Original Research Article

Prediction model of overweight and obesity in primary school children in urban areas

Titus Priyo Harjatmo*, Rosmida M. Marbun, Ratih Puspitaningtyas

Politeknik Kesehatan Jakarta II, Ministry of Health of Indonesia

*Correspondence:
Dr. Titus Priyo Harjatmo,
E-mail: titoespriyo@yahoo.co.id

ABSTRACT

Background: Overweight and obesity can occur both in children to adulthood. The prevalence of obesity for children aged 5-12 years is still high at 18.8% consisting of 10.8% overweight and obese at 8.8%. The prevalence of childhood obesity has increased in various countries including Indonesia. The results of previous data collection shows that the proportion of fat and obesity is quite high at 34.5%.
Methods: This type of research is a cross sectional study because the independent and dependent variables are measured at the same time. The sample was a portion of elementary school children in SD Kramat Pela Kebayoran Baru. Case samples are elementary school children who are overweight and obese (weight/height >1.0 SD) as many as 35 children and the control sample is elementary school children with normal weight/height ≤1.0 SD as many as 35 children.
Results: From the results of the analysis of physical activity variables showed that the group of children who are overweight or obese have an average activity lower than normal school children. Odds ratio analysis shows that the risk of being obese or obese is 18.1 times in inactive children compared to active ones (95% CI: 4.60-70.9). Screen time analysis with the incidence of obesity did not show significance.
Conclusions: Growth monitoring needs to be pursued regularly so that efforts to control obesity in school children can be done.

Keywords: Obesity, Overweight, Prediction model

INTRODUCTION

Excessive nutrition that causes obesity can occur both in children up to adulthood. Obesity is caused by an imbalance between the amount of energy that enters with what is needed by the body for various biological functions such as physical growth, development, activity, health care.[1] If this condition continues for a long period of time, then the impact is the occurrence of obesity. Based on data from Basic Health Research in 2013 showed that the prevalence of obesity for children aged 5-12 years is still high namely 18.8% consisting of 10.8% overweight and very obese (obesity) 8.8%. The high prevalence of childhood obesity is caused by urbanization growth and changes in one's lifestyle including energy intake. According to WHO, one in 10 (ten) children in the world are overweight. Increased obesity in children and adolescents is parallel to adults.[2]

A number of factors have been consistently found to be associated with obesity in childhood, such as maternal BMI, overweight pregnancy, maternal smoking during pregnancy, gestational diabetes and low socioeconomic status. In addition, studies have shown other possible relationships with childhood obesity, including caesarean section, high birth weight, rapid weight gain, lack of sleep

of the baby, exposure to antibiotics, low maternal vitamin D levels, mother-baby relationship and the presence of child care. Data supporting the relationship between other factors such as the incidence or duration of breastfeeding, or early feeding practices, and obesity appear to be more inconsistent.[3]

Obesity in children in particular will be a problem because the extra weight the child has will ultimately lead to health problems that are usually experienced by adults such as diabetes, high blood pressure, and cholesterol. Obesity can also cause several chronic diseases including impaired glucose metabolism, insulin resistance, type 2 diabetes in adolescents, hypertension, dyslipidaemia, hepatic steatosis, gastrointestinal disorders, and respiratory obstruction during sleep.[4]

From previous data collection results show that the proportion of overweight and obesity is quite high at 34.5%. The prevalence that tends to increase in both children and adults is a warning to the government and society that obesity and all its implications require special attention. Therefore research studies need to know the predictive model of obesity in elementary school children. The purpose of this study is to analyse the prediction models of overweight and obesity in elementary school children in Jakarta.

METHODS

This type of research is a cross sectional study because the independent and dependent variables are measured at the same time. This research was conducted in September 19, 2019 and has obtained ethical clearance approval.

The population in this study were all elementary school children in Kramat Pela Kebayoran Baru, South Jakarta. While the sample is a portion of elementary school children in SD Kramat Pela Kebayoran Baru. Case samples are elementary school children who are overweight and obese (weight/height >1.0 SD) as many as 35 children and the control sample is elementary school children with normal weight/height ≤1.0 SD as many as 35 children.

RESULTS

Sample and parents characteristics

From the results of the analysis of the study showed that as many as 47.5% of school children have male sex and 53.3% female. The distribution of the sex of children under five is slightly different from the results of monitoring the nutritional status in the Jakarta area for male sex 50.5% and female 49.5%. When viewed based on class distribution shows that as much as 51.7% in grade 5, 50.0% in grade 4 and 48.1% in grade 3.

From the study results that the characteristics of maternal education are relatively lower compared to overweight's

education but not found by people parents who are not in school.

