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Research

The Effects of Diet, Physical Activity, and Social Support on Overweight and Obesity in Female Adolescents

Yeti Rahelli[1], Agus Kristiyanto[2], Bhisma Murti[1]

[1]Masters Program in Public Health, Universitas Sebelas Maret
[2]Study Program in Physical Health Education and Recreation, Universitas Sebelas Maret

ABSTRACT

Background: Obesity is reaching global epidemic proportions with a threefold increase from 1975-2016. The percentage of adolescents aged 12-19 years old who are obese has increased from 5% -21% in the same period. The SCT can determine dietary behavior and regular physical activity. Study shows that a healthy diet, regular activity and social support contribute to weight gain. This study aims to estimate the effect of diet, physical activity, social support on overweight girls.
Subjects and Method: This study was an observational analytic study with a cross sectional design. The sample size was 120 study subjects using stratified random sampling. Data analysis with path analysis using the Stata 14 program.
Results: Overweight/ obesity was directly reduced by healthy diet (b= -3.62; 95% CI= -5.08 to -2.15; p<0.001), healthy behavior (b= -2.02; 95% CI= -3.40 to -0.67; p= 0.003), and high physical activity (b= -1.74; 95% CI= -3.40 to -0.10; p= 0.038). Overweight/ obesity was indirectly affected by vicarious learning, maternal education, family income, and family support.
Conclusion: Overweight/ obesity is directly reduced by healthy diet, healthy behavior, and high physical activity. Overweight/ obesity is indirectly affected by vicarious learning, maternal education, family income, and family support

Keywords: diet, physical activity, family support, SCT, path analysis

Correspondence:
Yeti Rahelli. Master of Public Health Sciences, Universitas Sebelas Maret. Jl. Ir. Sutami No. 36A Kentingan Surakarta 57126, Central Java, Indonesia. Email: yetirahelli@student.uns.ac.id

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BACKGROUND

Obesity has increase by 4 times in adolescence in the last 30 years. The percentage of adolescents aged 12-19 who are obese increased from 5% to 21% in the 1975-2016 period. Based on UNICEF in 2018 as many as 15% of adolescents in Indonesia are overweight or obese.

Currently, Indonesia has 3 major health problems, namely stunting, wasting and obesity. Based on the Basic Health Rises (Riskesdas) of Yogyakarta Province in 2013, it shows the prevalence of overweight is 12.9% and obesity is 6% in adolescents aged 16-18 years in Yogyakarta City. Based on a UNICEF survey in 2018, it was found that there were changes in diet and physical activity in adolescents that led to overweight and obesity.

Increased BMI in adolescents is a major risk factor for non-communicable diseases such as cardiovascular disease, diabetes, musculoskeletal disorders, and several cancers such as endometrial, breast,

ovarian, kidney and colon cancer. Overweight and obesity can mostly be prevented. A supportive environment and society determines one's choices, such as in choosing healthier food consumption and regular physical activity (WHO, 2020).

SUBJECTS AND METHOD

1. Study Design

This was an analytic observational study with a cross sectional design. The study was conducted at 4 islamic senior high school in Yogyakarta.

2. Population and Sample

The population in this study were female adolescents. A sample of 120 female adolescents was selected by stratified random sampling.

3. Study Variables

The dependent variable is overweight/ obesity. The independent variables are maternal education, family income, diet, physical activity, social support (family support), and SCT (vicarious learning and behavior) variables.

4. Definition of Operational Variables

The body weight of the study subjects (kg) at the time of data collection obtained by filling out a questionnaire sheet, then divided by the height squared (m), the results of the next calculation used a special percentile for age and gender to determine the weight status of the research subject. The body weight is more if the percentile is ≥85th.

Maternal education is the last formal education level taken by the parents of the study subject.

Family income is the income received by parents from working in the last 6 months is calculated on average per month with nominal rupiah in order to meet the daily needs of life that affect children's food intake.

Diet is food diet consumed by study subjects to control, control, or lose weight so that there is no overweight and even obsession.

Physical activity is an activity carried out by study subjects to make the body condition improve health and maintain physical health.

