ORIGINAL ARTICLE

Obesity and Its Risk Factors Among Adolescent in Indonesia

Purwo Setiyo Nugroho[1], Anisa Catur Wijayanti[2], Sri Sunarti[1], Suprayitno[1], Sudirman[1]

[1] Faculty of Health Sciences and Pharmacy, Universitas Muhammadiyah Kalimantan Timur, Samarinda, Kalimantan Timur, Indonesia
[2] Faculty of Health Sciences, Universitas Muhammadiyah Surakarta, Sukoharjo, Jawa Tengah, Indonesia

ABSTRACT

Introduction: One of the health problems in developing countries, especially in Indonesia, is obesity. Indonesia Basic Health Research 2018 result revealed the prevalence of obesity in Indonesia as much as 21% in the research. It concluded very high when compared to obesity prevalence in Indonesia Basic Health Survey in 2007 and 2013. The aim of this study is to estimating risk factors that contributed to obesity in Indonesia. **Methods:** The research design in this study was a cross-sectional study by analyzing secondary data from the Global School-based Student Health Survey (GSHS). There were 9803 respondents was selected from 11142 respondents. Binary logistic regression was performed to answer the research objectives. **Results:** Sex (*p-value* 0.0001, AOR 1.908, 95% CI 1.672 – 2.014), educational level (*p-value* 0.034, AOR 1.431, 95% CI 1.026–1.994), age (*p-value* 0.0001, AOR 0.561, 95% CI 0.309–0.968), cigarette smoking (*p-value* 0.002, AOR 1.945, 95% CI 1.278 – 2.958), fruit consumption (*p-value* 0.002, AOR 1.458, 95% CI 1.153–1.843) and vegetables consumption (*p-value* 0.023, AOR 0.742, 95% 0.373 – 0.960) were significance variable in the occurrence of obesity in adolescents. Meanwhile, based on sociodemographic adjusted, gender (*p-value* 0.0001, AOR 1.660, 95% CI 1.366 – 2.019) and age (*p-value* 0.0001, AOR 1.822, 95% CI 1.500 – 2.213) were significance variable correlate to obesity in adolescents. **Conclusion:** Adolescent has a risk of obesity caused by their wrong behaviour, especially young females. Indonesian Ministry of Health needs to make health promotion through social media that it can be easily accessed by the adolescent.

Keywords: Obesity, Risk Factors, Adolescent, Indonesia

Corresponding Author:
Purwo Setiyo Nugroho, M.Epid
Email: purwo.skm@umkt.ac.id
Tel: +62857-36362626

INTRODUCTION

Nowadays, non-communicable diseases are not only a problem in developed countries but also in developing countries, especially in Indonesia. Non-communicable diseases contribute to increased mortality rates in Indonesia (1-2). Based on the Indonesian Basic Health Research Survey in 2018 among Indonesian people in 34 provinces revealed top 3common diseases such as stroke (21.1%), coronary heart disease (12.9%), and diabetes mellitus (6.7%) (3). It will impact on health and quality of life in the future.

Obesity among adolescents are 2.3% up to 12% in developing countries (4). Obesity in Uganda, Egypt and India revealed that there was a significant increase in obesity prevalence in adolescent girls (5). The prevalence of obesity in the Philippines is caused by socioeconomic factors (6). In general, the problem of obesity in developing countries is due to the influence of the economy, increasing the number of fast-food shops, risk behaviors such as smoking, lack of physical activity, and fast food consumption. Obesity can increase the risk of cardiovascular disease (6). So, we need to analyze the risk of obesity in adolescents for preventing obesity. Indonesia is a developing country in Southeast Asia that has a high obesity rate.

In Indonesia, obesity is a major (7) and the most significant risk factor that contributes to non-communicable diseases such as coronary artery disease, diabetes mellitus, cancer, and chronic diseases (8-9). Obesity is one of the critical risk factors for non-communicable diseases to be reduced because obesity correlates with human activity in the world. Teenagers have a high risk of obesity among them because they are in a period of very rapid growth (10). Based on World Health Organization (WHO) data, the prevalence of obesity is high in the world, recorded 39%, and the prevalence has the potential to increase throughout the year (11). The WHO report on nutrition, diet, and prevention of

non-communicable diseases reveals obesity as a risk factor for all non-communicable diseases (8).