Based on the work of parents, found as many as 48.7% of mothers who do not have a job or as a housewife. The following are data on the characteristics of elementary school children and their parents.

Table 1: Distribution of characteristics of school children and parents in Jakarta 2019 (n=70).

Variables	Overweight/obese		Normal	
Gender	**N**	**%**	**N**	**%**
Boys	19	47.5	21	52.5
Girls	16	53.3	14	46.7
Class groups				
Grades 3	13	48.1	14	51.9
Grades 4	7	50.0	7	50.0
Grades 5	15	51.7	14	48.3
Mother's education				
No school	0	0.0	3	100.0
Elementary school graduated/not graduated	4	66.7	2	33.3
Graduated	10	50.0	10	50.0
School graduated/not high school	15	46.9	17	53.1
College high	6	66.7	3	33.3
Overweight's education				
Not attending school	0	0.0	0	0.0
Elementary school completed/not completed	3	60.0	2	40.0
Graduated	6	33.3	12	66.7
School completed/ not high school completed/ not completed	17	51.5	16	48.5
Higher education	9	64.3	6	35.7
Occupation of overweight				
No work	0	0.0	1	100.0
Civil servants	4	66.7	2	33.3
Private employees	15	60.0	10	40.0
Workers/services	3	23.1	10	76.9
Entrepreneurs/traders	13	59.1	9	40.9
Others	0	0.0	3	100.0
Mother's work				
Not working	19	48.7	20	52.3
Civil servants	1	50.0	1	50.0
Private employee	6	75.0	2	25.0
Workers/services	2	50.0	2	50.0
Entrepreneurs/traders	6	37.5	10	62.5
Others	1	100.0	0	0.0

Homogeneity test of two groups

The similarity of characteristic tests in both groups, namely obese children and non-educated groups of

mothers, is important so that the homogeneity of both groups can be known.

Characteristics of parents	Overweight/obese		Normal	
	N	%	N	%
Father's education level				
No school	0	0.0	0	0.0
Elementary school completed/not completed	3	60.0	2	40.0
SLTP completed/not graduated	6	33.3	12	66.7
SLTP completed/not completed	17	51.5	16	48.5
Higher education	9	64.3	6	35.7
Mother's education level				
No school	0	0.0	3	100.0
Elementary school completed/not completed	4	66.7	2	33.3
Junor high school/not completed	10	50.0	10	50.0
Senior high school completed/not completed	15	46.9	17	53.1
Universities	6	66.7	3	33.3

Statistical test result with χ^2 between overweight and mother education based groups of children overweight/obese and normal children obtained value of p>0.05. This can be interpreted that the two groups are homogeneous.

Nutrition status of school children

Table 3 presented the nutritional status of school children grade 3.4 and 5 as many as 253 school children measured.

Table 3: Distribution of nutrition status of school children in Jakarta in 2019 (n=253).

Nutrition status	N	%
BMI/age index		
Obesity	34	22.3
Overweight	25	16.3
Normal	94	61.4
Height/age index		
Severe stunting	1	0.7
Stunting	19	12.4
Normal	133	86.9

It appears in the table above that as many as 253 school children have taken weight measurements, height. From this data has been presented based on the index Height/age and BMI/U. Based on the BMI/U index, it shows that as much as 22.3% in obese conditions and 16.3% in obese conditions so that the percentage of obese and obese children is 38.6%.

Nutrition status processing is carried out on 253 school children. However for further analysis screening of 35 obese children and 35 normal children was screened. From the results of data analysis of the variable characteristics of children and parents shows that there is no difference in the proportion of overweight/obesity and normal based on gender. Mother's education level and overweight's education. The following is the distribution of the characteristics of parents in overweght/obese children and normal children.

Physical activity

Table 4 shows that the average physical activity in the group of obese children is 27,325 steps and 38,133 steps in normal children. Thus the average physical activity in obese children was lower than in normal children. Categories with a median value as a reference the physical activity in school children as follows.

Table 4: Distribution of physical activity in children obese and normal children group (n=70).

Physical activity	overweight/ Obese		Normal		P value	OR	95% CI
	N	%	N	%			
Not active	4.60-70.9	62.9	3	8.6	0.000	18.08	22
Active	13	37.1	32	91.4			

It appears in the Table 4 that there are differences in the proportion of physical activity in the obese children group and the normal child group (p=0.000). The risk of obesity is 18.08 times in children with inactive physical activity compared to active children.

The results showed that 47.7% of respondents stated that they often watched television more than 5 hours a day.