Family support is support from parents or siblings in the form of helping or giving physical/psychological attention to study subjects to control or lose weight so that overweight and obesity do not occur.

Vicarious learning is behavioral learning through observation or observation of other people's behavior, especially a leader or someone who is considered to have more value than himself who will later become a vicarious experience.

Behavior is the formation of a new, healthy behavior after learning through observation or imitation (modeling).

Data Collection Tools: Questionnaires that have been tested for validity and reliability. Measuring scale: Continuous data. For the purposes of data analysis, continous data is converted into dichotomous data.

5. Data Analysis

Univariate analysis was used to describe each dependent and independent variable. Bivariate analysis (chi square) was used to explain the relationship between one independent variable and the dependent variable. Path analysis was used to determine the influence of an independent variable on the dependent variable, either directly or indirectly.

6. Study Ethics

This study has received ethical eligibility from the Health Research Ethics Commission of Dr. Moewardi Hospital Number: 1.138/IX/HREC/2020 and carried out by upholding and applying the principles of research ethics, namely respect for person,

beneficence and non-maleficence, and justice.

RESULTS

1. Sample Characteristics

Total study subjects in this study were 120 female adolescents in HS/MAN in Yogyakarta City. Most of the body weight status was in the normal weight category, which was 66 (55.00%) study subjects, while the least obesity category was 9 (7.5%) study subjects. The most recent education of fathers graduated from tertiary education, which was 54 (45%) and at least graduated from elementary school, which was 1 (0.83%) study subject.

Most of the mothers' last education graduated from college which was 49 (40.83%) and at least graduated from ES was 2 (1.67%) study subjects. Most of the father's income ranges from >Rp 1,000,000 to Rp 4,000,000, that was 58 (48.33%), while the least amount was in the range of 0 to. IDR 1,000,000, that was 19 (15.83%) study subjects.

Maternal income was mostly in the range 0 to Rp 1,000,000, namely 69 (57.5%), while the least amount was in the range of >Rp 4,000,000 to Rp 7,000,000, which was 4 (3.33%) study subjects.

Table 1. Distribution of Characteristics of Study Subjects (Continuous Data)

Characteristics	n	Mean	SD	Min.	Max.
Age	120	17.15	1.120	15	19
Body Weight	120	53.004	11.133	36	85
Body Height	120	156.183	5.321	138	172

Table 1showed that the results of the measurement of the age characteristics of the study subjects have a mean = 17.15, SD = 1.12, the lowest age was 15 years old, and the highest age was 19 years old. The body weight of the study subjects had a mean value of 53,004, SD = 11,133, the lowest body weight was 36 kg and the highest body weight was 85 kg.

The characteristics of the height of the study subjects had a mean value of 156,183, SD = 5,321, the shortest study subjects was 138 cm and the highest was 172 cm.

Table2.Distribution of Diet, Physical Activity, Family Support, Peer Support

Variables	Total (f)	Percentage (%)
Diet		
Not healthy	25	20.83
Healthy	95	79.17
Physical Activity		
Less	18	15
A lot	102	85
Family Support		
Not supportive	28	23.33
Supportive	92	76.67

Table 2 showed that most of the study subjects did a healthy diet by 95 (79.17%) and the least did an unhealthy diet by 25 (20.83%). The physical activity category was mostly in the large category, which was 102 (85%) and less was 18 (15%). Most of the family support categories were study subjects with supportive families, which was 92 (76.67%) and 28 unsupportive families (23.33%).

Table 3. Distribution of Social Cognitive Theory Variables

Variable	n	Mean	SD	Min.	Max.
Vicarious Learning	120	0.80	0.395	0	1
Behavior	120	0.65	0.478	0	1

Based on table 3, the vicarious learning variable has a mean= 0.80 and SD 0.395, the lowest value for vicarious learning variable was 0 and the highest was 1. Variable of behavior has a mean = 0.65 and SD 0.478, the lowest value for the behavior variable was 0 and the highest was 1.

