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Fat Intake, Blood Pressure and Randomed Blood Glucose Levels as Risk Factor of Metabolic Syndrome in Adolescent of Junior School in Denpasar City

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ABSTRACT

The metabolic syndrome in children is defined when 3 of the 5 components are classified: hypertension, low HDL cholesterol, high serum triglyceride, high blood glucose levels, and central obesity. This study was a retrospective study with case-control design. Data collection was conducted from August to October 2014. The population of this study were all students in 8 selected junior high schools. Based on the calculation result, it was known that the sample size for case and control group are 128 people. Case and control determination began with screening of waist circumference using a tape measure, measured from the diameter between the lower ribs 10 with the iliac crest at the end of normal expiration. Systolic and diastolic blood pressure was measured using a digital blood pressure gauge under the Omron brand. Blood glucose levels were measured using a multicheck parameter tool under the Nesco brand. BMI based on weight and height were measured using body scales and Microtoise. Fat intake data were collected using semi-quantitative food frequency method. Data were analyzed descriptively in the range and mean for waist circumference variable, blood pressure, randomed blood glucose levels, and fat intake. Furthermore, the calculation of Odd Ratio. Based on the results be concluded that adolescents who consume fat above 25% risk 3.3 times greater to experience metabolic syndrome. Systolic and diastolic blood pressure, BMI and blood glucose levels as the case group was higher than the control group.

Keywords: Adolescent, Blood presure, Fat intake, Metabolic syndrome, Randomed blood glucose levels.

INTRODUCTION

The incidence of chronic diseases or noncommunicable diseases increases more rapidly in developing countries. WHO estimates by 2020, noncommunicable diseases will cause about 75% of deaths in the region. Obesity is a worldwide problem in both developed and developing countries because of its increasing prevalence in adults and children (Mexitalia, et al., 2009). The prevalence of obesity at age 13-15 years in Bali Province (3.1%) above the national prevalence (2.5%) (Balitbang Kemenkes RI, 2010).

Obesity is a major risk factor for chronic disease and plays a central role in metabolic syndrome, including hyperinsulinemia, hypertension, hyperlipidemia, type 2 diabetes mellitus, and an increased risk of cardiovascular disease (Kelishadi, 2007). There is a strong association between obesity with metabolic syndrome in children and adolescents (Haris & Tambunan, 2009). Central adipose changes during adolescence are significant predictors for changes in LDL cholesterol concentration, blood pressure and insulin resistance in adolescents (Tybor, et al., 2011).

The metabolic syndrome in children is defined when 3 of the 5 components are classified: 1) hypertension, 2) low HDL cholesterol (<40 mg / dL), 3) high serum triglyceride (> 120 mg / dL), 4) high fasting blood glucose levels (> 100 mg / dL), and 5) central obesity characterized by waist circumference ≥80 cm for female and ≥90 cm for male. Recent guidelines from the International Diabetes Federation for the determination of metabolic syndrome require central obesity and 2 other components (Kelishadi, 2007). In other words, a person is defined as a person with metabolic syndrome if he is obese and is followed by two other components.

METHODS

This study was a retrospective study with case-control design, where cases and controls were based on central obesity criteria. This research was conducted in 4 junior high schools in Denpasar. Data collection was conducted from August to October 2014. The population of this study were all students in 8 selected junior high schools. The inclusion criteria for the sample cases were: age 11-15 years, waist circumference ≥80 cm for female and ≥90 cm for male (Kelishadi, 2007). While the exclusion criteria if the sample was diagnosed with diabetes mellitus, nephrotic syndrome, and heart disease. Based on the calculation result, it was known that the sample size for case and control group are 128 people.

Case and control determination began with screening of waist circumference using a tape measure, measured from the diameter between the lower ribs 10 with the iliac crest at the end of normal expiration. Systolic and diastolic blood pressure was measured using a digital blood pressure gauge under the Omron brand. Blood glucose levels were measured using a multicheck parameter tool under the Nesco brand. Body Mass Index (BMI) based on weight and height were measured using body scales and Microtoise. Fat intake data were collected using semi-quantitative food frequency method.

Data were analyzed descriptively in the range and mean for waist circumference variable, blood pressure, randomed blood glucose levels, and fat intake. Furthermore, the calculation of Odd Ratio.

RESULTS

In the case group, age was 12 years (54.7%), while in the control group the age was 14 years (36.7%). In the case group, the proportion of male was 65.6%, while in the control group was 56.3%. In the case group, the proportion of female was 34.4%, while in the control group was 43.8%.

Table 1. The sample characteristics

Characteristics	Case (n=128)		Control (n=128)	
	f (%)	Mean (SD)	f (%)	Mean (SD)
Gender				
Male	84 (65,6%)		72 (56,3%)	
Female	44 (34,4%)		56 (43,8%)	
Waist Circumference (cm)				
Male		96.74		75.85
Female		86.8		68.95
BMI		30.89		21.84

The BMI description by age in the case group was higher than in the control group, as were systolic and diastolic blood pressure, as well as blood glucose levels.

Measurements were performed on all sample, but for blood pressure there was one sample that could not be measured because the size of the sample's arms and legs was too large. There were 4 people who do not want to undergo blood glucose examination because they are afraid.

Table 2. The fat intake, blood pressure, and blood glucose levels

		Case	Control
Fat Intake	Range	10.49 – 95.38	8.10 – 74.58
	Mean	26.73	22.38
Sistole (mm/Hg)	Range	95-174	90-141
	Mean	122.6	114.1
Diastole (mm/Hg)	Range	53-113	46-90
	Mean	79.5	71.1
Blood glucose (mg/dL)	Range	62-150	62-154
	Mean	104.28	101.7

It was known that 30 people (23.4%) of the case group had hypertension, while from the control group only 11 people (8.6%). There were 4 people (3.1%) of the case group having impaired glucose tolerance, while from control group only 2 people (1.6%).

