

## TRANSPORTATION MODE CHOICE AND OBESITY: A CROSS-SECTIONAL STUDY AT SENIOR HIGH SCHOOL FEMALE STUDENT IN YOGYAKARTA, INDONESIA

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### ABSTRACT

**Background:** The prevalence of obesity has increased worldwide. Indonesia has also experienced a similar rising trend in obesity, especially in adolescents. The current phenomena is shifting mode of transportation from active to passive.

**Objective:** The objective of the study was to determine the correlation between transportation mode and obesity in high school adolescents in Yogyakarta, Indonesia.

**Methods:** A cross-sectional study was created and a total of 238 adolescent girls in class XI from all high schools/equivalents in Bantul, Yogyakarta Province, Indonesia was recruited. Data were collected in February-May 2017. Data characteristics, duration and mode of transportation were collected using a structured questionnaire. In addition, body mass index measured to determine obesity. A logistic regression analysis was performed using SPSS version 20.0.

**Results:** Subjects who used passive transportation mode had a risk of having obesity (OR 5.63, 95% CI: 1.71-8.52). Furthermore, passive transport duration >15 minutes increased the risk of obesity (OR 2.51, 95% CI: 1.07-5.99), while active transport >15 minutes was a protective factor (OR: 0.21 95% CI: 0.19-0.89).

**Conclusions:** There were correlation between the type and duration of the transportation mode used with obesity in adolescent girls.

**Keywords:** Adolescent girls; High school students; Obesity; Transportation

### INTRODUCTION

The prevalence of obesity has shown an increasing trend worldwide. It was reported that the prevalence of adult overweight (BMI>25) and obesity (BMI>30) reached more than 2 billion (39% of adult global population) and 600 million respectively in 2020.<sup>1</sup> Based on Basic Health Research (Riskesdas) the prevalence of central obesity at the age of 15 years and over in Indonesia continues to increase from year to year; in 2007, 2013 and 2018 were 18.8%<sup>2</sup>, 26.6%<sup>3</sup> and 31%<sup>4</sup>, respectively. While the prevalence of obesity at age ≥15 years in Yogyakarta in 2007, 2013 and 2018 were 18.3%<sup>2</sup>, 26.6%<sup>3</sup>, and 32.4%<sup>4</sup> respectively.

Overweight and obesity have increased the burden of public health problems.<sup>5</sup> Consistently, overweight and obesity have increased the risk of diabetes mellitus, cardiovascular disease, stroke and cancer.<sup>6,7</sup> Therefore, the increasing prevalence of obesity has a significant effect on public health problems and the nation's economic development.<sup>8</sup> On the other hand, obesity is a preventable disease<sup>9</sup> through improving healthy living

behaviour, including having adequate physical activity.<sup>10,11</sup>

Adequate physical activity is important for maintaining ideal body weight<sup>12</sup>, improves child's cognitive function and performance at school<sup>13</sup>, improve physical fitness and build up muscle mass<sup>14</sup>, provide greater opportunities for a healthy life and having a proper job in the future, and reduce the risk of comorbidities in latter age.<sup>15</sup> School-age children or adolescents have various alternatives to support their mobilization from home to school or vice versa. In addition, trend analysis shows that technological, economic and social development affects people having active being passive. For examples in the past people tend to use active transportation modes such as walking or cycling, but now changes to passive transportation such as riding a motorbike or car. Many studies showed that passive transportation associated with high of body fat<sup>16</sup> and obesity.<sup>17</sup>

The shift of transportation modes has emerged in several countries such as the United States<sup>10,11</sup>, California<sup>12</sup>, and several other countries, including Indonesia. But, in Indonesia

the report of student using mode transportation is still very rare. Study in Bogor, 2018 reported that only 10% student chose to walk and 15% used public transportation when going school.<sup>17</sup> According to our observation in Yogyakarta, student most use motor vehicles because there is bus school available. So far the phenomena of using active transportation such walking and cycling was rare although close distance between school and their home.