2. Results of bivariate analysis

Table 4. Bivariate Analysis of the Effect of Diet, Physical Activity, Social Support and Social Cognitive Theory on Overweight

Independent Variables	Percentile <85		Percentile ≥85		OR	95% CI		p
	n	%	n	%		Lower Limit	Upper Limit	
Maternal Education								
Low	12	37.50	20	62.50	0.15	0.05	0.40	<0.001
High	71	80.68	17	19.32				
Family Income								
Low	23	48.94	24	51.06	0.21	0.08	0.51	<0.001
High	60	82.19	13	17.81				
Diet								
Unhealthy	4	16.00	21	84.00	0.04	0.01	0.14	<0.001
Healthy	79	83.16	16	16.84				
Physical Activity								
Less	3	16.67	15	83.33	0.06	0.01	0.30	<0.001
A lot	80	78.43	22	21.57				
Family Support								
Not supportive	10	35.71	18	64.29	0.15	0.05	0.47	<0.001
Supportive	73	79.35	19	20.65				
Vicarious Learning								
Low	6	26.09	17	73.91	0.11	0.03	0.30	<0.001
High	77	79.38	20	20.62				
Behavior								
Unhealthy	16	38.10	26	61.90	0.10	0.04	0.32	<0.001
Healthy	67	85.90	11	14.10				

3. Results of Path Analysis

Table 5 shows the indirect effect of parental education on overweight/ obesity through physical activity, female adolescents with high parental education were 1.82 unit more likely to do physical activity than those with low parental education (b= 1.82; 95% CI= 0.60 to 2.99; p= 0.003). Parental education has an indirect effect on overweight/obesity through diet and was approaching statistically significant, female adolescents with high parental education were 1 unit more likely to do a healthy diet compared to young women with low parental education (b= 1.00; 95% CI= -0.08 to 0.77; p= 0.07).

Parental education has an indirect effect on overweight/obesity through behavior, female adolescents with high parental education were 1.53 unit more likely to

engage in healthy behaviors than those with low parental education (b= 1.53; 95% CI= 0.58 to 2.50; p= 0.002).

Family income has an indirect effect on overweight/obesity through family support, it mean that female adolescents with high family income have a 1.21 unit higher probability of getting support from family than those with low family income (b= 1.21; 95% CI= 0.29 to 2.03; p= 0.009).

