

Antenatal and postnatal risk factors of obesity in children age 2-5 years old in Yogyakarta District, Indonesia

I Ketut Rutin Pastadita^{1*}, Sunartini², Yudha Patria²

¹District Hospital of Malinau, East Kalimantan, ²Department of Pediatrics, Faculty of Medicine, Universitas Gadjah Mada/Dr. Sardjito General Hospital, Yogyakarta, Indonesia

ABSTRACT

Obesity and overweight have become a health issue throughout the world, with a dramatic increase in prevalence each year. An obese child is thought to be adorable, but parents are not aware of the health risk it holds. Preventive measures by decreasing the risk factors for obesity are more effective than treating the problem. The aim of this study was to identify the risk factors of obesity in antenatal and postnatal period in children in Yogyakarta District. This was an observational study with a case control design. Criteria of obesity were defined according to WHO 2006 growth chart. Subjects were children age 2 to 5 years old that were enrolled in playgroups in the Yogyakarta District with a targeted sample size of 41 children. Parents of children that met the inclusion and exclusion criteria were given questionnaires to fill out. The results were analyzed using bivariate analysis and multivariate logistic regression. Thirty four obese children and 34 non obese children (as control) were explored for the obesity risk factors. Prematurity/gestational age (OR = 16; 95%CI = 3.27-78.28; p=0.001), passive smoking (OR = 5.50; 95%CI = 1.90-15.96; p=0.001), low birth weight (OR = 7.27; 95%CI = 1.45-36.47; p=0.008), eating more than 3 times daily (OR = 2.19; 95%CI = 1.66-2.89; p=0.007), meals that are high in lipid (OR = 4.18; 95%CI = 1.45-12.02; p=0.007) were shown to be risk factors for obesity in children. Factors such as picky eaters (OR = 0.16; 95%CI = 1.45-12.02; p=0.002), early introduction to solid food (OR = 0.29; 95%CI = 0.10-0.79; p=0.01), exercise (OR = 0.25; 95%CI = 0.06-0.32; p=0.04), and watching TV or playing video game under 2 hours daily (OR = 0.30; 95%CI = 0.09-0.95; p=0.04) were identified as protective factors against obesity. By using the multivariate analysis, there were only 2 risk factors for obesity i.e. eating more than 3 times daily and prematurity/gestational age and there were only 2 protective factors i.e. exercise and introduction to solid food that remained statistically significant as independent factors influencing obesity in children aged 2 to 5 years old in the Yogyakarta District.

ABSTRAK

Kegemukan dan kelebihan berat badan saat ini merupakan masalah kesehatan di seluruh dunia dengan prevalensi meningkat dramatis setiap tahunnya. Anak gemuk sering dianggap lucu dan menggemaskan tetapi orang tua tidak sadar akan risiko yang terjadi jika keadaan tersebut dipertahankan. Tindakan pencegahan terjadinya kegemukan lebih efektif dilakukan dibandingkan pengobatan dengan mengurangi kejadian faktor risiko kegemukan. Penelitian ini bertujuan untuk mengetahui faktor risiko kegemukan antenatal dan postnatal pada anak umur 2-5 tahun di Kotamadya Yogyakarta. Penelitian ini merupakan penelitian observasional dengan rancangan penelitian kasus kontrol. Sampel penelitian adalah anak umur 2-5 tahun pada kelompok bermain yang berada di wilayah Kotamadya Yogyakarta dengan kriteria kegemukan sesuai dengan definisi dari WHO 2006. Besar sampelnya yang ditargetkan adalah 41. Anak yang masuk kriteria inklusi dan kriteria eksklusi diambil datanya dengan memberikan kuesioner kepada orang tua. Hasil

