DETERMINANTS AND CONSEQUENCES OF CHILDHOOD OVERWEIGHT: HEALTH STATUS AND THE CHILD'S SCHOOL ACHIEVEMENT IN THAILAND

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ABSTRACT:

Background: Thailand is now facing an epidemic of childhood overweight and its associated burdens. The purpose of this study was to examine the association between childhood weight statuses, health status and school achievement across determinants among primary school children.

Methods: The data from the 4th Thai National Health Examination Survey (NHES IV) 2008-2009, that was collected from 4,821 children who lived in municipal and non-municipal areas, age between 6 and 12 years old, were analyzed to address the research objective. Ordinal and logistic regression models were employed to analyze the association between determinants and consequences of child weight status, health status and school achievement.

Results: The ordinal regression analysis found that the factors of being a girl, having more siblings, exercising less than three times per week, spending more time viewing TV, having a higher-educated father, or having a father who worked as a business owner, in government or agriculture had the highest probability of being associated with overweight/obese among school-age children. In addition, underweight children, living in a non-municipal area, the third-order birth, ate less than 3 meals per day, exercised less than 3 days per week, and with difficult access to a fitness center had the highest probability of low educational achievement. The logistic regression analysis found that children who sleep less than 10 hours per day, exercised less than three times per week, obese or with difficult access to a fitness center had the highest probability of being asthmatic, while a girl, younger, exercised less than three times per week, spending more time on the computer for games and learning, obese/overweight, living adjacent to facility for computer game or living farther away from a food shop/outlet had the highest probability of being hypertensive.

Conclusion: The burden of overweight/obesity tends to relate to adverse health consequences. This finding demonstrates the importance of this issue for policymakers who should consider the different child, parental and environmental characteristics in weight control/reduction programs for youth. Health promotion policy should include behavioral change and health education interventions.

Keywords: Childhood overweight, Health status, School achievement, Thailand

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INTRODUCTION

Globally, the prevalence of overweight and obesity has increased from 4.2% in 1990, to 6.7% in 2010As of 2010, there was a rapidly rising prevalence of adulthood as well as childhood overweight in all parts of the world, and this has become a global concern [1, 2]. Since 1995, developing countries such as Thailand are facing a nationwide problem of childhood obesity, particularly in urban areas, and prevalence of overweight/obese children age 6 to 14 years has risen rapidly [3].Overweight and obesity are a result of the imbalance between energy intake and output energy expenditure [4].The common indicators of nutritional status of Thai children include measures

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of overweight and obesity [5], and body mass index (BMI) of WHO [weight (kg)/height (m^2)] greater than 1 SD and greater than 2 SD [6]. Apparently, genetics and environment factors, including poor eating habits and lack of physical activity are influencing child weight status. A recent study found that the effect of environmental factors on child body weight was substantially higher than genetic factors [7, 8]. Rapid socio-economic advancement and urbanization have increased the availability of and accessibility to unhealthy food, led to reduced physical activity and increased sedentary lifestyles [9, 10]. Parental characteristics and socio-economic status of the family may be associated with child body weight. Previous studies established that parents normally influence their children's behavior such as eating habits and physical activity [11]. For example, children from two-parent families had a lower risk of being overweight/obese than children from single-parent families [12]. Some studies found that there was a significant association between parental socio-economic status and being of overweight/obese among school-age children [13-15]. Recent and rapid socio-economic growth is causing environmental changes that promote unhealthy weight gain for children [16]. As mentioned, child, parental and environmental factors may be associated with childhood overweight/obesity. Some studies examined outcomes of childhood overweight/obesity as they related to health status and academic achievement [17, 18].

For health status, overweight/obesity increases risk for chronic non-communicable diseases and premature morbidity and mortality for both adults and children. A number of studies found that asthma was the result of overweight/obesity in children. In addition, previous studies have established that high blood pressure is also a significant symptom that is associated with childhood overweight/obesity [19-21]. Hypertension is defined as having systolic blood pressure (SBP) and/or diastolic blood pressure (DBP) persistently in the 95th percentile or more [22]. To reverse these trends, there is a need for more predictive data on the risk factors and outcomes of childhood overweight. The aim of this study was to examine the relationship between child weight status and consequences across differential determinants among children age 6 through 12 years. The results of this study should be beneficial in the battle against rising prevalence of childhood overweight and reducing the health burden on children in the future.