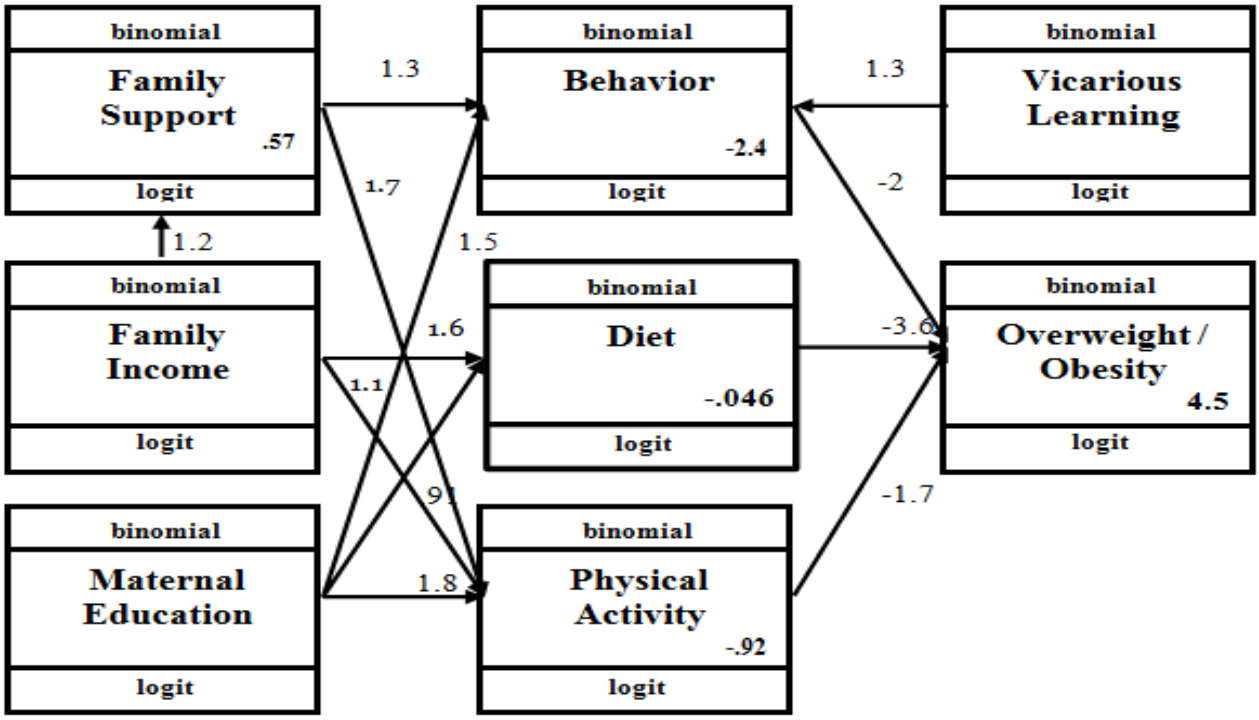

Figure 1. Structural Model Estimation

Table 5.Path analysis of the influence of diet, physical activity and social support on overweight and obesity in female adolescents

Dependent Variables		Independent variables	Path Coef. (b)	95% CI Lower Limit	95% CI Upper Limit	p
Direct Effect						
Overweight/Obesity	←	Diet (healthy)	-3.62	-5.08	-2.15	<0.001
	←	Behavior (healthy)	-2.02	-3.40	-0.67	0.003
	←	PhysicalActivity (a lot)	-1.74	-3.40	-0.10	0.038
Indirect Effect						
Physical Activity	←	Maternal Education (high)	1.82	0.60	2.99	0.003
Diet	←	Maternal Education (high)	1.00	-0.08	0.77	0.070
Behavior	←	Maternal Education (high)	1.53	0.58	2.50	0.002
Family Support	←	Family Income (high)	1.21	0.29	2.03	0.009
Diet	←	Family Income (high)	1.63	0.62	2.63	0.002
Physical Activity	←	Family Income (high)	1.22	-0.12	2.35	0.077
Behavior	←	Family Support (supportive)	1.37	0.18	2.34	0.023
Physical Activity	←	Family Support (supportive)	1.73	0.56	2.93	0.004
Behavior	←	Vicarious Learning (high)	1.37	0.06	2.45	0.039
Log Likelihood= -250.83						

Family income has an indirect effect on overweight/obesity through diet, female adolescents with high family income have a 1.63 unit higher chance of having a healthy

diet than those with low family income (b= 1.63; 95% CI= 0.62 to 2.63 ; p= 0.002).

Family income has an indirect effect on overweight/obesity through physical activity and it was nearly statistically significant, female adolescents with high family income have a 1.22 unit higher likelihood of doing physical activity more than those with low family income (b= 1.22; 95% CI= -0.12 to 2.35; p= 0.077).

Family support has an indirect effect on overweight/obesity through behavior, female adolescent with supportive families have a 1.37 unit higher likelihood of engaging in healthy behaviors than those with unsupportive families (b= 1.37; 95% CI= 0.18 to 2.34; p= 0.023).

Family support has an indirect effect on overweight/obesity through physical activity, female adolescents with supportive families were 1.73 unit more likely to do more physical activity than those with unsupportive families (b= 1.73; 95% CI= 0.56 to 2.93; p= 0.004).

Vicarious learning has an indirect effect on overweight/obesity through behavior, female adolescents with high vicarious learning have a 1.37 unit higher likelihood of behaving healthy than those with low vicarious learning (b = 1.37; 95% CI= 0.06 to 2.45; p = 0.039).

Diet has a direct effect on overweight/obesity in female adolescent. Female adolescents who do a healthy diet have a 3.62 unit lower likelihood of experiencing overweight/obesity than those with an unhealthy diet (b= -3.62; 95% CI= -5.08 to -2.15; p<0.001).

Behavior has a direct effect on overweight/obesity in female adolescents. Female adolescents with healthy behavior have a 2.02 unit lower chance of experiencing overweight/obesity than those with unhealthy behavior (b= -2.02; 95% CI= -3.40 to - 0.67; p= 0.003).

