



The Influence of Health, Social, and Economic Determinants on the Obesity to Teenagers during the COVID-19 Pandemic

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Abstract

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BACKGROUND: Obesity is fat accumulation in the human body that increases or excessive weight. This case may cause diseases appearing in the human body, such as hypertension, cardiovascular, diabetes, and stroke. The number of obesities increased when the COVID-19 virus started to infect Indonesia.

AIM: This study was conducted in October 2021 to discover the dominant factor of health, social, and economic determinants on the obesity that increased during the pandemic, especially to the first grade in 7 Malang Highschool (SMKN 7 Malang).

METHODS: This study is used analytical observational with the cross-sectional study approach. This study's population is 465 students; however, the study divides them into the sample using purposive sampling with inclusion and exclusion criteria. Hence, the final samples of the study are 102. The data were taken from interviews and observations, and will be analyzed using multivariate analysis.

RESULTS: The education level of parents is found (p -value) around $0.364 > 0.05$ (father) and $0.142 > 0.05$ (mother) which not influence obesity in teenagers. While, parents' income has (p -value) around $0.601 > 0.05$, which also means cannot significantly influence the obesity of teenagers. Whereas, food management finds a significant level (p -value) around $0.002 < 0.05$ and influences obesity in teenagers. Moreover, street food consumption also becomes the factor assumed to influence obesity.

CONCLUSION: It can conclude that parents' education level, income, food management, physical activity, and street food management can explain the variation of obesity variable to teenagers.

Introduction

Obesity is a severe disease that can cause emotional and social problems. Humans can be overweight if their weight reaches 10%–20% heavier than normal weight body; meanwhile, humans can be said as obese if their weight acquires 20% or more than normal body weight. Obesity has currently become the main problem globally; even World Health Organization has declared obesity as the global epidemic [1]. In the United States, almost 35% of adult people are obese, and one-third of children and teenagers are experiencing obesity. Obesity is the world's fifth leading cause of death, with about 3.4 million people dying each year [2].

Based on the National Longitudinal of Adolescents Health, the teenager who experienced obesity is estimated at around 12.5%. Besides, teenagers around 13–20 years old are also experiencing experienced obesity around 1.6% who have not experienced obesity again in the next 5 years in the future. The risk that can be raised from fat accumulation is known as hypertension ten times more, dyslipidemia 3–8 times more, and diabetes mellitus two times more [3]. In 2013, the result of Baseline

Health Research (RISKESDAS) stated that teenagers are experiencing obesity around 2.5% in the age of 13–15 years old and 1.6% on the teenager in the age of 16–18 years old. It can be seen from the obesity rates that rose by around 1.4% each year between 2007 and 2013, reaching 7.3%. As obesity rates increase, type 2 diabetes also increases [4].

At the end of 2019, the world has surprised by the COVID-19 virus's appearance; hence, the government decided to establish the "lockdown" system to press the increase of COVID-19's curve [5]. In this situation, the communities should have to do the activities such as work, school, and college life in their home. This case brings the social changes that are signed by lifestyle changes. Another big change in the economy is that people's shopping priorities have shifted to masks, face shields, hand wash, hand sanitizers, clothing, and food in order to survive. In addition, technology also provides easy access to adolescent lifestyles and reduces physical activity [6] thus it becomes the main cause of obesity [7].

Excessive energy intake, fat, and less activity simultaneously can influence obesity [8]. The increasing body weight because of the types of food can be related to high carbohydrate consumption, such as soft

drinks, fast food, and the food with the highest index glycemic glucose. In addition, the amount of food intake that contains excess carbohydrates and close eating schedules are becoming factors that cause obesity [7].

This study discusses the influence of determinants (health, social, and economic) related to the COVID-19 pandemic on adolescents which is still limited to the view of research data and only explains the determinants. Hence this study is required to be done to seek the best solution to find the right decision related to obesity conditions during the pandemic, starting from understanding the factors that influence it to what factors dominate. Therefore, the writers conduct comparative research toward determinant obesities in the COVID-19 pandemic, mainly on teenagers, and determines which factors give more effect to obesity.

