rongkwang were stratified into large school and small school. Each stratum was divided into school in rural area and urban area. Then 9 primary schools were selected by random sampling technique. The study was conducted with all students in 5th and 6th grade from 9 primary schools. The permission of Ethics Committee of Mahidol University and permission to collect data from principal of each target primary school were operated

before collecting data. This study used self-report of food intake, structure questionnaire and observation guideline as a research instrument. The self-report of snacks and beverages consumption was used to measure sugar consumption of the students. The students were asked to record type, size and brand of snacks and beverages that they only consumed during school times before they went back home for three day in the same week. Maikinwan sugar index or food recipe were used to identify the amount of sugar consumption that students consumed. Forty percent of maximum sugar consumption recommended for one day (12 g/day) was used as the standard of appropriate sugar consumption in school time (8, 17).

The questionnaire was developed based on the research literature and tested for reliability before interviewing by 4 interviewers. The questionnaire consist 4 parts of socio-demographic characteristics, knowledge on snack/sweet beverage consumption, attitude towards snack/sweet beverage consumption, school food environment.

Knowledge and Attitude on snack and sweet beverage consumption, gender and Body Mass Index (BMI) of student were included in personal factors. Student's weight and height were measured to obtain their BMI, and then BMI of children were categorized according to the CDC (Center of Disease Control and Prevention) BMI for age growth charts (18). School food environments questions included political, socio-cultural, and economic environments. The questions for daily allowances (baht/

day) and parents' occupations were included in economic environments.

Political environment comprised with questions about (a) school food rules (b) nutrition education program, and (c) information about snacks and beverages. Then students were classified as having or did not have awareness on school food rules, received all or some of nutrition education program, and received or not received information about snacks and beverages from school.

Question of socio-cultural environment comprised with (a) family modeling, (b) friends modeling, and (c) food as reward. Then students were classified to be 2 groups in each variables; having and did not have friend modeling, having and did not have family modeling, having and did not have experience on food as reward.

The physical school food environment was observed by researcher by observation guideline. The guideline included availability of 8 types of snacks (candy, crispy snack, ice cream, cake/bread, jelly, protein snack, and fruit) and 6 type of beverages (milk, fruit juice, syrup water, milk yogurt, sweet milk, and soft drink). Numbers of food shops in school and around school were also observed in the same time.

Descriptive statistic analysis was used to examine levels of sugar consumption and school food environments. The different of sugar consumption between groups in each variable were examined by using inferential statistics both parametric and non parametric statistics.

**Table 1** Physical environment of school food by school

School	No. of sweet snack items	No. of sweet beverage items	No. of food shop in school	No. of food shop around school
A	3	3	1	2
B	5	3	2	7
C	6	3	1	5
D	6	3	1	6
E	0	1	1	1
F	4	3	1	3
G	4	3	1	5
H	3	4	1	3
I	2	3	1	3

**Table 2** Amount of sugar consumption from snack and beverage (g/day in school)

Food	Median	Min	Max
Snack	5.33	0.00	39.58
Beverage	12.50	0.00	83.53

## RESULTS

The Physical environment of school food in each school have been presented in Table 1. It showed that E school did not sell sweet snack in school and was found sweet beverage only 1 items. The highest number of sweet snack and beverage items sold in school is 6 and 4 items respectively. Most school has 1 shop in school and food shop around school was ranged from 1 to 7 shops.

Most students (71.25%) consumed high levels of sugar (> 12 g). The average of sugar consumption was 19.11 g/day in school. Table 2 showed that amount of sugar from beverages was approximately 2 times higher than snacks consumption.

Table 3 showed that students from B school consumed highest amount of sugar which was 28.32g/day in school, and the lowest is 9 g/day from E school students. The results revealed that there was significantly different of sugar consumption by students among 9 schools. ( $p < 0.05$ )

Socio-demographic results showed that among 320 students, majority were 12 years old with higher proportion of male than female, and most of them (78.44%) had normal BMI with higher proportion of overweight girls than overweight boys.

## Personal factors

Table 4 showed that the proportion of overweight students who consumed high

level of sugar was 2 times higher than those who consumed low levels. However, underweight students were found 3 times higher proportion of students who consumed sugar at high level than low level. Good and poor knowledge students were relatively similar in sugar consumption at high level. There was approximately equal of students who consumed high level of sugar among negative, neutral, and positive attitude students.