MATERIALS AND METHODS

Documentation for this study was submitted and approved by the Institute for Population and Social Research, Mahidol University-Institutional Review Board (IPSR-IRB) which received documentary proof: COA. No. 2014/1-1-34. The data from the 4th Thai National Health Examination Survey (NHES IV) 2008-2009 (conducted by the Office of Health Survey of Thai Population and Health Systems Research Institute of the Ministry of Public Health) were used for this study. The 4,821-person sub-sample was selected from the total 7,145,513 survey population by stratified, four-stage random sampling. The first stage of sampling included Bangkok and four regions: Central, North, Northeast and South. The second stage selected 12 districts from Bangkok and 92 districts from 20 provinces by systematic random sampling. The next stage chose 340 polling stations and 272 villages from 68 polling stations in Bangkok and 68 villages in municipal and non–municipal areas from four regions by systematic random sampling. The last stage selected 4,821 Thai children age 6 through 12 years from polling units and villages by probability sampling. Both weight and height were treated as standard procedures. Weight was measured by a digital scale (Tanita) to the nearest 0.1 kg. Height was assessed using a steel measuring tape to the nearest 0.1 cm. Blood pressure was measured by an automatic blood pressure monitor (Microlife BP A100). Multivariate, ordered and logistic regression were employed in this study. The statistical analysis was fitted by using STATA v.13. There were three dependent variables in this study. Firstly, "child weight status" was assessed by using the index of adiposity based on the Thai weight-for-height index (THAI-WHZ), created by the Ministry of Public Health (MOPH) for assessing nutrition status of Thai children age 1 day to 19 years. The classification of the Thai growth reference categories are as follows: under weight (less than-1.5SD)(1); normal (between-1.5 SD and +1.5 SD)(2); overweight (between >+1.5 SD to + 2 SD)(3); and obese (between> +2 SD)(4). A second dependent variable was reported illness of the respondent (i.e., asthma and/or hypertension). Asthma was measured based on the assessment of the primary caregiver who was asked to make the following rating: "Child history of having or not having a diagnosis determined by a medical doctor in the past 12 months". The response categories were "have disease"(1), and "does not have disease"(0). Next, hypertension was diagnosed by

blood pressure. Response categories were "yes"(1), and "no"(0). The third dependent variable was school achievement of the sample and was classified into three categories as follows: Low average (score ≤89) 1); average (score 90-109)(2); and high average (score ≥110)(3). The predictor variables were child factors parental factors and environmental factors. The hypothesis testing was run for each of the risk factors. The 10% significance level was applied to consider rejection of the null hypothesis because childhood overweight/obesity is a new trend in Thailand.

A major characteristics of samples were as follow: More than a half of the sample were living in municipal areas, and about half were boys and half were girls. The mean age was 9 years (SD = 2 years). The subjects were first or second order births (90.8%), had at least two siblings (72.8%), ate 3 meals per day (67.3%), exercised less than 3 days per week (52.3%), watched TV more than 2 hours per day (77%), did not play computer games (60%) or use the computer for learning (50%), and slept less than 10 hours per day (56.7%). For parental factors, primary school and labor contractor accounted for the largest category of fathers' education (48%) and occupation (33%) respectively. Most of the sample had both father and mother present (74%) and took care by their mothers (64.4%). For environmental factors, almost all the children's houses were adjacent to a food shop/outlet (96%), were near a facility for physical activity (75%) or were near to an outlet for computer gaming (52%).

RESULTS

Factors related to childhood overweight

This paper used a multivariate, ordinal and logistic regression model to investigate the research hypothesis that the likelihood of child weight status and consequences were related to child, parental and environmental characteristics. The results showed that child weight status, health status and school achievement models had Chi-square values less than 0.01. This indicates that these models were suitable to predict child weight status, health status and school achievement. The odds ratios of the model are presented in tables.

Table 1, we found that being a girl, had more siblings, exercising less than three times per week, spending more time viewing TV, having a higher-educated father, or having a father who worked as a business owner, in government or agriculture, were more likely to be associated with overweight/obese than being a boy, had fewer siblings, exercised at least three times per week, spending less time viewing TV, having a lower-educated father, or having a father who worked as a labor contractor, with odds ratios of 1.32, 1.07, 1.28,1.27, 1.39, 1.22, and 1.23, respectively. Living in a non-municipal area, or living adjacent to facility for computer game and living farther away from a food shop/outlet were less likely to be associated with overweight/obesity than living in a municipal area, or living farther away from computer game and living adjacent to a food shop/outlet with odds ratios 0.77, 0.89 and 0.72.