Methods

This study is used observational analytics with a cross-sectional study by collecting the data to variable independent and dependent at the same time [9]. This study was conducted in SMKN 7 Malang, because the school had quite high obesity prevalence compared to other schools. The study was done during October 2020 until October 2021. The populations of this study are the entire students of SMKN 7 Malang, with around 465 respondents. However, it will be limited by using purposive sampling that has adjusted with the decision criteria by the writer (Table 1) [10]. To determine the sample in total, the writers used Slovin formula as below:

$$n = \frac{N}{1 + N(e)^2}$$

Notes:

n = Total sample

N = Total population

e = The percentage of tolerated failure level 10%.

Hence, from the calculation, the sample is found for 83 respondents, but in order to get a valid result, then the writers add the sample to 102 respondents.

Table 1: The criteria of sample taken by using purposive sampling

Inclusion criteria	Exclusion criteria
The first grade (X) who has maximal age around 18 years old and the student of SMKN 7 Malang	Teenagers who have regular fasting on Monday and Thursday
Willing becomes a research respondent	Teenagers who are currently sick or have some treatment
The teenager who lives with their parents	
Cooperative teenager	

This study also has primary and secondary data. The primary data are taken from interviews and observations through questionnaire. Besides, the secondary data are taken from related institutions such as the name, gender, and address of respondents. Furthermore, various

variables are found, including the independent variable such as social (education level of the parents), economic (income level), and health (physical activities, food management, and street food consumption). While, the dependent variable is related to the obesity in teenagers during the pandemic and the confounding variable includes the physiology (descent), psychology (unstable emotions), and accidents or brain injury factor. The entire variable that has been found and collected will be analyzed with univariate, bivariate, and multivariate analysis. In this study, univariate analysis is used to describe the social, economic, health, and obesity variables, while bivariate analysis is used to know the influence between free and bound variables using Chi-square statistic test with failure degree 0.05 and multivariate analysis is used to find the influence of each variable and find the most influential variable using regression logistic analysis.

Results

Subject characteristic

The teenagers' characteristic from the first grade (X) of SMKN 7 Malang has fulfilled the inclusion and exclusion criteria (Table 2). Most of the teenagers sampled in this study are teenagers with good education levels of their father (51%) and teenagers with good educational levels of their mother (56.9). Then, almost 74.5% of teenagers have parents with low incomes. Furthermore, another teenager has food management (53.9%). In addition, 77.5% of teenagers have the highest street food consumption, and the rest of teenagers have a normal nutritional status.

Table 2: Research subject characteristic

Characteristic	Frequency, n (%)
Level of education - father	
Less	50 (49)
Good	52 (51)
Level of education - mother	
Less	44 (43.1)
Good	58 (56.9)
Parents' income	
Lower	76 (74.5)
High	26 (25.5)
Food managements	
Less	47 (46.1)
More	55 (53.9)
Physical activities	
Light	46 (45.1)
Moderate	56 (54.9)
Street food consumptions	
Low	23 (22.5)
High	79 (77.5)
Obesities	
Obesity	20 (19.6)
Normal	82 (80.4)

Source: Primary Data (2021).

The correlation between the education level of parent, income level, food managements, physical activities, and street food consumption to the obesity on teenagers during COVID-19 pandemic

The parents' education level (father/mother) is one of the educational stages that the parents have

passed, such as primary school, junior high school, senior high school, and college. The parents' education criteria are divided into two among good criteria if the minimum of education was on senior high school/equal and fewer criteria if the education was under senior high school/equal. According to the determination, it is found that subject research has a father with a good education level around 52% and less education level around 50%. Meanwhile, the mother has a good education level around 58% and less education level around 44%. Most of the respondents who have normal weight include the good educational level of the father (78%). Then, a few of the respondents include the lower educational level of the father (22%). The research result shows that there is no aught relationship between parents' educational level with obesity occurrence in teenagers ($p = 0.364$ and 0.142).

Furthermore, parents' income is the total salary that parents have accepted on their life within 1 month of the time range. The parent's income level's determination criteria are divided into two among good income levels if the total salary is bigger than regional minimum wage and lower-income level if the total salary is lower than regional minimum wage. According to the determination, the result is found that 74.5% of teenagers included in the parents' lower income and 25.5% include the parents' good income. Most of the respondents who have normal weight have lower-income parents (80.3%). Then, a few respondents who experienced obesity had parents with good income (19.2%). The result shows no aught relationship between parents' income level with obesity occurrence in teenagers ($p = 0.601$).