Obesity in Indonesia increases at all ages, especially in the teenage group. The causes of obesity in developing countries may be different from developed countries (12-13). Indonesian Basic Health Research in 2018 reveals the prevalence of obesity in Indonesia is 21%, and this prevalence is higher than the results of the previous Indonesian Basic Health Survey in 2007 (10.3%) and 2013 (15.4%) (3). Based on data from Indonesia's Basic Health Research from 2007 to 2018, the prevalence of obesity increased during nine years. Therefore, this study will discuss significant risk factors for obesity in Indonesia.

MATERIALS AND METHODS

Study Design and Sampling

The research design in this study was a cross-sectional study by analyzing secondary data from the Global School-based Student Health Survey (GSHS). This survey was conducted by the Indonesian Ministry of Health and the World Health Organization in 2015, and this survey is the second survey conducted in Indonesia (14). The first survey was conducted in 2007 and the second survey in 2015. The scope of the GSHS survey was a risk factor for non-communicable diseases, which included alcohol use, dietary behaviour, drug use, hygiene, mental health, physical activity, protective factors, sexual behaviour, tobacco use, violence, and unintentional injury (14). Data collection and details of the Global School-based Indonesian Student Health Survey can be accessed at this website link (World Health Organization's Website) https://extranet.who.int/ncdsmicrodata/index.php/catalog/489. The questionnaire was validated by WHO and Indonesian Ministry of Health. The 2015 Indonesian GSHS was a school-based survey of the student in class 7^{th}-12^{th}, which are typically attended by the students age 13-17 years old. A two-stage cluster sample design was used to produce data representative of all students in class 7^{th}-12^{th} in Indonesia. At the first stage, schools were selected with probability proportional to enrollment size. In the second stage, classes were randomly selected and all students in selected grades were eligible to participate (14).

The total respondents in this study were 9809 people selected from 11142 people based on the completeness of the data in the dataset; the sampling technique in this study used total sampling. A number of missing data were 1333 respondents who not included in this study because the missing data could interpret the bias results. This study is a school-based data survey conducted among junior high school to senior high school in Indonesia from 34 provinces. The risk variables for obesity included in this study were sex, education level, age, smoking, frequency of smoking, alcohol consumption, sitting activities, fruit consumption, vegetable consumption, consumption of carbonated drinks, consumption of fast food, and physical activity.

Obesity Status

Obesity status was measured by body mass index median by age and sex (14). Respondents who have >+ 2 SD were categorized as obesity. Obesity status in this research divided two ordinal scale categories, namely obesity and no obesity (14).

Sociodemographic Status

< 14.03-years-old respondents were categorized as high risk and > 14.03-years-old were categorized as low risk. Age is categorized based on the cut-off point value of 14.03, which is the mean value of the overall age of the respondents. This is the easiest way to describe significant effects in each group category (15). The gender variable was classified male and female, while grade school was classified junior high school (class 7^{th} up to 9^{th}) and senior high school (class 10^{th} up to 12^{th}) (14).

Behavioural Status

Smoke cigarette status was measured by asking respondents about the history of smoking cigarettes activity on at least one day during the 30 days before the survey. This variable was divided into two categories, namely smoking and no smoking (14). Smoking frequency status was measured by asking respondents. The question about the frequency of smoking cigarettes during the past 30 days before the survey. This variable was divided into two categorize, namely high risk (10 – 30 days) and low risk (0 – 9 days) (14). Alcohol consumption status was measured by asking respondents. The question about the respondent's alcohol drinking (one or more times during their life), so this variable was divided into two categorize, namely drinking alcohol and no drinking alcohol (14). Sitting activities variable was measured by asking respondents about the respondent's activity spent three or more hours per day. For example how many times doing sitting activities (sitting and watching television, playing computer games, talking with friends which not in school or doing homework during a typical or usual day). This variable was divided into two categorize, namely often and rarely (14).

Fruit consumption variable was taken by asking respondents about ate fruit less than one time per day (during 30 days before the survey. This variable was divided into two categorize namely rarely and often (14). The vegetable consumption variable was taken by asking respondents about ate vegetables less than one time per day (during the 30 days before the survey). This variable was divided into two categories, namely rarely and often (14). Consumption of carbonated drinks variable was taken by asking the respondent about the consumption of carbonated drinks respondent's three or more times per day (during the 30 days before the

survey). This variable was divided into two categorize, namely often and rarely (14).

The fast-food consumption variable was taken by asking respondents about fast food ate activity in fast food restaurants three or more days (during the seven days before the survey). This variable divided two categorize, namely often and rarely (14). Physical activity status variable was taken by asking respondents about physical activity at least 60 minutes per day on all seven days (during the seven days before the survey). This variable was divided into two categorize, namely low activity and high activity (14).

