ASSESSMENT OF MATERNAL FACTORS ASSOCIATED WITH OVERWEIGHT AND OBESITY AMONG PRIMARY SCHOOL CHILDREN IN BANGKOK, THAILAND

Attapong Sinkitjasub[1,2], Kanittha Chamroonswasdi[2], Paranee Vatanasomboon[3], Warapone Satheannoppakao[4] and Phitaya Charupoonphol[2]

[1]Doctor of Public Health Program (International Program), Faculty of Graduate Studies, Mahidol University, Nakhon Pathom, Thailand; [2]Department of Family Health, [3]Department of Health Education and Behavioral Sciences, [4]Department of Nutrition, Faculty of Public Health, Mahidol University, Bangkok, Thailand

Abstract. The prevalence of overweight and obesity among children in Thailand is increasing. It is important to assess the factors associated with this problem. In this study we aimed to assess maternal factors potentially associated with overweight and obesity among primary school students in Bangkok, Thailand in order to inform obesity prevention programs for this study population. Study subjects were children who were in fourth to sixth grades at 5 schools in Bangkok and the mothers of each of these students. Both maternal and child subjects were asked to complete a standardized questionnaire asking about demographics and lifestyle. Subjects were chosen randomly. The height and weight of each maternal and child subject were obtained. The study was conducted during 5-30 March 2019. A total of 142 maternal and child subject pairs were included in the study. The mean (±standard deviation (SD)) ages of maternal subjects and child subjects were 39.8 (±6.9) and 10.9 (±0.9) years, respectively. A total of 16.9% of child subjects were overweight (defined as a BMI = 25.0-29.9 kg/m^2) and 6.3% were obese (defined as a BMI ≥30.0 kg/m^2). On multiple logistic regression analysis, factors significantly associated with overweight/obesity in child subjects were: poor maternal knowledge about weight control in children (adjusted odds ratio (adjusted OR) = 2.416; $p = 0.045$), poor maternal communication with child about weight control (adjusted OR = 4.014; $p = 0.005$), poor maternal feeding practice (adjusted OR = 3.195; $p = 0.038$), poor maternal control of child behavior (adjusted OR = 3.205; $p = 0.006$) and poor child eating behavior (adjusted OR = 5.134; $p = 0.005$). Child obesity prevention and control programs for the study population need to develop methods to educate mothers about childhood obesity and improve good parenting skills. Further studies are needed to determine if these methods are useful in preventing and controlling the public health problem of childhood obesity in this study population.

Keywords: childhood overweight, childhood obesity, maternal practice

Correspondence: Kanittha Chamroonswasdi, Department of Family Health, Faculty of Public Health, Mahidol University, 420/1 Ratchawithi Road, Ratchathewi, Bangkok 10400, Thailand.
Tel/Fax: +66 (0) 2354 8536
Email: kanittha.cha@mahidol.ac.th

INTRODUCTION

Childhood overweight and obesity has been defined as excessive fat accumulation in children aged 2-18 years old (Karnik and Kanekar, 2012). The extended 2012 International Obesity Task Force (IOTF) defined overweight as a body mass index (BMI) ≥25 kg/m^2 and obesity as a BMI ≥30 kg/m^2 (Cole and Lobstein, 2012). The World Health Organization (WHO) has defined overweight as a BMI per age 1.1-1.9 standard deviations (SD) above a standardized graph set by the WHO and defined obesity as ≥2 SD above the standard set by the WHO (Onis *et al*, 2007). Childhood overweight/obesity is an emerging public health problem in both developed and developing countries (Kelly *et al*, 2008). Childhood overweight/obesity has short- and long-term impacts on child development and health. Obesity is associated with hyperlipidemia, hypertension, diabetes, cardiovascular disease, cancer, skin disease and bone and joint disease (Sahoo *et al*, 2015). Childhood overweight/obesity is also associated with depression and low self-esteem (Sahoo *et al*, 2015). Childhood overweight/obesity often continues into adulthood, with negative impacts on the individual, family and society (Freedman *et al*, 2001; Reilly and Kelly, 2010).

