

Effects of Fruit and Vegetable Consumption, a Socio-Economic Factor of Adolescent Obesity in Surakarta City

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ABSTRACT

Background: Adolescent obesity is an escalating global epidemic. It is estimated that 70% of obese teenagers aged 10 to 13 years are at risk of being obese over their life course. Obesity becomes a problem because it brings complications and it is associated with accelerated atherosclerosis, increased incidences of degenerative diseases, such as cardiovascular diseases, stroke and diabetic. The purpose of this study was to describe the effects of fruit and vegetable consumption, a socio-economic factor of adolescent obesity.

Subjects and Methods: The study was an analytical observation using case control design. The study was conducted in Surakarta city in February to March 2017, and it involved 140 subjects. Samples were collected using purposive sampling technique with fixed disease sampling. The independent variables under the study were fruit and vegetable consumption, mothers' education, family income, and age. The dependent variable of the study was obesity. Data was collected using questionnaire, information on the fruit and vegetable consumption was gathered through a 24-hour food recall, and weight and height were measured. The data was analyzed using path analysis.

Results: The statistic finding showed that obesity was affected by fruit and vegetable consumption ($b=-0.01$, $SE < 0.01$, $p=0.010$), and age ($b=-0.28$, $SE= 0.14$, $p=0.048$), and the fruit and vegetable consumption was affected by the mothers' education ($b=14.118$, $p=0.133$) and family income ($b=-0.35$, $SE= 0.44$, $p=0.431$).

Conclusions: Fruit and vegetable consumption and age are directly associated with adolescent obesity. Mothers' education and family income are indirectly associated with adolescent obesity.

Keywords: Adolescent, fruit and vegetable consumption, socio-economic, obesity.

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BACKGROUND

Obesity in adolescence is an escalating global epidemic. It does not only affect health in the adolescence, but it also harms the future health. It is estimated that about 70% of obese teenagers aged 10 to 13 years are at risk of being obese over their life course (Lazarou dan Soteriades, 2009). Obesity becomes a problem because it brings complications and it is associated with accelerated atherosclerosis, and increased incidence of generative diseases, such as cardiovascular diseases, stroke, and

diabetic (Indonesia Ministry of Health, 2014).

Based on the global data, there are 43 millions of children who are overweight or obese, and 92 millions of children who are at risk of overweight worldwide, especially in developing countries (Gokler et al, 2015). As of 2013, the prevalences of overweight and obesity among adolescents aged 13 to 15 years in Indonesia were 8.3%, and 2.5%, respectively. The prevalence of overweight among adolsecents aged 16 to 18 years was 7.3%, including 5.7% overweight dan 1.6%

obesity (Indonesia Ministry of Health, 2013).

The obesity prevalence in Indonesia increased from 1.4% in 2007 to 7.3% in 2013. DKI Jakarta was the province with the highest overweight prevalence (4.2%), and the area with the lowest prevalence was West Sulawesi (0.6%). Central Java was one of the 15 provinces whose obesity prevalence was above the national prevalence rate (Indonesia Ministry of Health, 2013).

Based on the data of Central Java Health Office in 2015, the percentage of obesity among the teenagers aged >15 years was 28.97%, and 24.04% of them were males and 31.28% of them were females (Central Java Health Office, 2015). In November 2016, Surakarta City Health Office conducted a preliminary study to measure obesity in 3,042 adolescents aged >15 years. The study found 838 obese adolescents, 23.79% of them were males, and 29.53% were females (Surakarta City Health, 2014).

Adolescence is a crucial transitional period to the next life stages, however many teenagers do not pass through this stage optimally. Environment and lifestyle make the adolescents experience nutritional problems, including obesity (McNaughton et al, 2008).

Obesity in adolescence also affects the psychology of the teenagers, especially the female ones. Adolescents are prone to negative body image so that they have low self-confidence, which restricts their development (Rahayu dan Dieny, 2012).

Overweight and obesity in adolescence are caused by a complex interaction among genetics, behavior and life style, eating behaviors, and socio-economic factors (Guo et al, 2012). Modern life style includes higher consumption of fast food than healthy food, such as fruit and vegetables (Salmean et al, 2013).

