Paediatrica Indonesiana

VOLUME 48 September • 2008 NUMBER 5

Original Article

Association between obesity and lipid profile in children 10-12 years of age

Ruqoyatul Himah, Endy P. Prawirohartono, Madarina Julia

Abstract

Background Worldwide prevalence of obesity in children has been increasing. Together with dyslipidemia and hypertension, obesity is associated with higher risk of cardiovascular morbidity later in life.

Objective The aim of this study was to assess association between obesity and occurrence of dyslipidemia in 10-12 years old children.

Methods We performed a cross sectional study on 53 obese and 53 non-obese children matched for age and gender in Yogyakarta. Obesity was defined as body mass index (BMI) at or above the 95th percentile of the CDC 2000 reference. The levels of total cholesterol, LDL-cholesterol, HDL-cholesterol and triglyceride were measured. Dyslipidemia was defined as increased level of total cholesterol, LDL-cholesterol, triglyceride and decreased level of HDL-cholesterol.

Results Obese children had higher risk of increased level of triglyseride, i.e. RR 2.6 (95% CI 1.6 to 4.4), P<0.001 and decreased level of HDL-cholesterol, i.e. RR 17.8 (95%CI 14.0 to 20.1), P=0.003. Overall, relative risk for dyslipidemia in obese children was 5.2 (95%CI 4.2 to 5.9), P=0.002, higher than in non-obese children.

Conclusion Compared to non-obese children, obese children have higher risk of dyslipidemia, particularly hypertriglyceridemia and hypo-HDL. **[Paediatr Indones 2008;48:257-60]**.

Keywords: *obesity, hypercholesterolemia, dyslipidemia, hypertriglyceridemia*

Obesity has become a serious health problem in many countries worldwide, in both developed and developing countries. The increase of obesity prevalence has been associated with the advanced technology and imbalance of eating habits.[1-2]

Obesity is a serious problem because it is associated with increased risk of cardiovascular diseases. The Bogalusa Heart Study reported that 5-10 year old children with obesity had 3 times risk of getting increased levels of LDL-cholesterol, 3.4 times risk of getting decreased levels of HDL-cholesterol, 7 times risk of getting increased levels of triglyceride, and 2.5 times risk of getting hypertension compared to non-obese children.[3] In West Virginia, 43% children with obesity had at least one other risk factors of coronary heart disease later in life, i.e. hypertension, dyslipidemia, or insulin resistance. In addition, 25% of children with obesity, dyslipidemia, hypertension and one of whose parents suffered from coronary heart disease before the age of 55 years, suffered from coronary heart disease in their twenties.[4-6] We

From the Department of Child Health, Medical School, University of Gadjah Mada, Sardjito Hospital, Yogyakarta, Indonesia.

Request reprint to: Ruqoyatul Himah, MD, Department of Child Health, Medical School, University of Gadjah Mada, Sardjito Hospital, Jl. Kesehatan no. 1, Sekip Utara, Yogyakarta, Indonesia. Telp: 62-274-587333. Fax: 62-274-587333.

conducted this study to assess the association between obesity and occurrence of dyslipidemia in children aged 10-12 years old in Yogyakarta.

Methods

We conducted a cross sectional study during April to September 2004. Weight and height were measured in school children in 14 public elementary schools chosen from 37 public elementary schools in Yogyakarta. Screening in these 14 elementary schools yielded 255 obese children, with the prevalence of 11.5%. Out of these 255 children, 72 children met the age requirement, which was 10 to 12 years old. We selected randomly 53 out of these 72 children. We recruited 53 non-obese children, matched for age and sex. The protocol of the study was approved by the Ethical Committee of Gadjah Mada University.

We defined obesity based on body mass index (BMI)-for-age percentile relative to the CDC 2000 reference. Children having a BMI-for-age percentile at 95th or above were classified as obese, while those were below the 95th percentile were classified as not obese.[7] BMI was defined as body weight in kilogram divided by square of height in meter. Body weights were measured with a digital scale with accuracy of 0.1 kg. Heights were measured with a microtoise with accuracy of 0.1 cm. Every student was weighed once only in their uniform, without shoes or hat.