As the prevalence of overweight and obesity in Indonesia rises, active transportation is a suitable strategy to eradicate obesity, improve physical fitness, build good habits and cheap transportation.<sup>15,18</sup> Several studies have shown that active transportation is associated with increased opportunities for physical activity, energy expenditure and improved health status.<sup>5</sup> This study aims to determine the relationship between moda transportation and obesity in high school adolescents in Yogyakarta, Indonesia.

## METHODS

This was a cross-sectional study in Bantul, as a highest prevalence of obese women in Yogyakarta<sup>4</sup>. Random class was carried out with all female students in class XI from all high schools/equivalent, both public and private schools as study population. In total, there were

5.577 female students.<sup>19</sup> The number of samples was determined by the Lemeshow formula<sup>20</sup> with the proportion of female obesity on was set at 17.7%.<sup>3</sup> In the end, a total of 238 female students was included in this study.

The 238 participants origin form 27 senior high school were selected using the probability proportional to size sampling (PPS) technique. The variable of interest includes the type of transportation mode (active transportation, e.g., bicycles, or passive transportation, e.g., cars, motorbikes, and public transportation), the duration of the trip to/from home to school ( $\leq 15$  and  $>15$  minutes)<sup>23</sup>, and obesity status by calculating BMI (Obese= z-score  $>2$  SD; Not obese= z-score  $\leq 2$  SD).<sup>22</sup> Respondent's characteristics and transportation data were collected using a structured questionnaire. In addition, nutritional status data were observed using a Camry EB9003 digital weight scale with an accuracy of 0.1 kg and microtoise with an accuracy of 1 mm. Data were collected in February-May 2017. Data was normal distribution tested using Kolmogorov-Smirnov. Moreover, analysis to determine the correlation of transportation modes and nutritional status was performed by a logistic regression test using SPSS software. This study has approved by the Ethical Committee of Alma Ata University (No. KE/AA/II/53/E.C./2017). All participants of the study provided written informed consent.

## RESULTS

### Subjects Characteristics

Table 1. Study Subject's Characteristics

Characteristics	n	%
Age (year)		
15	2	0.8
16	117	49.2
17	117	49.2
18	2	0.2
Father's education		
Primary	76	31.9
Middle	93	39.1
Tertiary	69	29.0
Mother's education		
Primary	90	37.9
Middle	89	37.4
Tertiary	59	24.8
Father's Occupation		
Farmers	79	33.2
Private workers	95	39.9
Civil servant	36	15.1
Others	28	11.8
Mother's Occupation		
Housewife	116	48.7
Farmers	41	17.2
Private workers	49	20.6
Civil servant	22	9.2
Others	10	4.2

The number of subjects aged 15-16 years and 17-18 years is equal. Most of the subjects come from families where fathers have middle school education (39.1%) and mothers with primary education (37.9%). In addition, most fathers work as private-sector workers or self-employed (39.9%) and mothers as housewives (48.7%) (Table 1)

### **Obesity and Transportation Mode Used by Study Participants**

The prevalence's of obesity, transportation mode and it's duration showed in Table 2. The prevalence of obesity was 18.8%, used passive transportation was 52.5% and it's duration  $\leq 15$  minutes was 54.8%.

**Table 2. Obesity Prevalence, and Transportation Mode and Duration**

Characteristics	n	%
Obesity		
Yes	44	18.8
No	194	81.2
Transportation Mode		
Active	112	47.5
Passive	126	52.5
Duration of transportation status		
Passive		
> 15 minutes	57	45.2
$\leq 15$ minutes	69	54.8
Active		
> 15 minutes	48	42.9
$\leq 15$ minutes	64	57.1

### **Correlation between transportation mode with obesity in adolescent**

The was correlation between transportation mode with adolescent's obesity. Adolescent using passive transportation had a risk of obesity of 5.6 times higher than who had active transportation

mode. Adolescent using passive transport duration >15 minutes were 2.5 times more likely to have obesity (OR=2.5 CI 95% (1.1-5.9). On the other hand, having active transport >15 minutes is a significant protective factor for obesity (OR=0.2 CI95%0.2-0.9) (Table 3).