Factors associated with childhood overweight/obesity can be categorized into 3 groups: child factors, parental factors and environmental factors (Lobstein *et al*, 2004). Child factors include poor eating behavior, reduced physical activity and sedentary lifestyle (Adair and Popkin, 2005; Reinert *et al*, 2013; Rey-López *et al*, 2008; Sallis and Glanz, 2006). Parental factors include poor child-rearing styles (Golan, 2006; Rhee, 2008), poor parental knowledge about a healthy diet (Variyam, 2001; Birch, 2006) and not supervising eating behavior or physical activity (Ventura and Birch, 2008; Kakinami *et al*, 2015; Gerads *et al*, 2012), especially by the mother (Birch and Fisher, 2000; Spruijt-Metz *et al*, 2002). Environmental factors include easily accessible stores selling unhealthy food and lack of sports centers and playgrounds to allow adequate physical activity (Sallis and Glanz, 2006; Hill *et al*, 2003). Parental factors have the greatest influence on overweight/obesity (Lindsay *et al*, 2006; Gibson *et al*, 2013).

The family functioning theory (Miller *et al*, 2000) theorizes the function of the family provides an appropriate environment for family members to develop physical, psychological and social well-being and consists of 6 elements: problem-solving, communication, family role, affective response, affective involvement and behavior control.

Studies have shown these 6 elements to be significantly associated with childhood overweight/obesity among a variety of races and ethnicities (Halliday *et al*, 2014; Berge *et al*, 2013). The family function assessment device (FAD) is an instrument developed and used to assess family function, including overweight/obesity prevention, especially in regard to poor communication, poor behavior control and poor problem-solving (Berge *et al*, 2013; Herzer *et al*, 2010; Chen and Kennedy, 2004). The FAD instrument has been translated into at least 14 languages, including Thai, which was translated as the Chulalongkorn Family Inventory (CFI) (Trangkasombat, 2006). The application of this modified FAD instrument to overweight/obese Thai children has yet to be conducted.

The prevalence of childhood overweight/obesity in Thailand increased

from 5.4% observed at the 4th National Food and Nutrition Survey in 1995 to 10.9% observed at the 4th National Health Examination Survey in 2008. Another study from Thailand published in 2014 reported the prevalence of overweight/obesity among children aged 6-9 years to be 14.4% and among children aged 10-14 years to be 17.7% (Yamborisut and Mo-suwan, 2014). Another study of overweight/obesity among primary school children in Bangkok, Thailand reported a prevalence of overweight/obesity of 31.5% (Sirikulchayanonta *et al*, 2011). Another study performed in Bangkok, Thailand (Satrisiri, 2012) reported 13.3% of primary school children and 16.2% of secondary school children were overweight/obese. The relationship between maternal practices assessed by the family function theory and childhood overweight/obesity among primary school children in Bangkok Thailand has yet to be assessed.

In this study we aimed to assess the prevalence of childhood overweight/obesity among primary school children in Bangkok, Thailand and determine the maternal factors significantly associated with overweight/obesity in this study population using the family function theory in order to inform overweight/obesity control programs for this study population.

MATERIALS AND METHODS

Study design

This study was a cross-sectional survey conducted during 5-30 March 2019.

Inclusion and exclusion criteria for study subjects

Study subjects were primary school students in fourth to sixth grades attending a study school who lived in the same house as their mothers and the mothers of each primary school subject. Only subjects in whom the maternal subject was the main person responsible for feeding the child subject were included in the study.

Exclusion criteria for study subjects were being illiterate in the Thai language, those who were severely ill and subjects who did not complete the questionnaire.