Blood examinations were conducted in Prodia Laboratory, Yogyakarta. Prior to blood collecting, children were asked to fast for at least 10 hours. Blood were drawn at 08.00 am. Levels of cholesterol were measured using CHOL Dimention® method, while level of triglyceride were measured using TGL Dimention® method and DiaSys kit. Results of the laboratory test were assessed based on the criteria for hyperlipidemia by National Cholesterol Education Program Lipid Assessment for Children,[8] as shown in **Table 1**. The difference in the prevalence ratio (95% CI) between the obese and non-obese group was calculate using chi-square ($\chi 2$).

Results

We recruited 106 children, i.e. 66 (63%) boys and 40 girls. There was significant difference in lipid profiles between the obese and the non-obese groups. Compared to the non-obese group, the obese group showed prevalence ratio of 18 and 3 times higher to become hypo HDL-cholesterol and hypertriglyceridemia, respectively (**Table 2**). Occurrence of dyslipidemia in the obese group was 5 times higher than in the non-obese group (**Table 3**).

Discussion

Obesity is associated with increased accumulation of body fat, which in turn stimulates lipolysis and lipid turnover. Increased amount of glycerol and free fatty acid is released into portal circulation. Hepatic increased availability of free fatty acid stimulates gluconeogenesis which is associated with resistance to insulin and increased hepatic secretion of LDL. Resistance to insulin is associated with increased level of hepatic lipase and decreased level of lipoprotein lipase. All of these, ultimately, end in increased level of triglyceride, apo-lipoprotein, LDL-cholesterol and decreased level of HDL-cholesterol in the circulation.

Lipid levels depend on many factors, e.g. age, gender, race, nutritional status, nutritional intake and environmental factors.[11,12] Association between hypercholesterolemia and obesity had been reported. Tran reported that increase in body weight was associated with increase in blood cholesterol levels.[13] Increased calorie intake in obese children is also associated with hypercholesterolemia and hypertriglyceridemia.[11]

In this study we found that the prevalence of lipid profile abnormality in obese children was higher than those of non-obese children. Risks of increased total cholesterol and LDL-cholesterol in obese children were 1.3 and 1.2 times higher, respectively, than in non-obese group. A similar result had been reported by Threshakovec.[2]

Risk of hypertriglyceridemia in obese group in our study was 2.6 times higher than in non-obese group. Similar results had been reported by Kim.[14] However, our observed increased risk is smaller than those observed by Freedman[3] who found that the obese had risk of hypertriglyceridemia 7 times higher than the non-obese.[3] The difference with our study might lie in the age groups included, i.e. 10-12 years old in our study versus 5 to 17 years old in his study.

Table 1. Normal level of cholesterol and triglyceride in children[8]

Total cholesterol (mg/dL)	LDL-cholesterol (mg/dL)	Triglyceride (mg/dL)	HDL-cholesterol (mg/dL)	Interpretation
< 170	< 110	< 125	> 35	Normal
≥ 170	≥ 110	≥ 125	≤ 35	Abnormal

Table 2. Lipid profiles in obese and non-obese groups

	Obese (n = 53)	Non obese (n = 53)	Prevalence ratio (95% CI)	P
Total cholesterol :				
≥ 170 mg/dL	40	32	1.3	0.10
< 170 mg/dL	13	21	(0.95 to 1.63)	
LDL Cholesterol :				
≥ 110 mg/dL	34	29	1.2	0.32
< 110 mg/dL	19	24	(0.85 to 1.61)	
HDL Cholesterol :				
≤ 35 mg/dL	8	0	17.8	0.003*
> 35 mg/dL	45	53	(13.98 to 20.11)	
Triglyceride :				
≥ 125 mg/dL	34	13	2.6	0.001
< 125 mg/dL	19	40	(1.57 to 4.37)	

* Fisher's exact Test

Tabel 3. Prevalence of dyslipidemia* in obese and non-obese children

	Dyslipidemia	Non dyslipidemia	Prevalence Ratio (95% CI)	P
Obese	2	51	5.2	0.002**
Non Obese	0	53	(4.16; 5.85)	

* Dyslipidemia : hypercholesterolemia, hypertrglyceridemia, hyper LDL-cholesterol and hypo HDL-cholesterol
** Fisher's exact test

The increased risk for low level of HDL-cholesterol in obese group in our study was 18 times higher than in non-obese group. The increased risk was higher than that observed by Kim, i.e. 4.1 times.[14] Our study found no one in the non-obese group who had low level of HDL-cholesterol.

