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Original Article

Lipid profiles of vegetarian and non-vegetarian children at risk of overweight or obesity

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Abstract

Background The type, amount, and composition of a diet may affect the levels of cholesterol in blood. It is believed that children adhering to a vegetarian diet have lower total cholesterol levels and lower body mass indexes compared to children with non-vegetarian (omnivorous) diets. We wish to compare cholesterol levels of vegetarian and non-vegetarian Indonesian children who are at risk of overweight or obesity.

Objective To compare lipid profiles of vegetarian and non-vegetarian children who are at risk for overweight or obesity.

Methods We performed a cross-sectional study in January and February 2010. Subjects for this study came from Denpasar, Bali. Subjects filled questionnaires as well as underwent history-taking, anthropometric measurements, and blood testing. We performed lipid profile analyses on their blood samples. We used the independent *t* test and Mann-Whitney test for statistical analysis of the data. The level of significance was set at $P < 0.05$.

Results Our study included forty-four children at risk for overweight or obesity with a vegetarian or non-vegetarian diet. We found that vegetarian children had lower mean total cholesterol (144 mg/dl) than that of non-vegetarian children (171 mg/dl), a statistically significant difference of $P=0.014$. In addition, vegetarian children had lower mean triglyceride levels (150 mg/dl) than those of non-vegetarian children (264 mg/dl), a statistically significant difference of $P=0.025$.

Conclusion Among Balinese children at risk of overweight or obesity, vegetarians have significantly lower mean total cholesterol and triglyceride levels than non-vegetarians. **[Paediatr Indones. 2010;50:291-4]**.

Keywords: *obesity, vegetarian diet, metabolic syndrome, lipid profile.*

Adhering to a vegetarian diet is a popular lifestyle in many countries. Vegetarian diets are considered healthy, nutritionally adequate, and beneficial in the prevention and treatment of certain diseases. The American Dietetic Association (ADA) stated that children with a vegetarian diet have lower total cholesterol levels and body mass indexes compared to children with non-vegetarian (omnivorous) diets.[1] But until now, there has been no study in Indonesia that compares lipid profiles of vegetarian and non-vegetarian children at risk for overweight or obesity.

Children whose body mass index (BMI) is above the 85th percentile are considered at risk for overweight or obesity (CDC 2000).[2] Obesity is a predisposing factor for metabolic syndrome. Likewise, abnormal levels of cholesterols are a risk factor for coronary heart disease.[3] According to the American Academy of Pediatrics (AAP), the type, amount, and composition of a diet may affect the levels of cholesterol in blood.[4] Lipid profiles are frequently used to predict the likelihood of coronary heart disease and

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metabolic syndrome. The lipid profile test includes measurements of total cholesterol (TC), low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglycerides (TG).

The purpose of this study was to compare the mean lipid profiles of vegetarian and non-vegetarian Indonesian children at risk for overweight or obesity.

Methods

We conducted a cross-sectional study in Denpasar from January to February, 2010. The study was approved by the Ethics Study Committee of Udayana University, Medical School, Sanglah Hospital, Denpasar. We obtained written informed consent from the subjects' parents. We included children aged 2 to 18 years whose body mass index (BMI) was at or above the 85th percentile. We excluded children who had history of genetic diseases (such as familial hypercholesterolemia, familial hypertriglyceridemia, familial combined hyperlipidemia, and familial defective Apo B-100), metabolic diseases (such as diabetes mellitus type II and hypothyroidism), and chronic diseases (such as nephrotic syndrome and rheumatoid arthritis). Other exclusion criteria were children who: (1) Underwent chemotherapy during the period of the study (2) Took medication that alters lipid profiles (such as estrogen, estradiol, androgen, testosterone, progestin, glucocorticoids, cyclosporine, tacrolimus, diuretic thiazides, beta blockers, sertraline, protease inhibitors, isotretinoin, valproic acid, and associated drugs) during the period of study; (3) Performed physical exercise for over 90 minutes, more than three times a week before the study; (4) Consumed alcohol more than 200 grams a week before; (5) Smoked more than 20 packs of cigarettes a year; (6) Had physical development Tanner's stage 3 or more; (7) 7. Had blood pressure higher than the 95th percentile based on age and sex.

Subjects were divided into two groups, vegetarian and non-vegetarian. This study used a two-sided hypothesis with $\alpha = 0.05$ ($Z\alpha = 1.960$) and $\beta = 0.2$ ($Z\beta = 0.842$). Standard deviation (SD) of the combination (S) of the mean total cholesterol level in both groups was 23.15. Mean difference of 20 between total cholesterol levels ($x_1 - x_2$) of the vegetarian and non-vegetarian groups was considered significant. With this formula, the minimal sample number was 21 children in each group. We used Shapiro-Wilk test to determine data distribution. The relationships between variables were analyzed using independent t test or Mann-Whitney test. A P value of <0.05 was considered statistically significant.

Results

Forty-four children were enrolled this study, ranging from 4 to 14 years in age. Vegetarian and non-vegetarian children had similar body mass indexes and were considered at risk for overweight or obesity. Characteristics of the subjects are shown in **Table 1.**

The lipid profiles of vegetarian and non-vegetarian subjects are shown in **Table 2.** Vegetarian children had lower mean total cholesterol levels and lower mean triglyceride levels than non-vegetarian children. There were statistically significant differences in mean total cholesterol levels (P=0.014) and mean triglyceride levels (P=0.025) between the two groups. We found no significant differences in HDL, LDL, and TC/HDL ratios between the two groups.