Subject sampling method

We used a two-stage sampling method to select subjects. In the first stage, primary schools were divided into 5 areas: central, south, north, east and Thonburi. One study school was randomly selected for each area. In the second stage, study subjects were randomly selected from the appropriate grades at each study school until the number of child and mother subjects meeting inclusion and exclusion criteria was reached.

Sample size

The minimum required study sample size was chosen using the one-sample proportion with a known total population method (Lwanga and Lemeshow, 1991). The prevalence of overweight/obesity among primary school in Bangkok was determined to be 13% for the purpose of this calculation (Saritsiri, 2012). The minimum subject sample size was calculated to be 115 mother/child subject pairs. We added an additional 25% for missing data and round up giving a total study subject population of 150 mother child pairs: 30 pairs from each of the 5 study schools.

Data collection

Each subject was asked to complete a self-administered questionnaire: one for each child subject and another for each maternal subject. The questionnaire was developed by the researchers based

on a literature review. Both the child and maternal questionnaires were given by the teacher to the child who was asked to bring the maternal questionnaire home to be filled out by the mother and then both returned to the teacher. The weights and heights were based on subject reported values only; no measurements were given.

The maternal questionnaire consisted of 6 parts. Part 1 asked about sociodemographic factors with 12 items: maternal age, family members, marital status, education, occupation, family income, housing type, height, weight, health condition, average number of hours the child subject slept per night and average length of physical exercise per day. Part 2 consisted of multiple-choice questions asking about maternal knowledge regarding child weight control divided into 3 subsections: 10 items asking about knowledge regarding child eating habits, 6 items asking about knowledge regarding child physical activity and 6 items asking about knowledge regarding child sedentary behavior (Chiangkhuntod *et al*, 2013). Part 3 comprised 10 items of five point Likert-scale questions asking about maternal feeding practices (Luangubon, 2009). Part 4 comprised 10 items of five point Likert-scale questions asking about maternal perceptions of child eating behaviors (Chiangkhuntod *et al*, 2013). Part 5 comprised 6 items of five point Likert-scale questions asking about maternal perceptions of child physical activity and sedentary behaviors (Maopech *et al*, 2012). Part 6 consisted of five point Likert-scale questions based on family function theory asking about maternal practices regarding child weight control, modified from the Chulalongkorn Family Inventory (CFI) (Trangkasombat, 2006); it comprised 6 subsections of 5 items each: problem-solving, communication, family role, affective response, affective involvement and behavior control.

The child subject questionnaire consisted of 3 parts. Part 1 asked about sociodemographic factors with 7 items: age, sex, education level, occupation, health condition, height and weight. Part 2 consisted of five point Likert-scale questions comprised of 10 items asking about the child subject's eating behavior (Chiangkhuntod *et al*, 2013). Part 3 consisted of five point Likert-scale questions comprised of 6 items asking about the child subject's physical activity and sedentary behavior (Maopech *et al*, 2012).

The content validity of the questionnaire was determined by three experts: a pediatrician, a nutritionist and a public health professor. The questionnaire was pilot tested for reliability among 30 mother / child subject pairs not included in the main study but meeting inclusion and exclusion criteria. The Kuder-Richardson Formula-20 (KR-20) was used to analyze reliability of maternal knowledge about child weight control. The Cronbach alpha coefficient was used to analyze maternal feeding practices, maternal perceptions about child physical activity and sedentary behavior, the maternal family function, child eating behavior and child physical activity and sedentary behavior. The KR-20 value for the maternal knowledge about child weight control was 0.81. The Cronbach alpha coefficients for 1) maternal feeding practices, 2) maternal perceptions about child eating behavior, 3) maternal perceptions about child eating, physical activity and sedentary behavior, 4) the maternal family function, 5) child eating behavior and 6) child physical activity and sedentary behavior were 0.79, 0.85, 0.76, 0.89, 0.86 and 0.77, respectively.

The interpretation of each question-

naire followed the Bloom classification (Bloom *et al*, 1984) and was classified into 3 groups: low (<60%), moderate (60-79%) and high (≥80%).