**Table 3. The Correlation of Transportation Mode With Obesity**

	Obese		Non-obese		p-value	OR (CI 95%)
	n	%	n	%		
<b>Mode</b>						
Passive	30	69.1	96	49.5	0.001	5.6 (1.7 – 8.5) 1
Active	14	30.9	98	55.2		
<b>Duration</b>						
Passive						
> 15 minutes	15	68.2	42	42.0	0.027	2.5 (1.1-5.9) 1
$\leq 15$ minutes	7	31.8	62	58.0		
Active						
> 15 minutes	5	22.7	43	47.8	0.041	0.2 (0.2-0.9) 1
$\leq 15$ minutes	17	77.3	47	52.2		

## **DISCUSSION**

Adolescence is period of growth spurt, development and consolidation.<sup>23</sup> At this stage, they characterized by shifting of developmental and behavioural from childhood to have more mature and independence.<sup>24</sup> However, in most cases, someone's behaviour during adolescence tends to

persist in adulthood, which might affect their health status throughout their lives.<sup>25</sup> Currently, the number of adolescents in Indonesia is approximately 30% of the total population.<sup>26</sup> Therefore, the health status of Indonesian people in the future depends on adolescents' health behaviour today.<sup>27</sup> Moreover, unhealthy behaviour and wrong eating patterns will

become a state burden concerning increasing the prevalence of non-communicable diseases.<sup>15,25</sup> In this study, most adolescents have parents with secondary and tertiary education, with the father's occupation being mostly formal workers. These are structural factors related to health outcomes, including the health of family members.<sup>28</sup> In addition, parents who are highly educated will have the opportunity to get better jobs with adequate income so that they are able to provide better facilities to their children.<sup>28,29</sup>

In this study, 18.8% of adolescent girls were obese. Although its prevalence was lower than Basic Health Research 2018 but however, obesity in adolescents needs to be considered and prevented, considering the increasing trends. Obesity in adolescence has a higher risk to the early development of non-communicable diseases, such as glucose intolerance, cardiovascular disease, stroke, kidney disease and its complications.<sup>6,7</sup> Obesity in adolescent girls can also develop into glucose intolerance at childbearing age and pregnancy.<sup>30</sup>

The choice of transportation mode is related to vehicle ownership, costs, distance, travel time, comfort, or lifestyle. Using active transportation control ideal body weight, increase energy expenditure, improve physical fitness<sup>3,8,12</sup>, reduce sources of pollutants<sup>30</sup>, and save fuel and health care costs due to obesity and lack of physical activity.<sup>31</sup>

The results of this study found that there was a relationship between passive transportation and obesity in adolescents, with a risk of 5.6 times. In addition, the duration of passive transportation >15 minutes increases the risk of obesity by 2.53 times. On the other hand, a female adolescent who chooses active transportation to school with a duration of > 15 minutes will be protected from the risk of obesity. Pathway of active transport with lower risk of obesity and body fat composition as a small increases of level daily physical activity.<sup>32</sup> Physical activity potentially increases by an active mode transportation. Study in low-middle income countries showed that active transport for 5 minutes only increment the accumulative of physical activity and lowering risk of obesity.<sup>15</sup>

This study finding is in line with research in 12 countries that active transportation were more at risk of developing obesity.<sup>32</sup> Another study in Sweden that looked at the relationship between modes of transport for work and obesity found that the use of motorized transport >15 minutes was associated with obesity.<sup>21</sup> Further, active transportation from home to school and vice versa is recommended to increase energy expenditure for female adolescents as early prevention to obesity.

This study includes all female adolescents in high school/equivalent in Bantul to represent the diversity of adolescent characteristics. With a large number of subjects, this study allows suppressing bias. However, the cross-sectional study design has a weakness in making a causal inference. Besides that, this study does not observed variables such as intake, physical activity, genetics and others related with obesity.

## CONCLUSION

Passive transportation mode and longer duration is associated with an increased risk of obesity. Currently, a new student admission are based on zonation, so a specific policy of transportation mode to school could be considered to prevent obesity in Yogyakarta, of course this also need support by safe cycling and pedestrian trajectories for students.

## ACKNOWLEDGEMENT

We want to thank to Department of Education and Sports, all of high school/equivalent in Bantul, and all participant.

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