ORIGINAL ARTICLE

Physical Inactivity, High Carbohydrate Intake, and Metabolic Factors Associated with Abdominal Obesity among Indonesian Adolescents

ETIKA RATNA NOER[1,2*], ANIMARGAWATI[1,2] , RIA PURNAWIAN[1], *ISMISAFITRINURAINI[1]*

ABSTRACT

Background: Sedentary lifestyle and dietary intakelead to increased risk of abd obesity.high carbohydrate intake.
Aim: To evaluate the association between physical activity, dietary intake, and metabolic factors with abdominal obesity among Indonesian adolescents.
Method: A cross-sectional study in 71 obese adolescents in Semarang City, Indonesia. The subjects recruited from government high school. We measured Body Mass Index (BMI), Waist Circumference (WC), Blood pressure, Fasting Plasma Glucose (FPG), Triglyceride (TG), Uric acid (UA) and High Density Lipoprotein Cholesterol (HDL-c). Dietary intake was assessed using Food Frequency Questionnaire (FFQ) combined with 2-day food records. Pattern and duration of physical activity were assessed using International Physical Activity Questionnary (IPAQ).
Results: There were association between waist circumference with physical activity (r = - 0.541, p <0.01) with carbohydrate intake (r=0.34, p< 0,05) and with triglyceride level (r= 0.25, p<0.05). Physical activity are low in almost subjects, not attaining the 60 minutes daily**.**
Conclusion: Low physical activity and high carbohydrate intake with high triglyceride level may tend to increase larger waist circumference.
Keywords: Physical activity**,** dietary intake, abdominal obesity, adolescent

INTRODUCTION

Obesity is the result of complex interaction of genetic, environmental and psychological factors. The prevalence of adolescent obesity still high both in developed and developing countries[1]. Obesity is the condition as resulting from an imbalance between food intake and daily physical activity.[2]The Centers for Disease Control recently reported that a combination of poor diet and physical inactivity was the second leading actual cause of death in 2000. Indonesia is a developing country undergoing rapid epidemiological and nutritional transition in which double burden is serious public health problem.[3]Indonesia National Primary Health Survey 2013 showed significantly increased of obesity in Indonesia adolescents from 1.7% in 2007 to 7.3% in 2013.[4]Adolescence is identified as the critical periods for the development of obesity later in life. Studies have shown that most obese children remain obese through adolescence and into adulthood.Although obesity increases the risk of chronic non communicable diseases, studies have shown that the distribution of body fat is more important than general obesity Abdominal obesity(AO) show that excess fatty tissue, mainly in the abdominal region, is closely related to the risk of developing coronary artery disease, hypertension, diabetes mellitus, andsome types of cancer[5,6]. AO is a component of the metabolic syndrome according to the criteria of the National Cholesterol Education Program's Adult Treatment Panel III (NCEPATP). Waist circumference has been used as an indicator of AO with high sensibility and specificity. Indonesia undergoing a nutrition transition, shifting diets high in carbohydrate source and sedentary activity[7].Julia et.al, indicate that Indonesian people were richer and exposed to unlimited energy intake tended to become obese.[8]Indonesia National Primary Health Survey showed, sedentary activity level in adolescent (15-19 years old) in 25.5 % and CH intake level in 53,1%[4]. The traditional Indonesian diet, characterized by a high intake of carbohydrate and fat. Simple carbohydrates provide energy and therefore contribute to the total energy intake per day and thus potentially to a positive energy balance.[9]However, there is little information about the association between specific dietary behaviors such as carbohydrate intake, physical activity and abdominal obesity among adolescents.

[1]Department of Nutrition Science, Faculty of Medicine, Diponegoro University, Semarang, Indonesia
[2]Center of Nutrition Research, Diponegoro University, Indonesia
**Correspondence to Etika Ratna Noer*
Email : etikaratna@fk.undip.ac.id

METHODS

A cross-sectional study was conducted from July to September 2016 at two Government Senior High School in Semarang. Selection of the required subjects, we used a cluster sampling procedure in *"class"* represented. Respectively, the sampling units (clusters) in the first and in the second grade. The protocol of the study has been approved by Medical Ethics Committee of Kariadi Hospital-Diponegoro University(No.645/EC/FK-RSDK/2016). All subjects underwent anthropometric (height and weight) measurements to determine each subject nutritional status based on their body mass index (BMI). The subjects were classified as obese when their BMI for age using WHO 2007 (kg/m2) were at the 95th percentiles and above. Abdominal obesity determined by measurement of the waist circumference (WC). WC was measured using non stretchable tape in the midpoint between the lowest rib and the iliac crest. The cut off WC for girls>80cm and boys >90cm for Asian population. Metabolic factors were analysed using autoanalyzer in accredited laboratory. Measurement of the level of physical activity was calculated with IPAQ. Energy consumption was determined by analyzing the food records within 3 days (weekdays and weekend) and the food frequency during in a month.