About 16 millions (1%) people are not able to reach the age of life-expectancy (Dissability Adjusted Life Years/ DALY) due to premature death and productive age loss caused by dissability, there are about 1.7 millions death (2.8%) worldwide due to low consumption of fruit and vegetable. Sufficient fruit and vegetable consumption may reduce the risks of cardiovascular diseases, gastric and colorectal cancer (WHO, 2016).

Based on the basic health research (Risksedes, 2013), fruit and vegetable consumption among the children aged ≥ 10 years in Indonesia was low, and Gorontalo was the province with the highest fruit and vegetable consumption (92.5%) (Indonesia Ministry of Health, 2013).

Another contributing factor is socio-economic. People with low socio-economic status are at risk of developing bad diet habits that increase obesity (Collins et al, 2014). A study by Fillol et al (2011) in France on the relationship of socio-economic and obesity, which is measured using comprehensive socio-economic index, does not find significant difference (Fillol et al, 2011).

The socio-economic indicators are assessed from education, family income, and occupation (Basrowi dan Juariyah, 2010). Mothers' education strongly affects their children's health. Mothers with higher education are smarter in selecting better diet, both in quantity and quality. This affects the family consumption which also impacts on the children's nutritional status (Simanjuntak dan Hartono, 2010). Family income affects the family nutrient fulfillment (Majestika dan Maryanti, 2009).

Based on the background of the study, the researchers discussed the effects of fruit and vegetable consumption, the socio-economic factor of adolescent obesity using PRECEDE-PROCEED theory. The purpose

of this study was to describe the effects of fruit and vegetable consumption, the socio-economic factors of adolescent obesity in Surakarta City.

SUBJECTS AND METHODS

1. Research Design

The study was designed using analytical observation with case control approach. The study was conducted in February to March 2017 in Surakarta City.

2. Population and Sample

The study involved 140 respondents, who were the students of the first and second grades of junior high schools; 80 respondents were teenagers with normal nutritional status and 60 others were obese adolescents. The respondents were selected using purposive sampling technique, and they were sampled using fixed disease sampling. The data on fruit and vegetable consumption was collected using a 24-hour food recall, and the information on socio-economic factors, weight and height was gathered through questionnaire.

3. Research Variables

The independent variables under the study were fruit and vegetable consumption, mothers' education, family income, and age. The dependent variable was obesity. Obesity was measured following WHO indicator (2007), BMI/ age according to sex with Z-score of $-2SD$ to $1SD$, and $>SD$ for obesity. The fruit and vegetable consumption was measured by the amount of fruit and vegetable intake in the last 24 hours, the criteria used were <400 gram and ≥ 400 gram. Variable on the mothers' education was defined as the last formal education that mothers completed, the criteria used were $<$ senior high school and $>$ senior high school. Family income was the earnings generated by both parents in rupiah, and it was categorized into $<$ Regional Minimum

Wage and \geq Regional Minimum Wage. The adolescents' age was measured chronologically starting the day the teenagers were born to their last birthday. The adolescents' age was grouped into early adolescence (10-12 years old), middle adolescence (13-15 years), and late adolescence (16-18 years).

4. Data Analysis

The data on fruit and vegetable consumption was collected through two times food recalls with one week interval. The data was, then, processed using nutrition survey software.

The researchers complied with the study ethics, including consent forms for the respondents to inform the purpose of the study, anonymity (not mention the subjects' name), confidentiality of the subjects under the study.

Data processing techniques used under the study covered editing (reviewing questionnaires the subjects filled out during the data collection), scoring (giving values to each question), coding (changing the data into a more simple form in statistics analysis), entry (encoding the collected data into a computer software), and tabulating (processing the data in tables to present statistical description).

The study used univariate analysis for each variable of bivariate analysis, and it used multivariate analysis using path analysis to analyze the effects of more than one independent variables toward the dependent variables through intervening variables.

RESULTS

Results of the analysis to the 140 subjects under the study were presented in univariate, bivariate, and path analysis. The univariate analysis covered characteristics of the subjects under the study, as presented in Table 1 and 2.