Screen time (ST) is the time used by children to watch TV (TV), playing computer and play station (PS). Data were obtained from interviews using a structured questionnaire about how long the children carried out these activities on normal days and on Sundays. The average per day of the three activities is obtained by multiplying 6 for normal days plus the activities on Sunday, then divided by 7. Screen time was categorized

as low if <2 hours and high if ≥2 hours. Table 5 shows distribution of screen time in school children.

Table 5: Distribution habits watch screen time in children overweight/obese and normal children group (n=70).

Screen time	Overweight/obese		Normal		P value
	N	%	N	%	
TV					
Yes	32	91.4	33	94.2	0643
No	3	8.6	2	5.71	
Digital video disc					
Yes	8	22.9	7	20.0	0.771
No	27	77.1	28	80.0	
Video game					
Yes	23	65.7	19	54.3	0.329
No	12	34.3	16	45.7	
Computer					
Yes	7	20.0	5	14.3	0.526
No	28	80.0	30	85.7	
Handphone					
Yes	33	94.3	33	94.3	0.1
No	2	5.7	2	5.7	

The table above shows the distribution of watching habits in screen time school children. The types of media that are of interest to watch include TV, video games and mobile phones. While the computer has not been interested in considering the respondent is still sitting in classes 3, 4 and 5 while the video game media is not very attractive considering there are other alternative media. The percentage of the data above shows as much as 91.4% of school children in the obese children group and 94.2% in the normal children group. Likewise, the percentages are relatively the same for video games and mobile phones.

Table 6: Average screen time in overweight children/obese and normal children groups (n=70).

Screen time	Overweight/ obese		Normal	
	Mean	SD	Mean	SD
Watch DVD (minute)	18.9	3.6	14.6	2.4
Game player (minute)	66.9	7.7	42.6	5.6
Computer (minute)	12.0	2.4	7.0	2.7
Handphone (minute)	109.5	81.4	68.2	7.2
Watch TV (minute)	91.1	7.8	90.6	6.8

Table 6 shows that the average long time watching video game. HP and TV are relatively higher in the obese children group compared to the normal child group. The average length of screen time is more on mobile media compared to other media.

Table 7: Fruit and vegetable consumption habits in overweight/obese and normal children group (n=70).

Fruit and vegetable consumption habits	Overweight/obese		Normal		P value	OR	95% CI
	N	%	N	%			
Consumption of fruit							
Yes	6	17.1	5	14.3	0743	0.8	0.22-2.932
No	29	82.9	30	86.7			
Fruit frequency							
<2 times a week	23	65.7	29	82.9	0.101	0.397	0.129-1.218
≥2 times a week	12	34.4	6	17.1			
Consumption of vegetables							
Yes	30	85.7	5	14.3	0.232	0.364	0.06-2.016
No	33	94.3	2	5.7			
Frequency of vegetable consumption							
<2 times a week	20	57.1	19	54.3	0.810	1.123	0.437-2.885
≥2 times a week	15	42.9	16	45.7			

Fruit and vegetable consumption behavior

The results of this study also showed that around 90% of children consume vegetables and fruit with sizes <3 servings/day. The jam turned out to be girls more often consume vegetables and fruit compared to boys. Consumption of linear fiber will reduce the intake of overweight and salt which will further reduce blood pressure and prevent weight gain

Consumption of fast food

Here are the results of research related to the type of fast food on a regular consumed school children last month.

Table 8 shows that the types of fast food are consumed by school children so most children like sausage food as much as 62.9% and nuggets as much as 54.3%.

Table 8: Fast food habits in children overweight/obese and normal children group (n=70).

Consumption of fast food	Overweight/obese		Normal		P value	OR	95% CI
	N	%	N	%			
Kentucky							
Yes	18	51.4	13	37.1	0.229	1.792	0.690-4.650
No	17	48.6	22	62.9			
Hamburger							
Yes	5	14.3	6	17.1	0.743	0.806	0.221-2.932
No	30	95.7	29	82.9			
Pizza							
Yes	11	31.4	6	17.1	0.183	2.215	0.714-6.873
No	24	68.6	29	82.9			
Spagetti							
Yes	12	34.3	7	20.0	0.519	2.087	0.707-6.165
No	23	65.7	28	80.0			
Sausage							
Yes	22	62.9	16	45.7	0.150	2.010	0.773-5.223
No	13	37.1	19	41.9			

Table 9: Consumption frequency fast distribution in children overweight/obese and normal children group (n=70).