Factors related to consequences of childhood overweight

Factors related to asthma: According to the logistic regression model (Table 2), children who sleep less than 10 hours per day, exercised less than three times per week, obese or with difficult access to a fitness center were more likely to be asthmatic than children sleeping at least 10 hours per day, exercised at least than three times per week, normal weight or with easy access to a fitness center (odds ratio =1.17, 1.26, 1.34 and 1.21). Children having a higher-educated father or the second-order birth were less likely to be asthmatic than those having a lower-educated father, or the first-order birth, with odds ratios of 0.81 and 0.79, respectively.

Factors related to hypertension: According to the logistic regression model (Table 2), our findings show that being a girl, younger, exercised less than three times per week, spending more time on the computer for game and learning, obese/overweight, living adjacent to facility for computer game or living farther away from a food shop/outlet were more likely to be associated with hypertension than being a boy, older, exercising at least three days per week, spending less time on the computer for game and learning, having normal weight, living farther for facility for computer game or living adjacent to a food shop/outlet with odds ratios of 1.13, 2.08, 1.14, 1.07, 2.20, 4.28, 1.22 and 1.36 respectively. Samples were the second-order birth, had fewer siblings were less likely to be hypertensive than those were the first-order birth, or had more sibling, with odds ratio of 0.99, and 0.92, respectively.

Factors related to school achievement: According to the ordinal logistic regression model (Table 2), this study found that children were living in a non-municipal area, the third-order birth, ate less than 3 meals per day, exercised less than 3 days per week, with difficult access to a fitness center or underweight, were more likely to have poor educational attainment than those were living in a municipal area, the first-order birth, ate 3 meals per

Table 1 Odds ratios for relationships between child weight status and child, parental and environmental factors

Factors	Adjust OR	95%Conf.Interval		Z
		Upper	Lower	
Gender (reference :boy)				
Girl	1.32***	1.18	1.48	0.001
Age (reference :10-12)				
6-9	0.91	0.81	1.03	0.214
Residence (reference: municipal)				
Non -municipal	0.77***	0.68	0.87	0.001
Birth order (reference: first birth)				
Second birth	0.96	0.84	1.09	0.567
Third birth	0.85	0.69	1.06	0.222
Number of sibling	1.07*	0.99	1.15	0.10
Meals per day (reference: 3 meals per day**)**				
1or2 meals	0.93	0.83	1.05	0.344
Sleep duration (reference:≥10hours)				
<10 hours	1.07	0.96	1.19	0.318
Physical activity (reference: ≥3 days a week)				
<3 days	1.28***	1.14	1.43	0.000
Time watching TV (reference<2hours)				
≥2hours	1.27**	1.11	1.46	0.003
Time on playing computer games	0.99	0.94	1.06	0.99
Time on computer for learning (reference: none)				
1 hour	1.08	0.96	1.23	0.271
≥ 1 hour	1.04	0.86	1.27	0.720
Fathers' education (reference : Primary school)				
High school	1.07	0.94	1.22	0.363
upper high school or more	1.39***	1.18	1.65	0.001
Fathers' occupation (reference: labor)				
Agriculture	1.23*	1.05	1.45	0.034
government & business owner	1.22**	1.07	1.38	0.01
Marital status (reference: complete family)				
Single-parent family	0.94	0.82	1.07	0.432
Main caregiver (reference: mother)				
Other	1.02	0.90	1.16	0.764
Nearby facility for computer game (reference: not have)				
have	0.89*	0.79	1.01	0.10
Nearby food shop (reference: have)				
Not have	0.72*	0.54	0.96	0.05
Nearby facility for physical activity (reference : have)				
Not have	0.96	0.85	1.10	0.67
N = 4,675 Model chi-squared = -3778.65 Pseudo R2 = 0.145 D.F.= 22 significant 0.000				

* Significant at the 0.10 level, ** Significant at the 0.01 level, *** Significant at the 0.001 level

Table 2 Odds ratios for relationships between child weight status and health status and school achievement