The maternal knowledge about child weight control were classified based on the score; the total possible score was 22 points and was classified as having a poor knowledge (<14 points), moderate knowledge (14-17 points) and good knowledge (≥18 points). For each subsection of the maternal knowledge about child weight control and the maternal knowledge about child eating, the total possible score was 10 points and was classified by the total score as having a poor knowledge (<5 points), moderate knowledge (6-7 points) and good knowledge (≥8 points). The maternal knowledge about child physical activities and the maternal knowledge about child sedentary behavior were classified based on the scores; the total possible score was 6 points and was classified by the total score as having a poor knowledge (<3 points), moderate knowledge (3-4 points) and good knowledge (≥5 points).

The maternal feeding practices and the maternal perceptions about child eating and child eating behavior were classified based on the score; the total possible score was 50 points and was classified by the total score as low (<35 points), moderate (35-42 points) and high (≥43 points).

The maternal perceptions about child physical activity and sedentary behavior were classified based on the score; the total possible score was 30 points and was classified by the total score as low (<19 points), moderate (19-22 points) and high (≥23 points).

The maternal family function regarding child weight control was classified based on the score; the total possible score was 150 points and was classified as low (<108 points), moderate (108-126 points) and high (≥127 points). Each subsection of the maternal family regarding the child weight control (problem-solving, communication, family role, affective response, affective involvement and behavior control) were classified based on the score; the total possible score was 30 points and was classified as low (<19 points), moderate (19-21 points) and high (≥22 points).

Data analysis

We described demographic characteristics using frequencies, percentages, medians, means and standard deviations. The chi-square test was used to identify factors associated with childhood overweight/obesity. We used backward multiple logistic regression analysis to determine factors associated with childhood overweight/obesity. Statistical significance was set at p <0.05. The maternal BMI was classified using WHO criteria for adult Asians (WHO WPRO, 2000). The weight category defined as underweight <18.5 kg/m^2, normal weight = 18.5-22.9 kg/m^2, overweight = 23.0-24.9 kg/m^2, and obese ≥ 25 kg/m^2. The child subjects' BMI was classified following the Extended International Obesity Task Force (IOTF) standard criteria (Cole and Lobstein, 2012). The weight category defined as underweight ≤18.5 kg/m^2, normal weight = 18.6-24.9 kg/m^2, overweight = 25.0-29.9 kg/m^2, and obese ≥ 30 kg/m^2.

Ethical considerations

This study was approved by the Human Rights Committee on Human Experimentation, Faculty of Public Health, Mahidol University (MUPH2018-107) and the Ethics Committee, Bangkok

Metropolitan Administration (U045h/61). Maternal and child subjects gave written informed consent prior to inclusion in the study.

RESULTS

Sociodemographic factors

A total of 142 mother/child pairs completed their questionnaires and were included in the study. The mean (± standard deviation (SD)) maternal subject age was 39.8 (±6.9) (range: 27-58) years. The median number of family members was 4 (range: 2-9) persons/family. Seventy-nine point six percent of maternal subjects were married and lived with their spouses, 16.2% were divorced or separated from their spouses and 4.2% of them were widowed. Forty-two point seven percent of maternal subjects had graduated from high school. Twenty-eight point nine percent of maternal subjects were laborers or employees and 25.3% were unemployed or housewives. Family income varied considerably. The median of total family income was THB19,000 (range: 5,000-115,000) per month. Sixty-six point two percent of subjects rented a house and 19.7% owned their property. Sixteen point two percent of maternal subjects were overweight and 33.1% were obese; the median maternal BMI was 22.9 (range: 16.1-34.9) kg/m^2. The overall prevalence of overweight/obesity among maternal subjects was 49.3%. Seventy-six point eight percent of maternal subjects had no chronic illnesses; 22.5% had hypertension, dyslipidemia, diabetes mellitus, cancer or deafness (Table 1).