* corresponding author: rutin_seting@yahoo.com

pengumpulan data dianalisis dengan analisis bivariat dan regresi logistik multivariat. Sebanyak 32 anak yang memenuhi kriteria kegemukan ditelusuri secara retrospektif dengan memberikan kuesioner penelitian yang diisi oleh orang tuanya dan 34 kontrol tidak kegemukan dilakukan juga hal serupa. Pada analisis bivariat, prematuritas/umur kehamilan (OR = 16,00; 95%CI = 3,27-78,28; $p < 0,001$), perokok pasif (OR = 5.50; 95%CI = 1,90-15,96; $p = 0,001$), berat badan lahir rendah (OR = 7,27; 95%CI = 1,45-36,47; $p = 0,008$), intensitas makan lebih dari 3 kali (OR = 2,19; 95%CI = 1,66-2,89; $p = 0,007$), makanan berlemak (OR = 4,18; 95%CI = 1,45-12,02; $p = 0,007$) terbukti sebagai faktor risiko kegemukan pada anak 2-5 tahun dan empat lainnya sebagai faktor protektif kegemukan pada anak 2-5 tahun yang meliputi anak yang tidak memilih-milih makanan (OR = 0,16; 95%CI = 1,45-12,02; $p = 0,002$), pengenalan makanan padat (OR = 0,29; 95%CI = 0,10-0,79; $p = 0,01$), olahraga (OR = 0,25; 95%CI = 0,06-0,32; $p = 0,04$) dan menonton TV/game kurang dari 2 jam (OR = 0,30; 95%CI = 0,09-0,95; $p = 0,04$). Pada analisis multivariat hanya dua faktor risiko yaitu intensitas makan lebih dari 3 kali dan prematuritas serta dua faktor protektif yaitu olahraga dan pengenalan makanan padat/*solid food* yang terbukti sebagai faktor risiko independen. Faktor antenatal prematuritas dan faktor postnatal meliputi intensitas makan lebih dari 3 kali, olahraga dan pengenalan makanan padat terbukti sebagai faktor risiko independen kegemukan pada anak umur 2-5 tahun di wilayah Kotomadya Yogyakarta.

Keywords: obesity - children age 2 to 5 years old - antenatal - postnatal - risk factors

INTRODUCTION

Obesity is a condition of excessive fat accumulation in body tissues. This is a pathological condition as some research shows that obese children have a higher risk for coronary heart disease, hypertension, diabetes mellitus,¹ atherosclerosis, dyslipidemia and hiperkolesterolemia.²⁻⁵ Current incidence of obesity is increasing due to changes in diet and the mislead public view that health is identical to fat.⁶ Survey conducted in London in 2002 found the prevalence of obesity in elementary school children by 15.8%.⁷ The prevalence of obese children in elementary school in Yogyakarta Special Province was 9.75% in 1999.^{4,8} Approximately 26.5% of infants and children who were obese will stay obese for the next two decades and 80% of obese adolescents will become obese adults.⁹ Study in Japan showed that 1/3 of obese children grew up to be obese in adulthood and the risk of obesity was very high, about 2 to 6 times.¹⁰

There are three critical periods during development of the child in the incidence of obesity: prenatal period, especially the third trimester of pregnancy; the period of adiposity

rebound at age 6-7 years; and the period of adolescence.¹¹ It is important to know this critical period of the intervention to prevent future incidence of obesity. In reducing the risk factors, prevention will be more effective than treatment. Knowing the risk factors at antenatal and early postnatal is important to reduce the incidence of diseases associated with obesity. Interaction between genetic, biological, psychological, social, cultural and environmental factors is risk factor for obesity. Obesity in one parent will increase the risk of adulthood obesity by 3 times, and obesity in both parents will increase the risk about 10 times. Long duration of breast feeding has been known to have an inverse relationship with the incidence of childhood obesity and possible related psychological factors.¹² This study was conducted to identify the risk factors of obesity in antenatal and postnatal period in children age 2 to 5 years old in Yogyakarta District of Yogyakarta Special Region.