RESULTS

A total of 71 obese adolescent completed this study. All subjects were taken from two public senior high school with middle-up social economy status in Semarang City, Central Java, Indonesia. Characteristics of the subjects are presented in table 1. All subjects have a large WC measurement. Table 1 shows that boys have energy intake more higher than girls, little in fat intake.

Table 1: Baseline characteristics of subjects by gender

Parameters	Boys (n= 35)	Girls (n=36)	P*
Age	15.11±0.1	14.94±0.1	0.26
Waist Circumference , cm	96.89±12.69	87.64±8.19	0.20
Body Mass Index, (kg/cm^2)	31±0.75	30.93±0.58	0.93
Macronutrient Intake			
Energy intake , Kkal	2581.1±618, 64	2162.3±740.18	0.20
Carbohydrate intake, gram	422.7±89.3	400.20±113.1	0.06
Protein intake, gram	89.62 42.4	86.70 27.3	0.73
Fat intake, gram	92.09 33.2	96.72 30.3	0.54
Metabolic factors			
Fasting Blood Glucose (mg/dL)	78.6±2.11	76.19±1.44	0.35
Triglyceride (mg/dL)	117.6±8.47	94.75±5.2	0.24
High Density Lipoprotein (mg/dL)	43.09 8.0	46.97 5.6	0.02
Uric acid (mg/dL)	6.46±0.39	4.81±0.12	0.001
Physical activity, MET	944.59±194.5	997.96±287	0.88

*p-value for gender difference based on t-test

Table 2. Correlation between parameters with waist circumference among subjects

	r	P value	95% Confidence Interval
Physical activity	- 0.64	0.001*	- 0.03-0.01
Carbohydrate intake	0.34	0.033**	0.004 – 0.048
TGs	0.25	0.040**	0.018 – 0.113

* spearman test ** pearson test

Preference food of high CH are bakery, noodle, fried food, and sweet beverages. Regarding the result of bivariate analysis, physical activity, carbohydrate intake and triglyceride level had significant correlation with WC (Table 2).

DISCUSSION

The current study assessed the association between physical activity (PA), dietary intake, and metabolic factor with waist circumference in abdominal obese adolescent. All subjects have a large waist circumference. Consistent with Julia et al, showed the association between WC with BMI among adolescent. It confirmed that increasing obese will lead to AO in adolescent. PA level in almost the subject are low. Framingham Children's longitudinal study showed that children who watched more television during childhood had the greatest increase in body fat over time[10]. Collins et al, showed Indonesian obese adolescent have sedentary activity, like using computer more than three hours per day.[11]Similarly, we found an inverse relationship between structured PA and BMI. This finding indicates sedentary behaviours in obese adolescent, too much sitting and too little exercise have been implicated in the weight gain. Television viewing (TV) is one activity that has been used as a marker of sedentary behaviour, and has been found to be associated with body. Recent studies have documented deleterious associations of reported TV time and overall sedentary time with abdominal adiposity. With prolonged periods of sitting, fewer skeletal muscle contraction may result in reduced lipoprotein lipase (LPL) activity and clearance triglyceride. These relationships are complex, because pre-existing adiposity may also reflect the outcomes of previous long-term physical activity and sedentary behaviour patterns[12]. Physical activity related AO, consistent with Castro[13] that obese adolescent have sedentary activities.Our study confirms the high prevalence of sedentariness in Indonesian adolescents, as also observed in many other countries. Dietary intake in our study revealed that subjects have food preference with high carbohydrate. The starchy food found in bakery, noddle, fried food. One of the problems of western diet is that the starch it contains is digested and absorbed too fast.Dietary carbohydrates are associated with weight gain and will contribute resistance insulin[14]. The availability and ease of access to food and drinks high in fat and sugar near schools and within their canteens enables youth to purchase unhealthy choice. Culture and social values, such as the role of food, higher esteem afforded to imported foods, and structures of rank and status may differentially influence the type and amount of food consumed within communities[15]. Potential effects of intake of simple CH, especially those containing quickly-digestible, and potential incremental effects of high intakes of fructose become apparent. Indeed, high carbohydrate and specifically high sugar consumption are often considered particularly harmful with respect to energy balance disturbances[16].