The mean (±SD) child subject age was 10.9 (±0.9) (range: 9-12) years; 83.1% were female. Thirty-four point five percent of student subjects were in grade 4, 31.7% in grade 5 and 33.8% in grade 6. The median time slept per night was 8.2 (range: 6-8) hours. The median sedentary time was 2 (range: 0.5-6) hours/day. The median physical exercise time was 1 (range: 0-4) hours/day. Sixteen point nine percent of child subjects were overweight and 6.3% were obese. The overall prevalence of overweight/obesity among child subjects was 23.2%. Eighty-six point six percent of child subjects had no chronic illnesses; 13.4% had allergic asthma or glucose-6-phosphate dehydrogenase deficiency (Table 2).

Factor s associated with overweight/obesity among child subjects

The maternal subject factors significantly associated with overweight/obesity among child subjects in this study were overweight/obese maternal BMI (p = 0.003), low maternal knowledge regarding child weight control (p = 0.005), poor maternal practice regarding child feeding (p <0.001) and low maternal perception regarding child physical activity and sedentary behavior (p = 0.015) (Table 3). The maternal practices regarding child weight control based on family function significantly associated with to overweight/obesity among child subjects were maternal poor communication (p <0.001) and poor behavior control (p <0.001). The child factors related to overweight/obesity among child subject in this study were the child subjects who spend sedentary time more than 2 hours per day (p = 0.013) and those who has poor eating behavior (p = 0.004) (Table 4).

Factors associated with overweight/obesity on backward multiple logistic regression analysis

A low maternal knowledge level about child weight was significantly associated with child subject overweight/obesity (adjusted OR = 2.42; 95% confidence

Table 1
Socio-demographic characteristics and weight categories of maternal study subjects (n = 142).

Characteristics	Number	%
Age in years		
<30	11	7.7
30-40	61	47.2
>40	64	45.1
Number of family member		
<4	43	30.3
4-6	73	51.4
>7	26	18.3
Marital status		
Married	113	79.6
Divorced/separated	23	16.2
Widowed	6	4.2
Education		
Illiterate	3	2.0
Primary School	51	34.0
High School	64	42.7
College/university	15	10.0
Graduate School	2	1.3
Occupation		
Unemployed/housewife	36	25.3
Laborer/employee	31	21.8
Private service/worker	41	28.9
Business	33	23.2
Government officer	1	0.7
Household income in THB/month		
<15,000	45	31.7
15,000-30,000	81	57.0
30,001-60,000	14	9.9
>60,001	2	1.4
Housing type		
Own house/property	28	19.7
Rent house/property	94	66.2
Relative's house	6	4.2
Employer's house/property	14	9.9
Weight category (BMI in kg/m^2)		
Underweight (<18.5)	8	5.6
Normal weight (18.5-22.9)	62	43.7
Overweight (23.0-24.9)	23	16.2
Obese (≥25.0)	47	33.1

Table 1 (Continued)

Characteristics	Number	%
Health condition		
Healthy	109	76.8
Chronic illness	32	22.5
Hypertension	20	62.5
Dyslipidemia	7	21.9
Diabetes mellitus	4	12.5
Cancer	1	3.1
Physical disability/handicap	1	0.7

BMI: Body mass index; THB: Thai Baht; kg/m^2: kilogram per square meter.

Table 2
Socio-demographic characteristics and weight categories of child study subjects (n = 142).

Characteristics	Number	%
Sex		
Boy	24	16.9
Girl	118	83.1
Age in years		
9	8	5.6
10	45	31.7
11	48	33.8
12	41	28.9
Year in school		
Grade 4	49	34.5
Grade 5	45	31.7
Grade 6	48	33.8
Hours slept per day		
6-8	98	69.0
9-12	44	31.0
Hour spent in sedentary activity per day		
<2	24	16.9
>2	118	83.1
Hour spent in physical exercise per day		
<1	112	78.9
>1	30	21.1
Weight category (BMI in kg/m^2)		
Underweight (≤18.5)	22	15.5
Normal weight (18.6-24.9)	87	61.3
Overweight (25.0-29.9)	24	16.9
Obese (≥30.0)	9	6.3

Table 2 (Continued)

Characteristics	Number	%
Health condition		
Healthy	123	86.6
Chronic illness	19	13.4
Allergic asthma	18	94.7
G6PD Deficiency	1	5.3

BMI: Body mass index; kg/m^2: kilogram per square meter; G6PD: Glucose-6-phosphate dehydrogenase.