Table 1. Characteristics of the study subjects

Characteristics	Criteria	Frequency (n)	Percentage (%)
Obesity	Normal	80	57.14
	Obesity	60	42.86
Mothers' occupation	Public service officers	4	2.86
	Business owners	47	33.57
	Private employees	28	20.00
	Farm workers	2	1.43
	Factory workers	5	3.57
	Housewives/ unemployed	54	38.57
Adolescents' sex	Female	67	47.86
	Male	73	52.14

Table 1 showed that most of the study subjects (57.14%) belonged to normal weight, and 42.86% were obese. The criteria on the mothers' occupation showed that the mothers of most subjects under the study (38.57%) were housewives/

unemployed, and the mothers of very small number of subjects (2.86%) were public service officers. Most subjects under the study (52.14%) were males, and the other 47.86% were females.

Table 2. Univariate Analysis on the Variables under the Study

Variables	Criteria	n	%
Mothers' education	< senior high school	49	35
	≥ senior high school	91	65
Family income	< Regional minimum wage	71	50.71
	≥ Regional minimum wage	69	49.29
Fruit and vegetable consumption	< 400 g	71	50.49
	≥ 400 g	69	29.71
Adolescents' age	10-12 years	41	29.29
	13-15 years	98	70.00
	16-18 years	1	0.71

Table 2 showed that the mothers of most subjects (65%) belonged to highly educated group, and small number of the mothers (35%) belonged to low educated group. The data on family income showed that 50.71% belonged to the under regional minimum wage and 49.29% belonged to the equal or greater than regional minimum wage. The data on fruit and vegetable consumption showed that 50.71% of the

subjects consumed less than 400 gr of fruits and vegetables, and 49.29% consumed equal or greater than 400 gr of fruits and vegetables. The data on age showed that most of the subjects were teenagers aged 13 to 15 years, 29.29% of them were adolescents aged 10 to 12 years, and only 0.71% of them were youngsters aged 16 to 18 years.

Table 3. Bivariate analysis on fruit and vegetable consumption, the socio economic factor of adolescent obesity

No	Independent variables	r	p
1	Mothers' education	0.33	0.697
2	Family income	-0.01	0.912
3	Fruit and vegetable consumption	-0.21	0.014
4	Mother's age	-0.16	0.064

Table 3 showed that the r of the mothers' education was 0.33, meaning that the variable had a medium relationship with obesity, and its p of 0.912 showed insignificant relationship. The r (-0.01) of the family income showed a negative and weak relationship between the family earnings and adolescent obesity, and its p (0.912) indicated insignificant relationship. The r

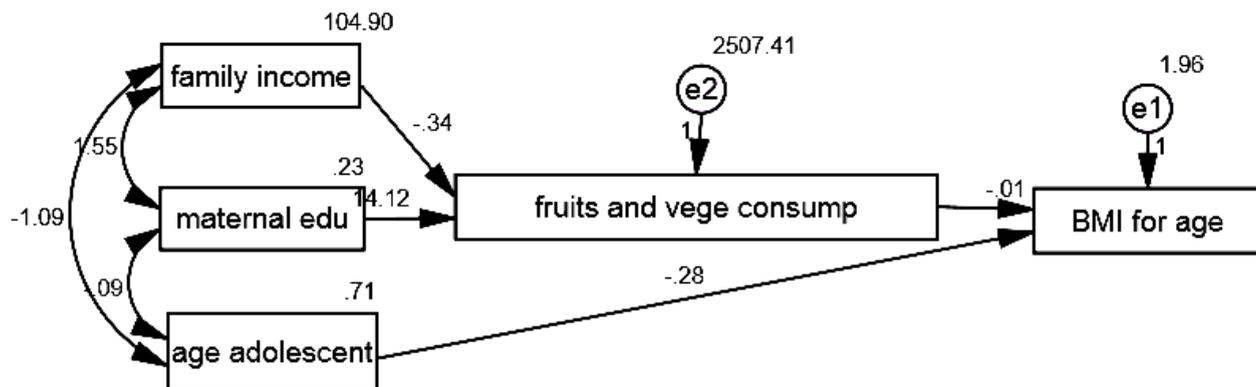
of the fruit and vegetable consumption was -0.21, meaning that the variable had a negative and weak relationship with the adolescent obesity, and its p (0.014) showed insignificant relationship. The age's r was -0.16, it showed a negative and weak relation, and its p (0.064) indicated insignificant relationship.