MATERIALS AND METHODS

This study was an observational research using case-control design. It was conducted in

July-December 2009 in the nursery (playgroup) in the Yogyakarta District of Yogyakarta Special Region. The subjects of this study were children aged 2-5 years with anthropometric obesity based on the WHO chart of 2006, who meet the criteria for inclusion and exclusion. Inclusion criteria were children aged 2-5 years, physically and mentally healthy, and had anthropometric measurements of obesity. Exclusion criteria were children with congenital anomalies, had received steroids or in long-term steroid treatment and chronic disease. Each of the study subjects was matched by the age, sex and playgroup site with the control (non-obese), and given a questionnaire study.

Sample size was calculated using the formula to test the hypothesis of unpaired analysis; number of study subject was 41 for each group. Yogyakarta District was chosen as site of the study as it represented the urban areas of Yogyakarta Special Region. It comprised of 14 districts, each district had its own playing group. Thirty four obese children and 34 non-obese children obtained from this study to further statistical analysis. This study was approved by the Medical and Health Research Ethics Committee, Faculty of Medicine, Universitas Gadjah Mada, Yogyakarta. All subjects involved in this study had provided a signed informed consent of each parent.

Antenatal risk (maternal characteristics, pregnancy characteristics, lifestyle, maternal illness) and postnatal factors (child characteristics, nutrition, diet, physical activity and other activities) were analyzed by bivariate analysis and multivariate logistic regression analysis to eliminate confounding variables. The results of multivariate logistic regression analysis found independent risk factors for obesity of children age 2-5 years. The study subjects were analyzed using a computer program with 95% confidence interval.¹³

RESULTS

This study was conducted in the nursery/playgroup in the Yogyakarta District in July-December 2009. Sixty eight children aged 2-5 years were involved in this study consisting of 34 obese subjects (cases) and 34 non-obese subjects (control). Two cases were excluded because they were not domiciled in the Yogyakarta District. Characteristics of study subjects are presented in TABLE 1.

TABLE 1. Basic characteristics of subjects (children age 2-5) involved in the study of risk factors of obesity in Yogyakarta

Characteristics	Obesity (%)	Non obesity (%)
Sex		
• Male	14 (44%)	15 (44%)
• Female	18 (56%)	19 (56%)
Maternal education		
• Primary education	3 (9%)	5 (15%)
• Higher education	29 (91%)	28 (85%)
Maternal employment		
• Housewife	13 (41%)	13 (38%)
• Working mothers	19 (59%)	21 (62%)
Father education		
• Primary education	0	3 (9%)
• Higher education	32 (100%)	31 (91%)
Father employment		
• Indonesian army	0	6 (18%)
• Entrepreneur	31 (97%)	17 (50%)
• Others	1 (3%)	11 (32%)
Income		
• < 2 million IDR	8 (25%)	9 (27%)
• > 2 million IDR	24 (75%)	25 (74%)

The antenatal factors namely gestational age and passive smoker were found as risk factors of obesity in children age 2-5 years in this study as shown in TABLE 2. The incidence of obesity in children age 2-5 years by bivariate analysis was significantly associated with preterm or premature pregnancy (OR=16.00;95%CI=3.27-78.28; p=0.01) and passive smoker (OR=5.50; 95%CI=1.90-15.96; p=0.01).

TABLE 2. Antenatal factors as risk factors of obesity in children (age 2-5) involved in the study

Characteristics	Obesity N=32(%)	Non Obesity N=34(%)	OR 95% CI	p*
Gestational age				
• Pre-mature	16 (50%)	2 (6%)	16.00	0.001
• A-term	16 (50%)	32 (94%)	(3.27-78.28)	
Passive smoker				
• Yes	24 (75%)	12 (35%)	5.50	0.001
• No	8 (25%)	22 (65%)	(1.90-15.96)	