Interviews showed that 26% of members of the case group stated that their parents were also overweight. All members of the case group and control group said that they did not have the disease. Most of them say that

their families do not suffer from diabetes mellitus, heart disease and cancer.

Almost all members of the sample stated that they regularly do sports, but the sport in question was at school sports. More members of case groups said they do not exercise regularly outside of school. Most of the case group members more often use gadgets or computers.

The fat intake of the case group higher than the control group. The fat intake of case group exceeded the recommended limit of 26.73%. Conversely, the average fat intake of the control group did not exceed the recommended limit of 22.39%. Maximum and maximal fat intake of case groups also exceeded the control group.

Fat intake is the percentage of sample fat intake compared with the energy adequacy per day. Table 4 shows that most fat intake in case group exceeds recommendation (> 25%), ie 46.9%, while in control group only 21.1%.

Table 4. Fat Intake per day

Fat Intake	Case (n=128)			Control (n=128)		
	f	(%)	Mean (SD)	f	(%)	Mean (SD)
Meet the recommendations	68 (53,1%)			101 (78,9%)		
Not meet the recommendations	60 (46,9%)			27 (21,1%)		

Result of analysis of relationship between fat intake with risk of metabolic syndrome showed value Odd Ratio = 3.3 (95%, CI 1.907-5.712, p = 0.000).

DISCUSSION

The International Diabetes Federation (IDF) states that to establish the metabolic syndrome requires central obesity parameters and 2 other components (Kelishadi, 2007). Someone is said to have metabolic syndrome when 3 of 5 components are found in hypertension (> 90th percentile), high serum triglyceride (> 120 mg / dL), low HDL cholesterol (<40 mg / dL), fasting blood glucose (> 100 mg / dL), central obesity characterized by the 90th percentile size at waist circumference or ≥80 cm for female and ≥90 cm for male (Haris & Tambunan, 2009). Anthropometric measurements especially waistlines are also important to support the diagnosis of Rizzo, et al. (2013). This study used waist circumference as the risk of metabolic syndrome.

In this study could not be calculated the prevalence of risk factors for metabolic syndrome in adolescents, because screening was not performed on all students. Research in Jakarta reported that the prevalence of metabolic syndrome in obese Chinese adolescents in North Jakarta and South Jakarta was 19.14% for men and 10.63% for women. The number of women at risk for metabolic syndrome in this study was also less than that of men.

The results of this study indicate that adolescents who consume fat above 25% risk 3.3 times greater to experience the risk of metabolic syndrome. Food intake is one of the determinants of obesity. Excessive fat and carbohydrate intake is a potential cause of obesity (Sargowo & Andarini, 2011). In this case, excess fat and carbohydrate intake will be stored in the form of fat cells.

In this study only investigated about fat intake, but based on the results of data collection was known that some of the case groups there are consuming fat <25%. Thus it can be assumed that they have consumed carbohydrates in excess, thus contributing to the excess energy intake. Excessive fat intake in many case groups derived from fast food, fried snacks, also pork. Most respondents say they like fast food and fried snacks that are easy to find, such as in the school cafeteria and stalls around the school, also obtained while on vacation with family.

Diets high in fat and simple carbohydrates associated with the risk of metabolic syndrome (Denova-Gutiérrez, et al, 2010). Increased consumption of red meat is also associated with the risk of metabolic syndrome (Azadbakht & Esmaillzadeh, 2009). Consumption of overfried fried foods is significantly associated with the incidence of Type 2 diabetes mellitus and arterial heart disease, and is associated with weight and comorbidity against hypertension and hypercholesterolemia (Cahill, et al., 2014).

Some metabolic disorders (hypertension, glucose metabolism disorders and dyslipidemia) are often associated with central obesity (Sargowo & Andarini, 2011). The results of this study indicated that more cases were hypertensive than the control group. In adolescent boys, blood pressure is affected by BMI and waist circumference (Novianingsih, 2011). Visceral fat is positively associated with risk factors for cardiovascular disease in children and adolescents (Tybor, et al., 2011).

High Blood glucose levels were present in both case and control groups. This is in line with the results of research conducted by Sargowo and Andarini (2011) that there is no difference between fasting blood glucose and 2 hours PP between adolescents with metabolic syndrome and non metabolic syndrome. It happens because

at this age, teens can still compensate for hyperglycemia. In this case, the pancreas will increase insulin secretion to restore plasma glucose levels to normal (Sargowo & Andarini, 2011).

Low physical activity is shown in case group. Epidemiological studies have shown that sedentary behavior is positively related to overweight in children and adults (Steinberger, et al., 2009). Physical activity is beneficial for weight management. This is evidenced by the relationship between physical activity with decreased levels of inflammatory cytokines and oxidative stress markers. Increased physical activity is also correlated with insulin sensitivity in adolescents (Steinberger, et al., 2009). Behavior modification is an approach to weight loss including increased physical activity, psychological training to motivate changes in eating or exercise behaviors, family counseling to promote weight loss, as well as promotion of physical activity and healthy eating at school (Crocker & Yanovski, 2009) .

CONCLUSION

Based on the results of the study can be concluded that adolescents who consume fat above 25% risk 3.3 times greater to experience metabolic syndrome. Systolic and diastolic blood pressure, BMI and blood glucose levels as the case group was higher than the control group.

To improve the health status of junior high school aged children and to prevent further obesity, School Health Units and parents need to improve monitoring of nutritional status, modify eating behavior and physical activity for overweight children and waist circumference (central obesity).

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