Table 3
Maternal subject factors associated with child weight category (n = 142).

Factors	Child weight category		p-value
	Overweight/obesity (n = 33) (BMI ≥23.0 kg/m^2) n (%)	Normal weight (n = 109) (BMI <23.0 kg/m^2) n (%)	
Weight category (BMI in kg/m^2)			0.003
Overweight/obese (≥23.0)	25 (33.3)	50 (66.7)	
Normal/underweight (<23.0)	8 (11.9)	59 (88.1)	
Knowledge about child weight control			0.005
Low	25 (32.9)	51 (67.1)	
Moderate to high	8 (12.1)	58 (87.9)	
Knowledge about child eating			0.040
Low	18 (34.6)	36 (65.4)	
Moderate to high	15 (8.2)	73 (91.8)	
Knowledge about child physical activity			0.035
Low	27 (29.0)	64 (71.0)	
Moderate to high	6 (12.2)	4 (87.8)	
Knowledge about child sedentary behavior			0.219*
Low	17 (19.3)	71 (80.7)	
Moderate to high	16 (29.6)	38 (70.4)	
Maternal practice about child feeding			<0.001
Poor	27 (35.1)	50 (64.9)	
Fair to good	6 (9.23)	59 (90.77)	
Maternal perception about child eating behavior			0.319*
Low	21 (26.9)	57 (73.1)	
Moderate to high	2 (18.8)	52 (81.2)	
Maternal perception about child physical activity and sedentary behavior			0.015
Low	31 (27.7)	81 (72.3)	
Moderate to high	2 (6.7)	28 (93.3)	

Table 3 (Continued)

Factors	Child weight category		*p*-value
	Overweight/obesity (n = 33) (BMI ≥23.0 kg/m^2) n (%)	Normal weight (n = 109) (BMI <23.0 kg/m^2) n (%)	
Overall family function regarding child weight control			0.029
Poor	20 (32.3)	42 (67.7)	
Fair to good	13 (16.2)	67 (83.8)	
Problem solving			0.235*
Poor	18 (28.1)	46 (71.9)	
Fair to good	15 (19.2)	63 (80.8)	
Communication			<0.001
Poor	24 (38.1)	39 (61.9)	
Fair to good	9 (11.4)	70 (88.6)	
Family role			0.157*
Poor	17 (29.8)	40 (70.2)	
Fair to good	16 (18.8)	69 (81.2)	
Affective response			0.095*
Poor	15 (31.9)	32 (68.1)	
Fair to good	18 (18.9)	77 (81.1)	
Affective involvement			0.104*
Poor	17 (30.9)	38 (69.1)	
Fair to good	16 (18.4)	71 (81.6)	
Behavior control			0.001
Poor	29 (32.2)	61 0(67.8)	
Fair to good	4 (7.7)	48 (92.3)	

BMI: Body mass index; kg/m^2: kilogram per square meter

Table 4
Child subject's factors associated with weight category (n = 142).