* : Fisher's exact test

The postnatal factors namely birth weight, feeding intensity, picky eaters, exercise and watching TV/play video game were found as risk factors of obesity in children age 2-5 years

in this study as shown in TABLE 3. The incidence of obesity in children age 2-5 years by bivariate analysis was significantly associated with low birth weight (OR=7.27; 95%CI=1.45-36.47; p=0.008), eating more than 3 times daily (OR=2.19; 95%CI=1.66-2.89; p=0.007) and meals that are high in lipid (OR=4.18; 95%CI=1.45-12.02; p=0.007). Meanwhile, factors namely picky eaters (OR=0.16; 95%CI=1.45-12.02; p=0.002), early introduction to solid food (OR=0.29; 95%CI=0.10-0.79; p=0.01), exercise (OR=0.25; 95%CI=0.06-0.32; p=0.04), and watching TV or playing video game under 2 hours daily (OR=0.30; 95%CI=0.09-0.95; p=0.04) were associated with protective factors against obesity.

TABLE 3. Postnatal factors as risk factors of obesity in children (age 2-5) involved in the study

Characteristics	Obesity N=32(%)	Non Obesity N=34(%)	OR 95%CI	p
Birth weight				
• LBW	10 (31%)	2 (6%)	7.27	0.008
• Non LBW	22 (69%)	32 (94%)	(1.45-36.47)	
Introduction to solid food				
• < 6 months	21 (66%)	12 (35%)	0.29	0.01
• > 6 months	11 (34%)	22 (65%)	(0.10-0.79)	
Feeding intensity				
• < 3x/day	0	7 (21%)	2.19	0.007
• > 3x/day	32 (100%)	27 (79%)	(1.66-2.89)	
Picky eaters				
• Yes	4 (13%)	16 (47%)	0.16	0.002
• No	28 (87%)	18 (53%)	(0.05-0.56)	
Exercise				
• Yes	23 (72%)	31 (91%)	0.25	0.04
• No	9 (28%)	3 (9%)	(0.06-0.32)	
Watching TV/play video game				
• < 2 hours	27 (84%)	21 (62%)	0.30	0.04
• > 2 hours	5 (16%)	13 (38%)	(0.09-0.97)	

* : Fisher's Exact Test

The incidence of obesity in children age 2-5 years by multivariate analysis was significantly associated with feeding intensity (OR=15.92; 95% CI=2.07-122.16; p=0.008) and gestational age (OR=10.16; 95% CI=1.09-94.31; p=0.041), whereas factors namely

introduction to solid (OR=0.01; 95% CI=0.01-0.51; p=0.008) and food and exercise (OR=0.03; 95% CI=0.00-0.26; p=0.002) were associated with protective factors against obesity (TABLE 4).

TABLE 4. Antenatal dan postnatal factors on multivariat analysis

Risk factors	OR	CI 95%	p
Gestational age	10.16	1.09-94.31	0.041
Introduction of solid food	0.01	0.01-0.51	0.008
Feeding intensity	15.92	2.07-122.16	0.008
Exercise	0.03	0.00-0.26	0.002

DISCUSSION

Antenatal and postnatal risk factors in some obese children aged 2-5 years were observed in this study. Bivariate analysis of these factors showed that passive smokers at home and preterm/premature pregnancy were risk factors for obesity in children aged 2-5 years. However, maternal education, father education, mother's employment and parental income were not risk factors for obesity. These results are consistent with the results reported by Sowan *et al.*⁹ that showed parental educational status, parental income and parental employment were not risk factors for obesity in children. Wojciak *et al.*¹⁴ reported that passive smoking is a risk factor of obesity in children. Nicotine in cigarettes affects the decrease in appetite. Moreover, the nicotine reduces blood flow to the placenta led affects the intake of the fetus.¹⁵

Another study also found maternal smoking as a risk factor for obese children. A systematic study review conducted by Oken *et al.*¹⁶ reported that smoking exposure during prenatal increases the risk of the incidence of obesity in childhood. Unfortunately, this study did not include maternal smoking to be analyzed so that it is possible see the relationship. Similarly,

preterm/premature pregnancy is one of the antenatal risk factors for obesity, according to a study by Hediger *et al.*¹⁷, Ong *et al.*¹⁸ and Bettiol *et al.*¹⁹ which states that prematurity is a risk factor for obesity. One theory states that rapid catch up on premature baby risks in becoming obese in the future, although it does not rule out other factors such as the influence of genetic factors and environment.