Data Analysis

Data were analyzed by computer software statistical application, which produced at the University of Auckland, New Zealand. Statistical analysis used chi-square for bivariate analysis and binary logistic regression for multivariate analysis. Chi-square was used for estimating crude odds ratio in all risk factor variables to obesity (16). Meanwhile, binary logistic regression was used in this research for a multivariate analysis estimating adjust odds ratio. Binary logistic regression can estimate the most significant variable among obesity's risk factors (17). Binary logistics is used to measure the relationship between variables that have categorical scale data. The reference category used in this analysis was groups that have a low risk of obesity (18). Binary logistic regression does not use the assumption of normality. This is because the normality test will cause data to be distorted, causing incorrect results (19). This statistical analysis used the significance level of 0.05.

Ethical Clearance

This research used the open dataset survey from WHO and the Indonesian Ministry of Health. The ethics research was reviewed by the Ethics Commissions of Indonesian Ministry of Health (reference number LB.02.01/5.2/KE.158/2015).

RESULTS

The number of respondents was 11142 students, but due to adjusting the completeness of the data and research variables, only 9803 respondents could be selected for inclusion in the study. Based on this number, the response rate in the survey was 87.9%. Respondents who had missing data in the dataset were excluded from this study. Based on univariate analysis (Table I), the prevalence of obesity among respondents was around 465 (4.7%), Sociodemographic status such as sex, educational level and age also were also revealed in Table I. From the sociodemographic distribution, most of the respondents were female (55.9%), junior high school (71.2%) and the mean age is 14.03 years old. Table I also showed behavioural characteristic among respondents in this study. Most respondents were no smoking (90.1%), low-risk smoking frequency (0-9 days) (97.6%), no drink alcohol (96.7%), rarely sit (72.9%), often consumed fruit (71.6%), often vegetable consumption (84.5%), rarely drinking carbonated soft drink (96.2%), rarely consumed of fast food (88.0%) and

Table I: Variable frequency distribution of the participants (n=9809)

Variables		Mean	n	%
Obesity status	Obesity	-	465	4.7
	No obesity		93444	95.3
Gender	Male	-	4321	44.1
	Female		5488	55.9
Grade school	Junior high school	-	6988	71.2
	Senior high school		2821	28.8
Age	High risk (≤ 14.03 years old)	14.03	6135	62.5
	Low risk (> 14.03 years old)		3674	37.5
Smoking cigarettes	Smoking	-	971	9.9
	No smoking		8838	90.1
Smoking frequency	High risk (10 – 30 days)	-	233	2.4
	Low risk (0 – 9 days)		9576	97.6
Drinking alcohol	Drinking	-	324	3.3
	No drinking		9485	96.7
Sitting activities	Often	-	2655	21.1
	Rarely		7154	72.9
Fruit consumption	Rarely	-	2785	24.8
	Often		7024	71.6
Vegetables consumption	Rarely	-	1521	15.5
	Often		8288	84.5
Drinking carbonated soft drink	Often	-	372	3.8
	Rarely		9437	96.2
Fast food consumption	Often	-	1174	12.0
	Rarely		8635	88.0
Physical activity	Low	-	1214	12.4
	High		8595	87.6

high physical activity (87.6%).

Bivariate analysis was showed by Table II and III, the table explain correlation between sociodemographic status and behavioural status of obesity. The result of the chi square analysis revealed significant correlation risk factor variables for obesity including sex (*p-value* 0.0001; COR 0.595, 95% CI 0.493 – 0.718), age (*p-value* 0.0001, COR1.490,95% CI 1.215 – 1.829), smoking (*p-value* 0.009, COR 0.593, 95% CI 0.405 – 0.869), smoking frequency (*p-value* 0.041, COR 0.345, 95% CI 0.128 – 0.932), fruit consumption (*p-value* 0.003, COR, 95% CI 0.565 – 0.884). Meanwhile, other variables were not significant for obesity include educational level (*p-value* 0.070), drinking alcohol (*p-value* 0.305), sitting activity (*p-value* 0.145), vegetables consumption (*p-value* 0.270), drinking carbonated soft drink (*p-value* 1.000), consumption of fast food (*p-value* 0.573) and physical activity (*p-value* 0.670).