Frequency of fast food consumption	Overweight/obese		Normal		P value	OR	95% CI
	N	%	N	%			
Kentucky							
≥2 times	33	94.3	23	65.7	0.003	8.609	1.758-42.164
<2 times	2	5.7	12	34.3			

Prediction model for overweight children/obesity

The prediction model for overweight/obese children needs to be done in order to identify the most dominant factors so that the types of interventions that can be done to prevent obesity can be formulated. Table 10 shows the equation model.

From the logistic regression analysis for the independent variables, namely the frequency of eating fruit, the frequency of eating vegetables, the frequency of fast food and physical activity to the occurrence of overweight/obesity, the analysis results obtained above. In this table, it can be interpreted that in children who are inactive activities have a risk for overweight/obesity by 41.4 times (95% CI OR: 5.0-340.3) compared with children who have activities in the active category. Whereas in children who often consume fast food has a risk of overweight/obesity by 29.7 times compared to those who rarely consume fast food.

Table 10: Predictive models of overweight and obese in school children.

Variables	B	SE	Wald	df	Sig	Exp (B)	95% CI for exp (B)	
							Lower	Upper
Fruit frequency	-0.516	0.748	0.475	1	0.491	0.597	0.138	2.586
Vegetables frequency	0.358	0.675	0.281	1	0.596	1.430	0.381	5.365
Fast food frequency	3.390	1.320	6.591	1	0.010	29.652	2.230	394.376
Physical activity	3.722	1.075	11.985	1	0.001	41.365	5.028	340.319
Constant	-10.157	3.550	8.184	1	0.004	0.000		

DISCUSSION

Table 1 shows that the proportion of overweight/obese in female sex is higher than in male. From the results of previous studies show that gender also plays a role in the emergence of obesity. Obesity is more common in women. Especially during the growing period of children.[3]

In the Table 2, shows a picture of the characteristics of parents where the proportion of the level of education between fathers and mothers is relatively the same. But the education of fathers is relatively more who have

university education compared to mothers. Education level is one important factor in the process of growth and development of children. Mothers who have a high level of education will more easily receive messages and information on nutrition and health of children. Parents who have knowledge and higher education will understand better about the choice of food processing and how to feed healthy and nutritious food for their children because the mother's education level influences the level of her understanding of health care, hygiene and awareness of the health of children and families. From the follow-up studies show that education level is one of the factors causing obesity in adulthood. The incidence of obesity in children is a sign of high social status, fertility and well-being. One indicator of social status is the level of education. The results of multivariate analysis showed that children with an education level not attending school/not completing elementary school had a twice-obese chance compared to children>completing elementary school after being controlled by the child's gender, father's obesity history, sports habits.[4]

Table 3 shows that the proportion of overweight/obese children in these school children is quite high compared to the proportion of overweight/obese in the basic health research results in 2018. The proportion of overweight/obese children is relatively similar to the percentage done by undergraduate students of applied nutrition and dietetics at the location the same in 2018. The percentage of school children who suffer from stunting is 13.1%.[5] Simply stated, the onset of obesity can be explained if the food input exceeds normal requirements, therefore if the input exceeds the body's energy needs, then this excess will be saved. Excess energy will be stored in the form of fat in adipose tissue. To regulate the size of these reserves the body has a regulatory mechanism so that there is a balance between input and output of energy.[6] In Table 5 shows there is no difference in fat/obese by sex, mother's education level and father's education level. However, other research shows that the familial characteristic of obesity is widely known given the relationship between child and parental obesity. The importance of education, especially maternal education, is shown by the higher occurrence of overweight and obesity in students whose mothers have a lower educational level, which suggests that maternal education is a risk factor for childhood obesity.[7]

Table 4 explains physical activity that is done regularly will reduce the risk of obesity and other degenerative diseases such as hypertension, heart disease, diabetes mellitus, osteoporosis, cancer and so on. In the table shows that the risk of obesity/obesity in inactive children is 18.08 times (95% CI, 4.60-70.9) significantly compared with active children. From the results of previous studies found that physical activity in middle and high school age children is important for the formation of habits for life as well as for the short term is on body weight monitoring. Research that has been done concludes that reducing the child's time in front of the

TV/computer/PS can be a strategy to reduce the incidence of obesity, especially in women.[8]