Factors	Weight category		*p*-value
	Overweight/ obesity (n = 33) (BMI ≥25.0 kg/m^2) n (%)	Normal weight/ underweight (n = 109) (BMI <25.0 kg/m^2) n (%)	
Hour slept per day			1.000*
<8	23 (23.5)	75 (76.5)	
>8	10 (22.7)	34 (77.3)	

Table 4 (Continued)

Factors	Weight category		*p*-value
	Overweight/obesity (*n* = 33) (BMI ≥25.0 kg/m^2) *n* (%)	Normal weight/underweight (*n* = 109) (BMI <25.0 kg/m^2) *n* (%)	
Hour spent in sedentary activity per day			0.013
>2	27 (30.3)	62 (69.4)	
≤2	6 (11.3)	47 (88.7)	
Hour spent in exercises per day			0.466*
≤1	28 (25.0)	84 (75.0)	
>1	5 (16.7)	25 (83.3)	
Eating behavior			0.004
Poor	28 (31.5)	61 (68.5)	
Fair to good	5 (9.4)	48 (90.6)	
Physical activity and sedentary behavior			0.114*
Poor	11 (16.9)	54 83.1)	
Fair to good	22 (28.6)	55 (71.4)	

BMI: Body mass index; kg/m^2: kilogram per square meter.

interval (CI): 1.09-6.58; $p = 0.045$). A poor maternal subject feeding practices level such as: allowing child to eat snacks instead of meal, allowing a child to eat sweets and have soft drink, allow child to have a large portion size of meal and providing or cooking high-calories foods, was significantly associated with child subject overweight/obesity (adjusted OR = 3.20; 95%CI: 1.16-9.60; $p = 0.038$). A poor maternal communication level regarding child subject weight control was significantly associated with overweight/obesity in the child subject (adjusted OR = 4.01; 95%CI: 1.53-10.53; $p = 0.005$). A poor maternal level for behavior regarding child subject weight control such as: allowing child to have high-calories foods, allowing child to spend sedentary activities more than two hours per day and do not control child to have regularly physical exercises, was significantly associated with child subject overweight/obesity (adjusted OR = 3.21; 95%CI: 1.03-11.10; $p = 0.006$). Poor eating behavior was significantly associated with child subject overweight/obesity (adjusted OR = 5.13; 95%CI: 1.64-16.11; $p = 0.005$) (Table 5).

DISCUSSION

The prevalence of overweight/obesity among our child subjects (23.2%) was higher than that observed from the 4th National Health Examination Survey in 2008 (13.2%) (Yamborisut and Mo-suwan, 2014). The prevalence of overweight/obesity among study mothers (49.3%) was higher than the reported in the National Thai Food Consumption Survey (Jitnarin

Table 5
Association of factors with child subject weight category.

Factors	95%CI	*p*-value
Moderate to high maternal knowledge level about child weight control	1.086 - 6.583	0.045
Fair to good maternal feeding practices	1.164 - 9.595	0.038
Fair to good communication level about child weight control	1.529 - 10.531	0.005
Fair to good behavior control	1.025 - 11.103	0.006
Fair to good child eating behavior	1.636 - 16.110	0.005

CI: Confidence interval.

et al, 2011) (40.9%). These findings are similar to other studies from Thailand which reported that adults and children who lived in an urban area tend to have an overweight/obesity status, more than rural areas (Firestone *et al*, 2011; Yiengprugsawan *et al*, 2011). The urban lifestyles are more likely to be living within time constraints such as getting to work or school, hurrying, causing the lack of healthy food preparation for parents and children. Moreover, the transportation within cities has a high automobile dependence, disincentive to increasing physical activities/exercise and more accessibility to buying fast foods from convenient stores. All of these environmental factors are more likely to increase the risk of overweight/obesity. Since all of our study subjects lived in the city, this may therefore explain that overweight/obesity among children and their mother living in Bangkok is more commonly found higher than the national surveys from the whole country.

In our study, maternal subjects who were overweight/obese were significantly more likely to have an overweight/obese child subject, similar to previous studies (Tzou and Chu, 2012; Svensson *et al*, 2010). Svensson *et al* (2010) reported that the severity of childhood obesity among subject aged 7–15 years was found significantly positively associated with maternal BMI and parental BMI. These findings may confirm that the lifestyle of overweight parents often affects to their children since child are more likely to follow the parent's footprint in term of lifestyle practices such as, eating behaviors, sedentary behaviors, exercises and physical activity behaviors.