Table 4. Path Analysis Results on the Effects of Fruit and Vegetable Consumption, the Socio-Economic Factor of the Adolescent Obesity

Endogenous Variable	Exogenous Variable	SE	p	Unstandardized path coefficient (b)
Direct effects				
Obesity ←	Fruit and vegetable consumption	<0.01	0.010	-0.01
Obesity ←	Age	0.14	0.048	-0.28
Indirect effects				
Fruit and vegetable consumption ←	Mothers' education	9.39	0.133	14.12
Fruit and Vegetable consumption ←	Family income	0.44	0.431	-0.35
Fit model				
p= 0.826 (>0.05)				
CMIN (χ^2) = 6.944				
CFI=1.000 (≥ 0.90)				
NFI=0.975 (≥ 0.90)				
GFI =0.997 (≥ 0.90)				
RMSEA= <0.001 (≤ 0.05)				

Table 4 showed the results of multivariate analysis using path analysis model, and it resulted the path coefficient (b) of the effects of fruit and vegetable consumption (b= -0.01, SE=0.01, p=0.010). This finding implied an increase to one unit of fruit and vegetable consumption decreased the obesity score by 0.01 unit. Obesity was indirectly affected by fruit and vegetable consumption (b=-0.01, SE<0.01, p=0.010), age (b=-0.28, SE=0.14, p=0.048). Fruit and

vegetable consumption was affected by mothers' education (b=14.19, SE= 9.39, p= 0.133), family income (b=-0.35, SE= 0.54, p=0.431). The structural model of the path analysis was presented in Picture 1. The model fulfilled the fit requirements of the path analysis with p= 0.826 (>0.05), CFI= 1000 (≥ 0.90), NFI= 0.975 (≥ 0.90), GFI= 0.997 (≥ 0.90), RMSEA= <0.001 (≥ 0.05).



Picture 1. Structural model of path analysis

DISCUSSION

1. The effects of fruit and vegetable consumption toward adolescent obesity

Fruit and vegetable consumption affects adolescent obesity, meaning that higher fruit and vegetable intake may reduce obesity. The study found that the respondents with obesity consumed less fruit and vegetables, they preferred fat and energy-rich foods. The finding is consistent with a study by Irfan et al (2015) describing that adolescents do not consume sufficient fruit and vegetable servings each day, so that the recommended dietary allowances, teenagers often consume fast food with limited menu, and they like high calorie and high fat and sodium foods. These cause overweight and obesity.

The prominent factor causing obesity is behavioral factors such as unhealthy dietary habits, low fruit and vegetable consumption, and low physical activities. Fruit and vegetable are significant fiber sources for adolescents since they are still in a development phase, which is associated with obesity. Obese adolescents need to consume larger amount of fruit and vegetable than those with normal weight (Saikia et al, 2016).

Adequate fruit and vegetable consumption is strongly viewed to be able to reduce the risk of obesity. Fruit and vegetable are high in fiber so they require more chewing and digestion time. High fiber foods are insoluble when digested, and they increase the food volume so that the risk of overeating is prevented; meanwhile, the soluble fibers turn into gel-like substance during digestion process and they slow foods to pass through intestines so that the body is satisfied longer (Asian Food Information center, 2010).

A study by Makaryani (2013) found a different result; fiber consumption was not associated with obesity incidence. This finding is consistent with a research by Purwanti (2002) that indicates several main factors contributing to overweight, such as genetics; children whose both parents are overweight are 80% likely to be overweight, and children whose one of the parents is overweight is 40% at risk of being overweight, and this prevalence decreases by 14% among children whose parents are not overweight. In addition, psychological factors, such as stress, fear and anxiety may bring different attitudes, for example eating favorite foods excessively.

2. The Effects of Mothers' Education Toward Adolescent Obesity

Mothers' education is not attributed to adolescent obesity. It happens because adolescents occasionally eat at home, they prefer eat out and consume fast food with their peers. According to More (2014), there is emotional change during adolescence, the teenagers develop their self-autonomy and often refuse the parents' values, including dietary selection, and they change eating habits. Teenagers tend to skip dinner time with family to avoid parents' supervision, they also prefer junk foods because of its taste and peer pressure.

This finding is in line with a study by Octari et al (2014) showing that mothers' education is not linked to adolescent obesity. Most of the subjects' mothers had middle education level, but most of the adolescents had normal nutritional status. This happens because adolescents often eat out and consume junk food with their peers. There are no guarantees that children from mothers with high education level do not have nutritional problems, such as obesity. Adolescence is a critical period during which the teenagers search for self-identity. Adolescents are easily influenced by environment and modern life-style. They trust their friends better than their mothers. Changes in the modern life-style make the adolescents prefer fast foods to home-made foods.