Table 6 shows the habit of watching screen time in elementary school children, the proportion of watching video games is more in obese children compared to normal children. The average time spent using a cellphone in obese children (109.5 minutes) is higher than in normal children (68.2 minutes). The results of this study are reinforced by previous studies that one of the causes of childhood obesity is a sedentary lifestyle that is less physical activity, like watching television (TV) and playing computer (screen based activity) more than 2 hours/day. The longer time watching TV is associated with the risk of an unhealthy body composition and an increase in BMI. Other than that, TV in the bedroom is associated with more time for using screen based activity (SBA). Children with a TV in the bedroom are more likely to be overweight. Other than that, children who watch TV ≥3 hours/day tend to be 48% more obese than children who watch TV <1 hour/day. Screen based activity, especially TV is associated with low consumption of vegetables and fruit and high consumption of high-calorie snacks, fast food and high sugar packaged drinks. Food and beverage advertisements that are aired while the child is watching TV contribute to the child's obesity. Increased energy intake during SBA due to inaccurate food choices is the consumption of high energy density snacks (foods high in added sugars and fats) and lack of control over the number of servings eaten.[9] The impact of technological progress causes children to tend to like games that use less energy like watching television, game using a remote control, play station or games on the computer. Besides the habit of watching television for hours on children by providing a variety of snack foods cause snacking habits in children.

Vegetables and fruit are important sources of fibre for children in their infancy, especially related to obesity. Overweight and obese children need high-fibre foods such as vegetables and fruit. Based on PUGS (General Guidelines for Balanced Nutrition), consumption of vegetables and fruit at least 3 servings/day. The pattern of consumption of vegetables and fruit in the Indonesian population is still lower than the recommended amount. Table 10 shows the consumption habits of fruits and vegetables. The proportion of eating habits of fruits and vegetables is relatively the same in overweight/obese children with normal children. From the literature review, it is clear that the consumption habits of Indonesian people today vary greatly in line with the development of the amount and type of food. Another phenomenon that occurs among the public is the fondness of consuming fast food. Indonesian people in general have a curiosity about foreign food culture and want to try it because they are bored with traditional food. Therefore. Indonesian people are easily influenced by new things. Moreover, many foreign foods are promoted through cyberspace and print media. Therefore. Indonesian people do not want to be left behind. They certainly want to enjoy what is

offered by cyberspace and print media. Because of this, Indonesian society has changed. With the existence of cyberspace and print media, Indonesian people can now know what foreign foods are usually consumed by foreign people.[10]

Table 8 shows the fast food consumption habits. The habit of eating fast food in overweight/obese children with normal children is statistically not significant. As is well known that foreign countries, especially western countries, like to consume fast food. In Indonesia, many foreign foods are available in the form of fast food. With globalization, most Indonesian people are starting to turn to fast food. Fast food is now plentiful and easy to find. Maybe with a delicious meal and served in a short time, make us to consume it very often. Though we all know that fast food also has a negative impact on the body in the long run.

In the table 10, it can be interpreted that in children who are inactive activities have a risk for obesity by 41.4 times (95% CI OR: 5.0-340.3) compared with children who have activities in the active category. Whereas in children who often consume fast food have a risk of fat/obesity by 29.7 times compared to those who rarely consume fast food.

CONCLUSION

From the results of the analysis of physical activity showed that the group of children who are obese have an average activity higher than normal school children. Odds ratio analysis shows that the risk of obesity is 18.08 times in inactive children compared to active ones (95% CI: 4.60-70.9). From the screen time analysis with the incidence of obesity did not show significance.

ACKNOWLEDGEMENTS

REFERENCES

1. Ayu R. Sartika D. Risk factors for obesity in children 5-15 years in Indonesia. Makara J Health Res. 2011;15(1):37-43.
2. WHO. Obesity: Preventing and managing the global epidemic. WHO Obesity Technical Report series 894. World Health Organization. Geneva, 2000.
3. Butler ÉM, Derraik JG, Taylor RW, Cutfield WS. Childhood obesity: how long should we wait to predict weight? J Pediatr Endocrinol Metab. 2018;31(5):497-501.
4. Era FD. Risk factors for obesity and the level of obesity in elementary school children Banda Aceh. Idea Nurs J. 2009;3(2)69-77.
5. Hills AP, Andersen LB, Byrne NM. Physical activity and obesity in children. Br J Sports Med. 2011;45(11):866-70.
6. Giugliano R, Carneiro EC. Factors associated with obesity in school children. J Pediatr (Rio J). 2004;80(1):17-22.
7. Densa S. Prediction Model for Adolescent Body Mass Index Based on the Birth History and Children Nutrition Status. J Kesehatan Masyarakat Nasional. 2013;1:19-27.
8. Goran MI, Reynolds KD, Lindquist CH. Role of physical activity in the prevention of obesity in children. Int J Obesity. 1999;23(3):18-33.
9. Wang Youfa. Potential mechanisms in childhood obesity: causes and prevention. 2015: 69-78.
10. Heryudarini H, Cahyo KN. Physical activity patterns of children 6-12 years old in Indonesia. Gizi Indonesia. 2013;36(2):99-108.