In our study, maternal subjects having a low knowledge level regarding child weight control, child eating and physical activity was significantly associated with an overweight/obesity child, subject similar to the findings of other studies (Variyam, 2001; Berge *et al*, 2013; Golan and Crow, 2004). These therefore explain that parents with the lack of knowledge on a proper and healthy food preparation for children, for example, preparation of high fibers, low fat and low sugar with the right portion size in each meal for their child may lead their child to have overweight/obesity.

In our study, poor maternal subjects feeding practices were significantly associated with child subject overweight/

obesity similar to the other studies (Birch and Fisher, 200; Birch, 2006). Poor child feeding practices, such as skipping breakfast or allowing a child to eat snacks instead of meals, has been reported to be associated with overweight/obesity in children (Chen and Kenedy, 2004; Moore *et al*, 2012). Since the child has to rely on parents to provide and taking care of their foods, and if parental feeding practices were poor, this usually affects child overweight/obesity.

In our study, poor maternal communication regarding child weight control and poor maternal control of child behavior regarding weight control were significantly associated with overweight/obesity among child subject similar to previous study (McConley *et al*, 2011). The maternal communication regarding child weight control was also reported to have a direct impact to child health behaviors and weight control (Gerads *et al*, 2012). Parental communication regarding child weight control is very important. The clear and rational, verbal communication massages from parents to their child in order to explain the adverse effects of eating junk foods, sweets, snacks and beverages, including a proper sedentary living may benefit their child weight control. A positive communication about child weight control from parents to their child will be raised child's awareness about healthy behaviors in order to change their lifestyle in healthier ways (Borra *et al*, 2003).

In our study, poor maternal control of child behavior regarding weight control was significantly associated with overweight/obesity among child subject. Other studies have also reported that lack of appropriate child monitoring and control by parents, such as allowing a child to eat snacks, sweets and junk foods is related to poor child eating behavior among overweight/obese children (Wen *et al*, 2010; McConley *et al*, 2011). These findings confirm that maternal control of child behavior regarding weight control were important to control overweight/obesity in children.

In our study, the overall maternal family function practices were significantly associated with child subject overweight/obesity. However, some studies found parental family function by using FAD was not related to child weight status (Davis *et al*, 2011; Gibson *et al*, 2013). Previous findings demonstrated family function in general aspects of parents, which not focused on child weight control toward the monitoring of eating behaviors, physical activities and sedentary behaviors. Thus, the focal point of this study is to emphasize maternal practices based on family function and identify the most influencing factors in the child overweight/obesity. This may indicate that the use of FAD, which has not been modified, to be consistent with parental practice on a child's weight control may find non-association of parental family function with child overweight/obesity.

Our study had some limitations. Firstly, sample selection excluded fathers and other family members who may also be caretakers of the child subjects. Our study only focused on the maternal/child unit. Secondly, environmental factors affecting overweight/obesity were not taken into account. Thirdly, our small sample size may reduce the ability to identify significant associations. Fourthly, the self-administered nature of the questionnaire increases the risk for recall bias. Finally, even though this was a study of overweight/obesity, we did not actually measure height or weights of

any subjects, throwing off the prevalence of obesity. This was probably the major limiting factor in our study.

In summary, we found a large proportion of child subjects and even larger proportion of maternal subjects to be overweight/obese. The factors significantly associated with child subject overweight/obesity were maternal knowledge on child weight control, maternal feeding practices, maternal communication about child weight control and maternal behavior control regarding child weight control. These factors need to be taken into consideration when developing programs to control overweight/obesity in the child study population. Those programs must take into consideration the maternal factors to be effective. Further studies in larger population that actually involve checking heights and weights of study subjects need to be conducted to confirm our results and studies determining the efficiency of the weight control programs must be performed.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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