There is abundant evidence that obesity increases the risk of elevated hypertrygliceridemia. Our study showed there was a correlation between TG level with WC. Abnormal lipid metabolic of obesity consists of increased triglycerides (TG)[17]. The main sources fat intake in subject comes from fried foods. Lipolysis Mechanism of TG-rich lipoproteins is impaired in obesity by reduced mRNA expression levels of LPL in adipose tissue[18].

This study has several limitation. First, physical activity may not truly represent actual physical activity. The objective tools ex pedometer or accelerometer can be used. Energy intake may be underreported. Future research employing magnetic resonance imaging or computed tomography would provide more precise analysis of how body fat in abdominal depots.

CONCLUSION

Public concern about dietary intake and physical activity in AO adolescent still low. Low physical activity and high carbohydrate intake with high triglyceride level may tend to increase larger waist circumference.

Acknowledgment: The study was supported by funding from the High Education Ministry of Indonesia.

REFERENCES

1. Kim Y, Lee S. Physical activity and abdominal obesity in youth. 2009;581:571–81.
2. Saris WHM, Foster GD. Simple carbohydrates and obesity : Fact , Fiction and Future. 2006;1–3.
3. Usfar A, Lebenthal E, Achadi E, Hadi H. National Prevalence of Obesity Obesity as a poverty-related emerging nutrition problems : the case of Indonesia. Obes Rev. 2010;11:924–8.
4. Kementrian Kesehatan Republik Indonesia. Riset Kesehatan Dasar. 2013.
5. Ferreira AP, Oliveira CER. Metabolic syndrome and risk factors for cardiovascular disease in obese children : the relationship with insulin resistance (HOMA-IR). J Pediatr (Rio J). 2007;83(1):21–6.
6. Kelishadi R, Mirmoghtadaee P, Najafi H, Keikha M. Systematic review on the association of abdominal obesity in children and adolescents with cardio-metabolic risk factors. J Res Med Sci. 2015;20:294–307.
7. Kim S, Moon S, Popkin BM. The nutrition transition in South Korea 1 – 3. 2000;44–53.
8. M. Julia, M.M. van Weissenbruch, E.P. Prawirohartono AS, Waal HAD de. Tracking for Underweight , Overweight and Obesity from Childhood to Adolescence : A 5-Year Follow-Up Study in Urban Indonesian Children. Horm Res. 2008;69:301–6.
9. Dam RM Van, Seidell JC. Carbohydrate intake and obesity. 2007;61.
10. Proctor MH, Moore LL, Gao D, Cupples LA, Bradlee ML, Hood MY, et al. Television viewing and change in body fat from preschool to early adolescence : The Framingham Children ' s Study. 2003;827–33.
11. Collins AE, Pakiz B, Rock CL. Factors associated with obesity in Indonesian adolescents. 2008;(September 2006):58–64.
12. Shibata A, Oka K, Sugiyama T, Salmon J, Dunstan DW, Owen N, et al. Physical Activity, Television Viewing Time, and 12-Year Changes in Waist Circumference. Med Sci Sport Exerc. 2015;(October).
13. Antônio J, Castro C, Elaine H, Nunes G, Augusto D, Silva S. Prevalence of abdominal obesity in adolescents : association between sociodemographic factors and lifestyle. Rev Paul Pediatr (English Ed [Internet]. 2016;34(3):343–51. Available from: http://dx.doi.org/10.1016/j.rppede.2016.01.007
14. Sartorius B, Sartorius K, Aldous C, Madiba TE, Stefan C, Noakes T. Carbohydrate intake, obesity , metabolic syndrome and cancer risk ? A two-part systematic review and meta-analysis protocol to estimate attributability. 2016;
15. Kessaram T, Mckenzie J, Girin N, Edwin O, Jr AM, Pullar J, et al. Overweight, obesity, physical activity and sugar-sweetened beverage consumption in adolescents of Pacific islands : results from the Global School-Based Student Health Survey and the Youth Risk Behavior Surveillance System. BMC Obes. 2015;1–10.
16. Aller EEJG, Abete I, Astrup A, Martinez JA, Baak MA Van. Starches, Sugars and Obesity. 2011;341–69.
17. Klop B, Elte JWF, Cabezas MC. Dyslipidemia in Obesity: Mechanisms and Potential Targets. Nutrients. 2013;1218–40.
18. Estrada JCAJBLIG-ZCDA. Fatty Acid Content of Plasma Triglycerides May Contribute. Metab Syndr Relat Disord. 2016;XX(XX):1–7