The result in Table 6 showed that there was no significantly different of sugar consumption among high, medium and low BMI students. The finding also showed that good and poor knowledge students were not statistically different in sugar consumption. The similar result of students' attitude was found.

### **Physical environment**

Table 5 showed that fruit juice and syrup water was sold by almost all school. However, there were no soft drink, sweet milk and candy in any schools while milk (no sugar) was found in every school. Higher proportion of students who consumed high level of sugar was shown in school that sold more snacks or beverages items than the less items school was showed in Table 5. Table 5 also shows that schools that had 2 food shops in school or had equal or more than 4 food shops around school were more likely to had higher proportion of student consumed high level of sugar than schools that had only 1 food shop in school or had a few food shops around schools. Table 7 showed that there was significantly different of sugar consumption between students from school that sold fruit juice, syrup water, crispy snack, fruit, or protein

snacks and students from school that those types of food were not available. The different of sugar consumption between students from different physical environments were also shown in Table 7.

### **Political environment**

Ninety of students have awareness on school food rules and received all nutrition education programs. The result in Table 5 showed that among students who were defined as have awareness on school food rules was found more students who consumed low levels of sugar than those who did not have awareness. Student who received some nutrition education programs was found higher proportion of students who consumed sugar at high level than those who received all that programs. Most of students received information about snacks and beverages from school which teachers is major source of information and followed by friends.

### **Socio-cultural environment**

Most students have friend modeling on their food choice and had experience of food as reward. However, less than half of students had family modeling on their food practice and among this students group, they were found higher proportion of student who consumed high level of sugar than students that did not have family modeling. The result in Table 6 showed that students in different political and socio-cultural environment were not found significantly different in sugar consumption.

### **Economic environment**

The average of daily allowance in this study is 15 baht/day. Most student received

money 10-20 baht/day. Laborer or wagers were majority of parent occupation. Student who received high daily allowance were more likely to consume sugar at high level than those who received medium and

low daily allowance. The result in Table 6 also showed that there was significantly different of sugar consumption among student who received high, medium and low daily allowance.

**Table 3** Comparison of median of sugar consumption between 9 schools.

School	Number of students	Median	P- value
A	33	15.57	< 0.001*
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	

\*Significant at p-value < 0.01

**Table 4** Personal factor and sugar consumption (n=320)

Variables	Sugar consumption Levels	
	High n (%)	Low n (%)
<b>BMI</b>		
High	26 (66.67)	13 (33.33)
Normal	180 (71.71)	71 (28.29)
Low	22 (73.33)	8 (26.67)
<b>Knowledge</b>		
Poor	108 (69.23)	48 (30.77)
Good	120 (73.17)	44 (26.83)
<b>Attitude</b>		
Negative	36 (69.23)	16 (30.77)
Neutral	119 (72.12)	46 (27.88)
Positive	73 (70.87)	30 (29.13)



**Table 5** School food environments and sugar consumption (n=320)

variables	Sugar consumption Levels	
	High n (%)	Low n (%)
<b>Physical Environment</b>		
<b>Sweet snacks items</b>		
≤2	40 (62.50)	24 (37.50)
>2	188 (73.44)	68 (26.56)
<b>Sweet beverages items</b>		
<3	70 (66.67)	35 (33.33)
≤3	158 (73.49)	57 (26.51)
<b>Food shop Inside school</b>		
1	192 (69.06)	86 (30.94)
2	36 (85.71)	6 (14.29)
<b>Food shop Around school</b>		
<4	76 (60.80)	49 (39.20)
≤4	152 (77.95)	43 (22.05)
<b>Political Environment</b>		
<b>Food rules</b>		
Do not have food rules	25 (78.13)	7 (21.88)
Have food rules	203 (70.49)	85 (29.51)
<b>Nutrition education program</b>		
Receive some programs	24 (75.00)	8 (25.00)
Received all programs	204 (70.83)	84 (29.17)
<b>Received information</b>		
Yes	200 (70.67)	83 (29.33)
No	28 (75.68)	9 (24.32)
<b>Socio-cultural Environment</b>		
<b>Friend modelling</b>		
Do not have friend modelling	67 (72.83)	25 (27.17)
Have friend modelling	161 (70.61)	67 (29.39)
<b>Food reward</b>		
Do not have experience	76 (72.38)	29 (27.62)
Have experience	152 (70.70)	63 (29.30)
<b>Family modelling</b>		
Not have family modelling	130 (67.71)	62 (32.29)
Have family modelling	98 (76.56)	30 (23.44)