Table II: Correlation between obesity and sociodemographic (n=9809)

Variables		Obesity Status		p-value	COR (95% CI)
		Obese n (%)	No Obese n (%)		
Gender	Female	203 (3.7)	5285 (96.3)	0.0001	0.595 (0.493 – 0.718)
	Male	262 (6.1)	4059 (93.9)		
Grade school	Junior high school	349 (5.0)	6639 (95.0)	0.070	-
	Senior high school	116 (4.1)	2705 (95.9)		
Age	High risk (≤ 14.03 years old)	330 (5.4)	6135 (94.6)	0.0001	1.490 (1.215 – 1.829)
	Low risk (> 14.03 years old)	135 (3.7)	3674 (96.3)		

Table IV explains the multivariate logistic binary regression analysis of the sociodemographic risk of obesity in adolescents. The results of the analysis found that gender (*p-value* 0.0001, AOR 1.660, 95% CI 1.366 – 2.019) and age (*p-value* 0.0001, AOR 1.822, 95% CI 1.500 – 2.213) were significant variables in the occurrence of obesity in adolescents.

Table V shows multivariate analysis using binary logistic regression of behavioural risk factors of obesity. It shows significant variables that correlate to obesity are sex (*p-value* 0.0001, AOR 1.908, 95% CI 1.672 – 2.014), educational level (*p-value* 0.034, AOR 1.431, 95% CI 1.026 – 1.994), age (*p-value* 0.0001, AOR 0.561, 95% CI 0.309 – 0.968), cigarette smoking (*p-value* 0.002, AOR 1.945, 95% CI 1.278 – 2.958), fruit consumption (*p-value* 0.002, AOR 1.458, 95% CI 1.153 – 1.843) and vegetables consumption (*p-value* 0.023, AOR 0.742, 95% 0.373 – 0.960). Meanwhile, the frequency of

Table III. Correlation between obesity and behavioural risk (n=9809)

Variables		Obesity Status		p-value	COR (95% CI)
		Obese	No Obese		
Smoking cigarettes	Smoking	29 (3.0)	942 (97.0)	0.009	0.593 (0.405 – 0.869)
	No smoking	436 (4.9)	8402 (95.1)		
Smoking frequency	High risk (10 – 30 days)	4 (1.7)	229 (98.3)	0.041	0.345 (0.128 – 0.932)
	Low risk (0 – 9 days)	461 (4.8)	9115 (95.2)		
Drinking alcohol	Drinking	11 (3.4)	313 (96.6)	0.305	-
	No drinking	454 (4.8)	9031 (95.2)		
Sitting activities	Often	140 (5.3)	2515 (94.7)	0.145	-
	Rarely	325 (4.5)	6829 (95.5)		
Fruit consumption	Rarely	103 (3.7)	2682 (96.3)	0.003	0.707 (0.565 – 0.884)
	Often	362 (5.2)	6662 (94.8		
Vegetables consumption	Rarely	81 (5.3)	1440 (94.7)	0.270	-
	Often	384 (4.6)	7904 (95.4)		
Consumtion of carbonated soft drink	Often	18 (4.8)	354 (95.2)	1.000	-
	Rarely	447 (4.7)	8990 (95.3)		
Fast food consumption	Often	60 (5.1)	1114 (94.9)	0.573	-
	Rarely	405 (4.7)	8230 (95.3)		
Physical activity	Low	61 (5.0)	1153 (95.0)	0.670	-
	High	404 (4.7)	8191 (95.3)		

Table IV: Binary logistic regression analysis: Sociodemographic risk of obesity among respondents

Variables		AOR	95% CI	p-value
Gender	Female	1.660	1.366 – 2.019	0.0001
	Male	Reference		
Age	High risk (≤ 14.03 years old)	1.822	1.500 – 2.213	0.0001
	Low risk (> 14.03 years old)	Reference		

Table V: Binary logistic regression analysis: Risk of obesity among respondents

Variables		AOR	95% CI	p-value
Gender	Female	1.908	1.672 – 2.014	0.0001
	Male	Reference		
Grade school	Junior high school	1.431	1.026 – 1.994	0.034
	Senior high school	Reference		
Age	High risk (≤ 14.03 years old)	0.561	0.309 – 0.968	0.0001
	Low risk (> 14.03 years old)	Reference		
Smoking cigarettes	Smoking	1.945	1.278 – 2.958	0.002
	No smoking	Reference		
Smoking frequency	High risk (10 – 30 days)	1.942	0.667 – 5.655	0.224
	Low risk (0 – 9 days)	Reference		
Fruit consumption	Rarely	1.458	1.153 – 1.843	0.002
	Often	Reference		
Vegetables consumption	Rarely	0.742	0.373 – 0.960	0.023
	Often	Reference		

smoking did not correlate significantly with obesity.