A study by Simatupang (2008) also supports the study findings; it indicates that there is no meaningful relationship between mothers' education and obesity. Mothers are only able to control their children consumption at home, whereas the adolescents spend more time out of home, such as schools, tutoring places, and they go for pleasures with their peers. This causes obesity, especially when the adolescents are exposed to appealing and tasty fast foods.

A study by Nayera et al (2016), which is conducted among Egyptian adolescents, finds consistent findings; mothers' education is not linked to adolescent obesity. Most of the subject's mothers are highly educated; however most of them are unemployed so they have more time to prepare for foods that may cause obesity.

A study by Haryanto (2012) shows different findings. It shows a meaningful relationship between mothers' education and adolescent obesity. It is assumed that this finding is correlated to the effects of living place and socio-culture that influence the mothers' knowledge and parenting style. Mothers' education is associated with their knowledge and understanding on health, nutrition, and other children-related issues. These affect parenting style, nutrition management, and food selection, which contribute to adolescent obesity.

3. The Effects of Family Income toward Adolescent Obesity

Family income does not influence adolescent obesity. This finding is supported by Aritonang, the study finds that high income does not guarantee people will consume varied and quality foods; however it may lead to the consumption of tasty and rich in fat, oil, and other obesity-causing substances-fast food. The family income under the study was categorized into two, i.e. less than the regional minimum wage, and equal or greater than the regional minimum wage. Family income is associated with the parents' ability to suffice needs, select foods, as well as it affects the family life-style and brings impacts to children. This finding is consistent with a study by Octari et al (2014) showing no relationship between the family income and adolescent obesity. The study resulted to p value 0.396.

Many obesity incidences are found in the families with low socio-economic level.

This low socio-economic level does not make people not consume fat-rich foods, which are easily available nowadays. Grilled meatballs, sausages, instant noodles are cheap and easily found at schools. The study is also consistent with a study by Caesarianna and Indriawati (2007); it shows no relationship between family income and adolescent obesity. Families with greater than regional minimum wage do not always select quality foods. Most mothers, who are unemployed, spend more time farming chickens, ducks, and fish to meet the childrens' nutrient needs. This finding is supported by Nayera et al (2016) showing that most of the obese adolescents come from families with unemployed mothers.

A study by Reynaldi et al (2010) found a different finding, adolescents from families with high income are three times at risk of being obese than those coming from low income family. High family income means easy access to purchase and consume delicious and expensive foods. Parents with high income tend to give their children large amount of allowances. The children usually spend the money to consume modern/ fast food.

4. The Effects of Age toward Adolescent Obesity

The analysis results showed the effects of age toward obesity incidences; the two variables had negative relationship, meaning that the older adolescents were less obese. One of the internal factors affecting nutritional status is sex, and female adolescents, in general, are not happy with their body since their body fat increases during adolescence (Anthony, 2009). This finding is consistent with a study by Kusumajaya (2007) showing that adolescents, particularly the female adolescents are dissatisfied about their body image. The female adolescents aged 14 to 17 years view themselves fatter than their real size. They tend

to take attempts to lose weight as they are getting older.

Body image is part of an individual's cognitive factors that affect their life-style shown by their eating behavior. A study by Bosi MLM et al (2009) in Brazil indicates that the adolescents who are dissatisfied with their body image often have inappropriate eating behavior to lose weight.

The study found that most of the respondents (70%) were adolescents aged 13 to 15 years. During the middle adolescence period, the teenagers put more attention to their body shape, taking attempts to make their body look better, and expect to see the results instantly. At this stage, peers influence greater than parents, the adolescents expect freedom; they refuse the family eating pattern and often try to be vegetarians.

The study is supported by Afrienny et al (2014), which finds that the adolescents aged 13 to 14 years are 0.645 times at risk of obesity compared to those aged 11 to 12 years. A study by Sartika (2011) to 170,699 children under this study found the highest proportion belonged to the respondents aged ≥ 10 years.

Another supporting study is Powell et al (2013), it finds that the adolescents aged 6-11 years have a higher chance for obesity because they like watching advertisements on TV. These advertisements often present nutrient poor foods, so the adolescents have food references which change their eating pattern and increase weight.

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