**Table 5** School food environments and sugar consumption (n=320) (cont.)

variables	Sugar consumption Levels	
	High n (%)	Low n (%)
<b>Economic Environment</b>		
<b>Daily allowance levels</b>		
Low	33 (52.38)	30 (47.62)
Medium	118 (73.29)	43 (26.71)
High	77 (80.21)	19 (19.79)
<b>Father occupation</b>		
Labor/wager	179 (71.60)	71 (28.40)
Government officer	13 (72.22)	5 (27.78)
Own business	36 (69.23)	16 (30.77)
<b>Mother occupation</b>		
Labor/wager	183 (70.38)	77 (29.62)
Government officer	2 (50.00)	2 (50.00)
Own business	43 (76.79)	13 (23.21)

**Table 6** Comparison of mean of sugar consumption and the percentage of students classified by personal factors and school food environment (n=320)

Variables	n	%	Mean	P-value
<b>Personal factor</b>				
BMI				0.67
High	32	12.19	21.23	
Normal	30	9.30	21.18	
<b>Knowledge</b>				0.84
Poor	156	48.75	22.94	
Good	164	51.25	22.57	
<b>Attitude</b>				0.34
Negative	52	16.25	23.83	
Neutral	103	32.19	20.32	
<b>Political Environment</b>				
<b>Food rules</b>				0.10
Do not have food rules	32	10.00	22.10	
Have food rules	288	90.00	28.85	
<b>Nutrition education program</b>				0.93
Receive some programs	321	0.00	22.73	
Received all programs	288	90.00	23.01	
<b>Received information</b>				0.17
Yes	283	88.44	22.26	
No	37	11.56	26.97	
<b>Socio-cultural Environment</b>				
<b>Friend modeling</b>				0.47
Don't have friend modeling	92	28.75	23.97	
Have friend modeling	228	71.25	22.34	
<b>Food reward</b>				0.16
Do not have experience	105	32.81	21.09	
Have experience about	215	67.19	23.65	
<b>Family modeling</b>				0.11
Don't have family modeling	192	60.00	21.52	
Have family modeling	128	40.00	26.90	

**Table 6** Comparison of mean of sugar consumption and the percentage of students classified by personal factors and school food environment (n=320) (cont.)

Variables	n	%	Mean	P-value
<b>Economic Environment</b>				
<b>Daily allowance</b>				<0.001*
Low	63	19.69	16.03	
Medium	161	50.31	22.75	
High	96	30.00	27.16	
<b>Father's occupation</b>				0.80
Labor/wager	250	78.13	22.83	
Government officer	18	5.63	24.60	
Own business	52	16.25	21.71	
<b>Mother's occupation</b>				0.80
Labor/wager	260	78.13	22.58	
Government officer	4	1.25	19.11	
Own business	56	17.50	23.80	

\* Significant at p-value &lt; 0.01

**Table 7** Comparison mean of sugar consumption between availability of snacks and beverages in schools, number of sweet items, and number of food shops (n=9)

Physical Environment	Mean	P-value
<b>Availability of sweet items</b>		
<b>Cake/bread</b>		0.37
Available	23.33	
Not available	19.60	
<b>Crispy snack</b>		0.13
Available	23.73	
Not available	18.84	
<b>Ice cream</b>		0.45
Available	22.99	
Not available	22.35	
<b>Thai dessert</b>		0.75
Available	23.49	
Not available	22.09	
<b>Chocolate</b>		0.03**
Available	20.89	
Not available	23.19	
<b>Jelly</b>		0.16
Available	25.45	
Not available	22.14	
<b>Fruit</b>		0.004**
Available	25.14	
Not available	17.86	
<b>Protein snack</b>		<0.001**
Available	24.89	
Not available	19.37	
<b>Fruit Juice</b>		<0.001**
Available	23.81	
Not available	12.52	
<b>Syrup water</b>		0.13
Available	23.81	
Not available	12.52	
<b>Milk yogurt</b>		<0.001*
Available	19.60	
Not available	23.33	

**Table 7** Comparison mean of sugar consumption between availability of snacks and beverages in schools, number of sweet items, and number of food shops (n=9) (cont.)