Table 1. Characteristics of subjects

Characteristic	Vegetarians at risk for overweight or obesity (n=22)	Non-vegetarians at risk for overweight or obesity (n=22)
Sex, Male/Female	12/10	13/9
Year of Age, mean (SD)	9.9 (3.4)	10.1 (1.3)
Ethnicity		
Balinese	21	18
Javanese	1	4
BMI kg/m^2, (SD)	24.6 (1.1)	25.0 (0.5)

Table 2. Lipid profiles of vegetarian and non-vegetarian children

Parameter	Vegetarians at risk for overweight or obesity (n=22)	Non-vegetarians at risk for overweight or obesity (n=22)	P
Total cholesterol, median (interquartile) mg/dL	144 (6.5)	171 (9.4)	0.014*
HDL, mean (SD) mg/dL	43 (12.7)	43 (9.2)	0.957
LDL, mean (SD) mg/dL	91 (25.9)	102 (25.0)	0.152
Triglycerides, median (interquartile) mg/dL	150 (22.4)	264 (57.2)	0.025*
TC/HDL ratio, median (interquartile)	4 (0.3)	4.2 (0.3)	0.188

*Mann-Whitney test

Discussion

Our study showed interesting differences in lipid profiles between vegetarian and non-vegetarian children. However, it should be noted that while screening subjects to be included in the study, we noticed that fewer vegetarian children were at risk of overweight or obesity than non-vegetarian children. One possible explanation is that there are far fewer vegetarians in the population than non-vegetarians. This idea is consistent with a study by Larsson and Johansson,[5] who found that the prevalence of vegetarian children in Sweden is only 5%. Another possibility is that vegetarian children have a lower risk of becoming overweight or obese than non-vegetarians. In support of this idea, a study by Aggarwal et al[6] showed that only 8.8% of vegetarians are at risk of overweight or obesity.

In addition, we had a larger percentage of males than females in our study. This finding is consistent with the National Health and Nutrition Examination Survey (NHANES)[7] during the period of 2003-2006 showing greater number of males at risk for overweight or obesity. Interestingly, a study by Robinson-O'Brian et al[8] demonstrated that adolescent and young adult males with a vegetarian diet can lower their risk of overweight and obesity.

In boys, pronounced centralization of fat tends to be stored in the abdominal region, with increases in subcutaneous fat and visceral fat; this pattern is similar but less dramatic for girls. In adolescent and young adult girls, fat tends to be deposited peripherally in the breasts, hips, and buttocks. According to another study, the risk of becoming overweight during adolescence appears to be higher among girls than it is among boys. [9] In our study, we did not further investigate why more boys than girls were at risk of overweight or obesity.

We performed lipid profile analyses on blood samples from non-fasting subjects, due to the young age of the subjects and a strictly controlled timeframe and examination schedule. A previous study suggests that predicting the risk of cardiovascular disease can be simplified by measuring the total cholesterol, HDL cholesterol or apolipoprotein levels without fasting and by disregarding the level of triglycerides.[10] Therefore, we chose this approach in our study.

We found the vegetarian group had lower mean total cholesterol than the non-vegetarian group (Z=-2.466 P=0.014). This result is similar to the findings of Hung et al[11] and Yen et al.[12] A study by Jago et al[13] showed significantly increased mean total cholesterol levels (upper limit) in omnivorous children at risk for overweight and obesity. Another study by Texeira et al[14] demonstrated a similar result in obese, omnivorous adolescents. Similar with Jago et al[13] and Zhang et al,[16] we also found a significantly lower mean triglyceride level in the vegetarian group. However, studies by Texeira et al[14] and Ambroszkiewics et al[17] yielded different results. They saw no significant difference in mean triglyceride levels in non-vegetarian and vegetarian prepubescent children.

Plant foods such as whole grains, beans, legumes, fruits, vegetables and different types of nuts are very good sources of dietary fibers. The hypocholesterolemic effect of fibers is probably due to an increase in bile-acid binding, fecal sterol excretion, and fermentation of soluble fibers which produce short-chain fatty acids that inhibit hepatic cholesterol synthesis.[15] Non-vegetarian diet, obesity, and central or abdominal fat distribution are associated with decreased levels of HDL and increased triglycerides in many studies of adults and adolescents. Abdominal obesity with increased

visceral fat is associated with increased levels of circulating free fatty acids, insulin and insulin resistance, all of which lead to increased synthesis of triglycerides and VLDL secretion by the liver.[18]

A limitation of this study is that no preliminary study was done due to time constraints. With a preliminary study, we could have had a general picture of the difference in mean and standard deviation (SD) of lipid profiles in vegetarian and non-vegetarian children who are at risk for overweight or obesity, thus enabling us to more precisely calculate the needed sample size. In addition, this study did not involve a strictly-controlled diet analysis (food record). A well-conducted diet analysis would have provided a representation of the amount, type, and composition of nutrients (proteins, fats, and carbohydrates) consumed by the subjects. Further study with a larger sample number may be able to demonstrate more completely and clearly the differences in lipid profiles of vegetarian and non-vegetarian children who are at risk for overweight or obesity.

In conclusion, in children who are at risk for overweight or obesity, the mean total cholesterol and triglyceride levels of vegetarian children were lower than that of non-vegetarian children.

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