Physical activity has a direct effect on overweight/obesity in female adolescent. Female adolescents who do a lot of physical activity have a 1.74 unit lower likelihood of experiencing overweight/obesity than those with lack of physical activity (b= -1.74; 95% CI= -3.40 to -0.10; p= 0.038).

DISCUSSION

There was an indirect effect of parental education on overweight/obesity through physical activity. A similar study by Haya (2016) shows a positive effect of parental education on physical activity levels (p= 0.001). Parents with a high level of education will understand how to maintain health better, so that the ways to maintain health can be delivered to their children such as active physical activity. This is in contrary from parents whose educational level is low, their knowledge will also be low. Similar research by Pavon (2012) shows that there is a significant effect between parental education and physical activity on children's physical activity.

There was an indirect effect of parental education on overweight/obesity through diet. A similar study by Handayani (2019) shows that there was a significant relationship between parental knowledge and dietary adherence (p= 0.004). Education is a determining factor for a person's knowledge and attitudes. The higher the formal education that parents take, the higher their mindset and ability to absorb information about their own health (Handayani, 2019). Parental education can help reduce energy intake for children's daily food needs (Haya, 2016). The more information the parents get, the more motivation and skills they will get, so that more attitudes are formed (Amir, 2018).

There was an indirect effect of parental education on overweight/obesity through behavior. Similar by Finders (2016) states

that high parental education supports healthy children's behavior. According to Handayani in 2019, the determining factor in the attitude and knowledge that parents have is the last formal education taken by parents. Social Cognitive Theory explains that a person's personality develops through a process of observation. A person can learn through observation or observation of the behavior of other people, especially a leader or someone who is considered to have more value for himself (Bandura, 1986). Learning in this case is healthy behavior carried out by parents to be emulated by their children.

There was an indirect effect of parents' income on overweight/obesity through family support. Mireku (2020) shows that the risk of overweight and obesity in adolescents increases along with decreasing family income (p= 0.001). The relationship between parents and children is an important factor in forming emotional bonds (James, 2018). High income allows parents to provide full support to their children such as instrumental, emotional, informational, and rewarding support. A supportive environment such as the presence of parents can increase weight loss efforts (Hansen, 2018).

There was an effect of family income on overweight/obesity through diet. Similar research by Noonan (2018) shows the results that adolescents in the low income group have a risk of being overweight and obese. In general, the economic status of the family is closely related to the last education taken by parents (Arnold, 2018). Diet plays an important role in children's growth and development, but children's food intake is influenced by household income (Shariff, 2015). Research conducted by Gilliland in 2015 shows that adolescents from high-income families have an intake of unsaturated fats, meet recommendations for dairy products, fruits, and vegetables compared to adolescents with low parental income.

There was an indirect effect of family income on overweight/obesity through physical activity. A similar study by Kim (2014) shows that there was an effect of family income on physical activity and it was statistically significant ($p<0.001$). A study by Jin (2015) shows that the prevalence of obesity of 20.3% and 56% of children classified as having low family income is associated with low fitness scores/low physical activity. A similar study by Duan (2019) shows that family income can be a good approach to children through attitude taken by parents such as healthy lifestyle changes and not buying certain foods that are considered unhealthy. Low family income can be a barrier to physical activity and consumption of healthy foods (Hanson, 2017).

There was an effect of family support on overweight/obesity through behavior. Behavior change can be done by presenting the role of parents or close family as a component of the intervention (Ganster, 2012). In line with the concept of reciprocal determinism, parents can influence children's behavior through changes in the physical or social environment. For example, parents influence a child's diet by controlling food availability, making healthy foods, and making meal schedules (Miller, 2017). Parents' behavior will be imitated by children and will form new skills around health behavior (Dwyer, 2017).

There was an indirect effect of family support on overweight/obesity through physical activity. This study is similar to a study by Morrissey (2015), showing that there is an effect of family support on increasing physical activity of adolescents aged 13-17 years. Providing this support can make children more valued, confident, and

motivated to change behaviors such as healthy eating patterns and active physical activity (Warnick, 2019). Parental support provided to children in behavior change is also carried out with health education, consumption of unhealthy fast food, and the importance of exercising fitness with physical activity (Marie, 2018). Social Cognitive Theory can be an initiative in changing health and physical activity through the environment (Marie, 2018). The literature shows that parental behavior can influence children's knowledge about health, self-efficacy, and expected outcomes. This is a learning process from parents to children, the process is learn by observing the environment as a means of obtaining knowledge, information, and changing behavior.