Physical Environment	Mean	P-value
<b>Number of sweet snacks items</b>		0.03*
≤2	18.80	
>2	23.70	
<b>Beverages items</b>		0.08
<3	23.18	
≤3	22.54	
<b>Food shop in school</b>		0.004*
1	21.54	
2	30.75	
<b>Food shop around school</b>		0.01*
<4	23.82	
≤4	22.51	

\* Significant at p-value &lt;0.05

\*\* Significant at p-value &lt;0.01

## DISCUSSION

The result showed that the median of sugar consumption was 19.11 g/day in school or around 5 teaspoons/day in school which less than the study in primary school in Rajaburee province (15), that reported average of sugar consumption in school was 9.4 tsp/day. Although this study collected sugar consumption only in school time, this number (~ 5 tsp/day in school) was closed to maximum recommendation for whole day sugar consumption or 6 tsp/day (8).

Presumable that whole day sugar consumption of students might higher than the maximum recommendation by Maikinwan Network. Therefore, most students in this study were classified as high levels of sugar consumption students. (71.25%) In addition, there might be

underestimating of sugar consumption because underreporting of food intake.

This study was not concern about others confounding factor of BMI such as physical activity that might result in no statistically different of sugar consumption among high, medium and low BMI student.

The common school food policy in every school is restriction selling sweet food in school that lead to unavailable of soft drink, sweet milk and candy in any school. However, fruit juice milk yogurt and syrup water that contained high amount of sugar were still found in many schools. Therefore, most students still exposed to sweet beverage in school, and amount of sugar from beverages consumption was higher than snacks consumption. Furthermore, between students from school that fruit juice

or syrup water was available and not available was found significantly different of sugar consumption. These results showed that prohibition selling soft drink, sweet milk and candy in school was not enough to reduce sugar consumption in school. Moreover, result of students' knowledge showed that less than half of them knew about health effect of drinking sweet beverages especially milk yogurt.

A greater availability and accessibility of sweet snacks and beverages in school facilitate sugar consumption of students. The student who exposed with more snacks items in school were more likely to consumed high sugar level than those who exposed with few items. Food shops around school were main source of sweet snacks and beverages, students who could access to more food shops around school tended to consume higher amount of sugar. While food shops in school were found both high and low sugar food items.

School food policy was the important strategy used to regulate availability and accessibility of unhealthy and healthy food in school which could improve school food environment. However, a requirement for revenue from school food shops might decrease priority of school food policy because sweetened could provide good revenue for school shop. Even most student were defined as have awareness on school food rules, and received all nutrition education programs, this study was not found statistically different in sugar consumption between student from different political environment. Therefore, school food policy might not regulate school food environment properly.

The respondent in this study was too young to give accurate answer of the questions about family food practice and friend modeling on their food choice. The finding did not show significant different of sugar consumption between student who have and do not have family modeling or friend modeling. However, the study in pre-adolescence reported that overweight girls had more responsive to external factor or peer modeling than underweight or normal weight students that was major group in this study. Offering food as reward was common in many culture including Thai culture, most student had experience on food as reward in school. Therefore, reducing sugar consumption in school needed cooperation of principal, teacher and food staff in school.

Regarding to Thailand National Lunch program that provided main food for all student in school, students had individual potential to purchase their money for sweet snacks and beverages in and around school. Students who received more daily allowance had higher opportunity to consumed sweet snack and beverages.

## CONCLUSION

This study showed that every school had school food policy to limit sweet snacks and beverages consumption. However, the result showed that most student consumed sugar in high level which major source of sugar came from sweet beverages. Fruit juice, syrup water, and milk yogurt were still found in many schools, and there was significantly different of sugar consumption between student from school that sold and did not sell those types of beverages.

Identification of nutrition value in any kind snacks and beverages in school and clarify definition of sweet food in school food policy were suggested to improve nutrition standard in school. The finding also found the significantly different of sugar consumption among student from 9 school, and students from different physical environment (availability of sweet food, number of sweet snacks, and number of food shops) and economic environment (daily allowance). Stronger school food policy is needed to regulate school food environment and introduce healthy food for students.

For the further study, developing of sugar index that cover snack and beverage items is important to identify exactly amount of sugar. Self-reporting technique which results in underestimating of sugar consumption is also needed to be adjusted for more accurate data.

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