DISCUSSION

The research questionnaire was a self-reported question. The question asked about historical activity and their information about the risk of non-communicable disease in the past. It can potentially recall Bias in collecting data, so recall Bias can threat the internal validity and credibility of this research (20-21). Missing data can be leading to invalid interpretation and conclusion if missing data were included in the analysis (22). The problem of missing data can have a significant problem on the research result (20).

A cross-sectional study was conducted in this research, which can have potentially temporality issue effect. Temporality was a limitation in this study that the temporality was caused variables research (dependent variable and independent variables) taking in one time. So the result of this study can only estimate the size of the correlation between variables without explaining the role of exposure variable or outcome variable (21). Based on binary logistic regression, gender is the most significant correlation to obesity in this research. This result was line with Dinsa's et al. Systematic review research that gender correlates with obesity. The study revealed that female strong correlation to obesity (23). According to the National Health Survey in Indonesia among the above 18 years old, prevalence obesity on a female was about 28.6% higher than male's obesity, about 16.9% (24). The female has a lack of habitual physical activity than male. Lack of physical activity potentially increases obesity among females. Physical activity can burn off fat in the body so that it can reduce obesity (23-24). In a developing country, obesity among female were caused by socio-cultural factors that affecting activity (25). Many factors caused in a developing country such as daily diet, lifestyle, urbanization, nutrition transition, and role in society (25). In China, females with obesity have a potential risk of metabolic syndrome, including diabetes mellitus and hypertension (26).

Sociodemographic factors analyzed in this study were gender, age, and class of students. But the significant correlation with obesity is age and gender. Female is more at risk of obesity than the male because of the limitation of physical activity by parents who are afraid of something unexpected happening to their daughter (27). This fear occurs as the effects of the many cases of sexual harassment that happens in adolescent women, as the consequences of difficultness to understand the intentions of others when they meet. When age is increasing, the risk of obesity in adolescents is lower because adolescents begin to understand and go on a diet in order to have an ideal body in order to attract the interests of the opposite sex (28).

Obesity in adolescents does not only occur in adolescence, but will continue into adulthood. So it is necessary to intervene factors that can be changed. Factors that can be changed are behavioral factors. Consumption of fruits and vegetables is very good for health in adolescents. These foods can be used as a substitute for risky foods such as eating high-sugar foods, fast food, cholesterol foods and other risk foods (29). But the problem is, the consumption of fruit and vegetables in adolescents decreases with age, especially in fruit consumption. This is because as we get older, teenagers become more independent, especially in choosing food. The selection of food in question tends to the selection of foods that are not healthy and tend to be fast food. The choice of fast food is related to the very high mobility of teenagers, so choosing fast food to be more practical. Health promotion through contemporary media in the form of videos, infographics, or animations regarding the selection of healthy foods can be a way to increase the consumption of fruits and vegetables among teenagers today (29).

The risk of obesity in adolescents is also influenced by a lack of physical activity and activities that require adolescents to be quiet in places such as playing games, watching television shows and playing social media

for a long time. World Health Organization said that more than 80% of teenage boys and 70% of teenage girls spend more than 2 hours watching television and operating computers, this is a high risk for obesity in adolescents (29).

Smoking can cause genetic components that can make fat build up in the waist. Not only that, smoking makes people increase their appetite, so that they can risk obesity (30). Reducing daily cigarette consumption and limiting the space for smoking by the local government in the form of a no-smoking area is an effective way to reduce the number of smokers in adolescents. It is undeniable that cigarette advertisements in Indonesia are mainly targeted at adolescents. This is showed by the many events for teens sponsored by cigarette companies (31).

The junior high school has a high risk for obesity in Indonesia, so the intervention program for adolescent must be done early. Early detection is essential to reduce obesity among adolescents in Indonesia. Based on early detection, it can to be data for obesity intervention. India and China, as developing countries, have a success story for obesity intervention. The first detection program was conducted since school age such as social-economic identification, behavioural risk, and healthy cultural activity (32). Meanwhile, the intervention program in developed countries were dominated by promotion health, diagnosis and therapy (24).

CONCLUSION

Adolescent has a risk of obesity caused by their wrong behaviour, such as smoking behaviour, rarely eat fruit, and rarely eat vegetables. Young female has a more risk factor than the male because of the limitation of physical activity by parents who are afraid of something unexpected happening to their daughter. Obesity in adolescents does not only occur in adolescence, but will continue into adulthood. So it is necessary to intervene factors that can be changed. Factors that can be changed are behavioral factors. Consumption of fruits and vegetables is very good for health in adolescents. Indonesian Ministry of Health needs to make health promotion about healthy adolescent behaviour through social media that adolescent can easily access it.

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