The definition of dyslipidemia according to American Academy of Pediatric (AAP) and National Cholesterol Education Program of Pediatric (NCEP) is increased level of total cholesterol, LDL-cholesterol, triglyceride and decreased level of HDL-cholesterol. This study showed that the obese group had the risk of dyslipidemia 5 times higher than the non-obese group. This increased risk was higher than those observed by Boyd,[15] who found that the obese group had risk of dyslipidemia 2 times higher than non obese group.

In conclusion, we observed that obese children 10-12 years of age have higher risk of dyslipidemia compared with non-obese children of the same age, particularly hypertriglyceridemia and hypo-HDL. American Academy of Pediatrics and National Cholesterol Education Program of Pediatric do not recommend routine screening for lipid level in children unless certain condition exist, including obesity.[8,16]

References

1. Slyper AH. Children obesity, adipose tissue, distributor and the pediatric practitioner. Pediatric 1998;102:1-9.
2. Thresacovec AM, Jawad AF, Stouffer NO, Elkasabany A, Srinivasan SR, Berenson GS. Persistent hypercholesterolemia is associated with development of obesity among girls: The

Bogulosa Heart Study. Am J Clin Nutr 2002;76:730-5.
3. Freedman DS, Dietsz W, Srinivasan SR, Berenson GS. The relation of Overweight to cardiovascular risk factor among children and adolescent: The Bogalusa Heart Study. Pediatrics 1999;103:1175-82
4. Crindle BM. Screening and management of children with hyperlipidemia. Pediatric Annual 2000;29.
5. Muratova VN, Demerath EW, Spangler E, Ogershok P, Elliot E, Minor VE. The relation of obesity to cardiovascular risk factor among children:the CARDIAC project. NEJM 2002;98 Suppl 6:263-7.
6. Lambert M, Assauline L, Feoli-Fonsecesa JC, Burn N, Delvin EE, Levy E. Determinant of lipid level variability in French-Canadian children with familial hypercholesterolemia. Arteriocler Thromb Vasc Biol 2001;21:979-84.
7. Tee ES. Obesity in Asia: prevalence and issue in assessment methodologies. Asia Pasific J Clin Nutr 2002;11 Suppl 3:S694-01.
8. Winter W. Pediatric lipid disorder in clinical practice 2004. Available from URL: http://www.emedicine.com
9. Slyper, AH. Childhood obesity, adipose tissue, distributor and the pediatric practitioner. Pediatric 1998;96:102-12.
10. Goran MI, Gower BA. Relation between visceral fat and disease risk in children and adolescent. Am J Clin Nutr 1999; 70:149-56.
11. Grundy SM. Cholesterol and coronary hearth disease. JAMA 1998;28:2849-58.
12. Mahan LK, Arlin MT. Nutrition in hypertension. In : Mahan LK, Arlin MT, editors. Krause's food, nutrition & diet therapy. 8th ed. Philadelphia: Saunders, 1992:387-94,569-78.
13. Tran ZV, Weltman. Different effect of exercise on serum lipid and lipoprotein leel seen with changes is body weight. JAMA 1985;254:919-24.
14. Kim HM, Park J, Kim HS, Kim DH, Park SH. Obesity and cardiovascular risk factor in Korea children and adolescent aged 10-18 years from the Korean National Health and nutritional examination survey, 1998 and 2001. Am J Epid 2006;64 Suppl 8:787-93.
15. Boyd GS, Koenigsberg J, Gidding S, Hassink S. Effect of obesity and high blood pressure on plasma lipid level in children and adolescents. Pediatrics 2005;166: 442-6.
16. Albisetti M, Chan A, McCrindel BW, Wong D, Monagle P, Andrew M. Impairement fibrinolytic activity is present in children with dyslipidemia. Pediatr Res 2004;55:576-80.