Factors	Consequences of childhood overweight/obesity					
	Odds Ratio (90% C.I.)					
	Asthma		Hypertension		School achievement	
Gender (reference :boy)						
Girl	1.11	(0.94-1.30)	1.13*	(0.99-1.29)	1.07	(0.95-1.22)
Age (reference :10-12)						
6-9	1.04	(0.87-1.24)	2.08***	(1.80-2.42)	0.89*	(0.77- 1.02)
Residence (reference: municipal)						
Non-municipal	0.99	(0.83-1.20)	1.03	(0.88- 1.19)	1.29**	(1.11-1.48)
Birth order (reference: first birth)						
Second birth	0.79*	(0.65-.096)	0.99*	(0.85-1.16)	1.02	(0.88-1.17)
Third birth	1.11	(0.82-1.49)	1.19	(0.92-1.55)	1.24*	(0.97-1.58)
Number of sibling	1.02	(0.92-1.13)	0.92*	(0.84-1.01)	0.98	(0.91-1.07)

Table 2 Odds ratios for relationships between child weight status and health status and school achievement (Cont.)

Factors	Consequences of childhood overweight/obesity					
	Odds Ratio (90% C.I.)					
	Asthma		Hypertension		School achievement	
Meals per day(reference: 3 meals per day)						
1or2 meals	0.92	(0.77-1.10)	0.94	(0.82-1.09)	1.19*	(1.03-1.37)
Sleep duration (reference:≥10hours)						
<10 hours	1.17*	(.99-1.38)	1.08	(0.95-1.24)	1.08	(0.95-1.23)
Physical activity (reference : ≥3daysa week)						
<3 days	1.26*	(1.07-1.49)	1.14*	(0.99-1.30)	1.17*	(1.03-1.33)
Time on viewing TV(reference :<2hours)						
≥ 2 hours	0.87	(0.71- 1.04)	1.05	(0.90-1.30)	1.30	(0.84- 1.13)
Time on computer for playing games	1.04	(0.96-1.13)	1.07*	(0.99- 1.14)	0.94	(0.89- 1.01)
Time on computer for learning (reference: none)						
1 hour	1.13	(0.94-1.36)	1.48***	(1.28- 1.72)	1.08	(0.94-1.25)
≥ 1 hour	0.92	(0.67-1.25)	1.27*	(0.98- 1.63)	0.89	(0.72-1.12)
Fathers' education (reference : Primary school)						
High school	0.88	(0.73-1.06)	0.92	(0.78- 1.07)	0.96	(0.83- 1.11)
upper high school or more	0.81*	(0.62- 1.04)	1.14	(0.94-1.39)	0.85*	(0.70-1.03)
Marital status(reference: complete family)						
Single-parent family	1.03	(0.84-1.26)	0.88	(0.75-1.04)	1.07	(0.92-1.25)
Fathers' occupation (reference: labor)						
Agriculture	0.91	(0.71-1.15)	1.07	(0.88-1.31)	1.08	(0.89-1.31)
government & business owner	0.92	(0.75-1.12)	0.98	(0.84-1.15)	1.06	(0.84- 1.15)
Main caregiver (reference: mother)						
Other	1.15	(0.95-1.391)	0.98	(0.85-1.14)	0.92	(0.79-1.06)
Nearby facility for computer game (reference: Not have)						
have	0.97	(0.80 -1.16)	1.22*	(1.05 - 1.41)	0.90	(0.78-1.03)
Nearby food supply (reference: have)						
Not have	1.29	(0.81-2.07)	1.36*	(0.95-1.95)	0.88	(0.63- 1.21)
Nearby facility for physical activity (reference : have)						
Not have	1.21*	(0.99-1.48)	0.91	(0.78-1.06)	1.15*	(0.99-1.34)
Child weight status (reference: normal weight)						
underweight	0.97	(0.74- 1.28)	0.95	(0.75- 1.19)	1.24*	(1.01-1.52)
overweight	1.20	(0.92-1.57)	2.20***	(1.81-2.67)	0.99	(0.79-1.23)
obesity	1.34*	(0.93- 1.92)	4.28***	(3.33-5.52)	0.96	(0.70- 1.31)
N = 4675 D.F.= 25	N = 4675 D.F.= 25			N = 4663 D.F.= 25		
Model chi-squared = -1471.76	Model chi-squared = -2025.05			Model chi-squared = -2712.30		
Pseudo R2 = 0.107 significant =0.01	Pseudo R2 = 0.493 significant =0.000			Pseudo R2 = 0.099 significant =0.000		