Postnatal risk factors that have been significantly proved as risk factors of obesity are low birth weight, feeding intensity of more than 3 times per day, and fatty foods. In addition, there are four protective factors from postnatal obesity that can reduce the risk of obesity in children. They are children who are not picky eaters, the introduction of solid food, exercise, and watching TV/playing video games less than 2 hours. These results are consistent with previous studies in which low birth weight are statistically significant risk factors for childhood obesity. Some other studies also showed the same results. Barker *et al.*²⁰, Hales *et al.*²¹ and Lindsey²² stated that the reason for child obesity is that low birth weight babies have a faster catch up growth that exceeds their needs in a day. Similarly, the intensity of excessive feeding

and fatty foods will increase the amount of calories into the body, which makes less than 50% of fatty foods converted into energy, while the rest will be stored as fat reserves in the body.^{10,23,24}

There are four risk factors that are protective from obesity: picky eaters, feeding solids (solid food), exercise activities and watching television/playing video games for less than 2 hours. In children with eating disorders, picky eaters are protective factors as they tend to have a poor appetite and eat in small amounts – it affects the intake of calories which in turn affects the weight to drop.¹² In some studies, early feeding in less than 6 months of age increases the risk of obesity in children, as babies are not ready to digest solids and it will also affect the increased calorie intake to the infant, making the excessive caloric intake to be stored in the body.^{25, 26} Some studies also mention that breastfeeding until the age of 6 months proves to be a protective factor of obesity, although it is not statistically significant.²⁷ Sports/physical activity will burn calories stored in the children's body. The more they do regular exercises, the more calories will be used.^{28, 29} Sports activities are physical activity done outdoor, either in the form of a game or sport. Physical activity is defined as body movement produced by skeletal muscles that need energy expenditure which includes work and daily activities. The physical activity requires mild, moderate or severe effort that can lead to health improvements.³⁰ Less physical activity causes the body to use less energy stored in the body and without appropriate physical activity, the excessive energy intake can lead to obesity. The most simple and common way to increase energy expenditure is physical exercise. This research is consistent with the results of previous studies in which children who watch television or play games more than 2 hours are at risk of becoming obese in the

future due to lack of physical activity on both of these activities.³¹ With the consumption of food while watching television or playing video games, approximately 40% of children are obese and about 80% of obese adolescents will become obese in adulthood.³² Increased weight in children usually begins at age 5-7 years. Children who are too often stuck in front of the TV or playing video games too much would be at risk of obesity later in life. Therefore, the American Academy of Pediatrics recommends a limit in watching television and playing video games on children, that is approximately 14 hours per week.³³

From the results of bivariate and multivariate analysis that was performed using multivariate logistic regression analysis, it was found that there are four independent risk factors for obesity, including gestational age preterm/premature, the introduction of solid food, the intensity of feeding of more than 3 times per day, and sport/physical activity. These results prove the intensity of feeding to be the greatest risk factor and it is consistent with previous studies where energy intake will increase which results in the risk of unused energy to be stored in the body. Similarly, preterm/premature gestational age increases the risk for obesity to occur by 10 times. Additionally, there are two protective factors from obesity, i.e. sport or physical activity and the introduction of solid food.

CONCLUSION

Independent risk factors for antenatal and postnatal obesity in children aged 2-5 years in the municipality of Yogyakarta are preterm/premature gestational age, the intensity of feeding of more than 3 times per day, and two protective factors are the early introduction of solid food and exercise/physical activity. Obesity-related counseling and approach are

necessary to prevent and control obesity, as well as further research with larger sample size and larger sample characteristics.

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