There was an indirect effect of vicarious learning on overweight/obesity through behavior. Social Cognitive Theory explains that a person's personality develops through a process of observation. Individuals can learn through observation or observation of other people's behavior, especially leaders or someone who is considered to have more value than themselves (Bandura, 2001). Similar study by Knol (2017) shows that positive/healthy behavior in maintaining a healthy lifestyle increases after intervention from the child's social environment. According to Bandura (1986) adults, symbolic models of television/ movie, and visual media play an important role in the formation of attitudes and behavior. This imitation or modeling is not only mimicking or repeating role modeling behaviors, but also involves adding or subtracting observed behavior, generalizing various observations as well as involving cognitive processes (Bandura, 1967).

There was a direct effect of diet on overweight/obesity in female adolescent. A healthy diet such as consuming balanced nutritious foods and not skipping meals can make the body's metabolism run smoothly, so that it can maintain or lose ideal body weight, and vice versa, an unhealthy diet will only lead to overweight/obesity (Almuhana, 2014). Similar study by Heryuditasari (2018) shows that there is a significant effect of diet on obesity. Female adolescents with unhealthy diets such as skipping meals, consuming high-calorie foods, fast food, and rarely consuming vegetables and fruits are certainly more at risk of experiencing overweight or obesity than young women who are on a healthy diet (Mekonnen, 2018). The main focus in maintaining ideal body weight is behavior modification (Wilfley, 2019). Social Cognitive Theory plays a role in changing adolescent diet behavior, namely the interaction of environmental factors such as family function, then cognitive factors such as expectations of results, and adolescent behavior. This theory is seen as successful in weight loss programs in various observational studies based on family environments (Bagherniya, 2018).

There was a direct effect of behavior on overweight/obesity in female adolescent. Kheng (2019) states that healthy behavior can be formed through the roles and functions of parents. These roles and functions include health education regarding nutrition, physical activity, positive parenting skills, parental behavior, and children's behavior management to encourage healthy eating/exercise behavior. Social Cognitive Theory is considered to have succeeded in preventing or controlling obesity, because there are social and cognitive factors in explaining individual behavior. Positive belief in behavior will certainly have a positive influence on healthy behavior (James, 2018). Environmental factors will affect children's cognitive factors such as self-efficacy and outcome expectations (Marie, 2018). Children will certainly have more

self-confidence after being given reinforcement or motivation by their parents, so that children will try to change their behavior.

There was a direct effect of physical activity on overweight/obesity in female adolescent. This study was in line with Utami (2017), which shows the influence of adolescent physical activity on the incidence of overweight or obesity. Inactive/ lack of physical activity in adolescents is related to sedentary lifestyle such as watching television, playing mobile phones, and excessive gaming. Robinson (2017) states that obesity in children and adolescents can be caused by prolonged exposure to screen media through increased eating while watching, the presence of high-calorie and low nutrition food and drink advertisements, and unhealthy eating patterns. Social Cognitive Theory is the an effective theory for changing physical activity behavior (Taylor, 2016). This theory explains the predictors and principles of behavior change using constructs such as self-efficacy, outcome expectations, and environmental factors such as family or friends (Shamizadeh, 2019). A study by Pojskic (2018) shows the importance of the role of the environment, especially schools for physical activity, regardless of whether or not children are obese, because high physical activity improves physical fitness and reduce the risk of obesity.

AUTHOR CONTRIBUTION

Research topics/concepts: Yeti Rahelli, Agus Kristiyanto, Bhisma Murti
Data Analysis: Yeti Rahelli, Bhisma Murti
Original Manuscript: Yeti Rahelli
Review, Editing: Yeti Rahelli, Agus Kristiyanto, Bhisma Murti

CONFLICT OF INTEREST

There was no conflict of interest in this study.

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