* Significant at the .10 level, ** Significant at the .01 level, *** Significant at the .001 level

day, exercised at least than 3 days per week with easy access to a fitness center or had normal weight , with odds ratios of ,1.29, 1.24, 1.19, 1.17, 1.15, and 1.24, respectively. The younger children and with higher-educated fathers were less likely to have poor municipal area, the first-order birth, ate 3 meals per day, exercised at least than 3 days per week with easy access to a fitness center or had normal weight, with odds ratios of ,1.29, 1.24, 1.19, 1.17, 1.15, and 1.24, respectively. The younger children and with higher-educated fathers were less likely to have poor educational attainment than the older children or with lower-educated fathers, with odds ratios of 0.89 and 0.85, respectively.

DISCUSSION

This study was to examine the association between childhood weight status, health status and school achievement across differential determinants among primary Thai school children. The study finding represented that increased risk for overweight and obesity among children include child, parental and environmental factors, and these factors were also strongly associated with the related adverse health consequences of overweight. Child factors related to being overweight/obese include female gender, had more siblings, viewing TV at least 2 hours per day, living in a municipal area, engaging in physical activity less than 3 days per week. Our results are similar to a recent study about determinants of childhood obesity which found that girls had a higher risk of being overweight/obese than boys [10], as result of girls spending more leisure-time than boys [23, 24].Children should

accommodate at least 60 minutes of moderate to vigorous-intensity physical activity daily at least three days per week [25]. Girls were being overweight/obesity related to lack of exercise [24, 26]. Besides, wealthy children living in urban area had a higher risk of being overweight/obesity than those in rural area because of the easier accessibility to unhealthy [27, 28]. A father with better SES was more likely to work outside his home and tended to buy fast food or eat out. Several studies supported that a positive association between a higher SES and a higher risk of being overweight/obese [13-15]. According to environmental factor, children living farther away from facility for supermarkets tended to buy unhealthy food such as sugar–sweetened beverages or fast food from grocery stores more than healthy food such as fresh fruits or vegetables [29, 30]. Regarding outcomes of childhood overweight including obesity, recent studies supported our results that there was a strong association with childhood overweight/obesity, asthma and hypertension [31-33]. Sleep duration is a significant determinant of asthma in overweight/obese children. Younger females spending more time in sedentary lifestyle such as watching TV or playing computer and less time in physical activity are a significant determinant of hypertension in overweight/obese children. The common reasons for inadequate sleep were increased screen time and less time engaged in physical activity, presumably due to being overweight/obese [34, 35]. The burden of overweight was associated only with health outcomes for children in this samples, while the burden of underweight was association with poor educational attainment.

Based on the findings of this study, government policy should address the increasing problem of overweight/obesity among school-age children. Prevention and control programs need to consider child, parent and community environment factors. Young children need healthy nutrition, daily physical activity and limited TV/computer screen time. This is particularly important for girls, children living in municipal areas, those engaged in physical activity less than 3 days per week, those spending screen time at least 2 hours a day and those with higher-educated fathers. Both children and parents should be the targets of these programs in order to improve health education interventions. Moreover, the government should build a more optimal environment, especially in schools and residential communities, in order to increase accessibility to healthy nutrition and daily physical activity.

CONCLUSIONS

The findings show that the factors of having a higher-educated father, and being a girl had the highest probability of being associated with overweight/obese among school-age children. Obese and those who exercised less than 3 times per day had the highest probability of being asthmatic , while obese and overweight children , age from 6 to 9 years and being a girl had the highest probability of being high blood pressure .Underweight and living in a non-municipal area had the highest probability of low educational achievement.

LIMITATION OF THE STUDY

We identified two limitations of the current study. First, the data of this cross-sectional study reflect only a limited period of time, while overweight/obesity can be a long-term condition. Thus, longitudinal studies are better than cross-sectional studies for examining causal relationships between determinants and consequences. Second, the findings from the literature review suggest that factors from all four levels related to overweight (child, parental, educational and environmental) be considered. However, this study collected data on some of the determinants from the child, parental and environment levels as secondary data. Thus, future studies be sure to include determinants from the child, parental, educational and environmental levels.

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