Food management is the total composition and type of food consumed by people or groups at a certain time to regulate food consumption [8]. The management of determination criteria is divided into two such lowest criteria if the total energy within 1 day $\leq 100\%$ of recommended dietary allowances (RDA) and the highest criteria if the total energy $\geq 100\%$ of RDA. Then, the result of determination found that around 53.9% of teenagers had consumed extra food and 46.1% had less food consumed. Half of the respondents with good food management are categorized as normal weight (93.6%). Then, around 30.9% of respondents with poor food management are categorized to the obesity. The result shows a relationship between food management and obesity occurrence in teenagers ($p = 0.002$).

Human engage in physical activity on a regular basis. Its goal is to have body energy and wellness in a planned, structured, and systematic way. The determining criteria of physical activity are divided into two, including light activity if the value of physical activity level (PAL) = 1.40–1.49 and moderate activity if the value of PAL = 1.50–1.99. According to the determination result, 54.9% of respondents have been done moderate activity, and 45,1% respondents have been done light activity. Most of the respondents have

normal weight, including moderate physical activity (89,3%).

Then, around 30, 4% of respondents have obese, including light physical activity. The result shows a relationship between physical activities and obesity occurrence in teenagers ($p = 0.012$). Street food consumption is a habit of consuming the street food prepared and sold by street vendors in certain places that can be eaten and consumed without further processing or preparation [11]. The determining criteria of street food consumption are divided into two: low street food consumption with ≤ 300 calories and high street food consumption with ≥ 300 calories.

Then, the determination results show that 77.5% of respondents are categorized as high street food consumers, and 22.5% of respondents are categorized as low street food consumers. Most of the respondents are included in the normal weight in the low street food consumption category (95.7%), and the rest of respondents are included in the obesity with high street food consumption category (24.1%). As shown in Table 3, the result shows a relationship between street food consumption and obesity occurrence in teenagers ($p = 0.028$).

Table 3: Parents' education level and obesity in teenagers

Characteristic	Obesity, <i>n</i> (%)	Normal, <i>n</i> (%)	<i>p</i>
Father's education level			
Less	11 (22)	39 (78)	0.364
Good	9 (17.3)	43 (82.7)	
Mother's education level			
Less	6 (13.6)	38 (86.4)	0.142
Good	14 (24.1)	44 (75.9)	
Parents' income			
Lower	15 (19.7)	61 (80.3)	0.601
High	5 (19.2)	21 (80.8)	
Food managements			
Less	3 (6.4)	44 (93.6)	0.002
More	17 (30.9)	38 (69.1)	
Physical activities			
Light	14 (30.4)	32 (69.6)	0.012
Moderate	6 (10.7)	50 (89.3)	
Street food consumptions			
Low	1 (4.3)	22 (95.7)	0.028
High	19 (24.1)	60 (75.9)	

Source: Primary Data (2021).

The result of multivariate analysis

Multivariate analysis regression logistic is conducted to identify whether parents' education level, income level, physical activity, food management, and street food consumption become the causes of obesity simultaneously and affect another variable that has been assumed as confounding in this study. The multivariate result shows that parents' education level, income level, physical activities, food management, and street food consumption affect the obesity that happens to teenagers, which is shown in Table 4.

Table 4 demonstrates that the lower the father's education level (OR = 2.060), mother's education level (OR = 0.180), parents' income (OR = 2.252), food management (OR = 0.130), physical activity (OR = 5.689), and street food consumption (OR = 0.104), may lead to the higher risk for teenagers'

Table 4: Logistic regression analysis result of parents' education and income, physical activity, food management, and street food consumption toward the obesity in teenagers

Determinants	B	p	OR	95% CI		Nagelkerke R ²
				Lower barrier	Upper barrier	
Father's education	0.723	0.289	2.060	0.542	7.828	0.372
Mother's education	-1.714	0.028	0.180	0.039	0.833	
Parents' income	0.812	0.277	2.252	0.521	9.744	
Food management	-2.037	0.006	0.130	0.030	0.559	
Physical activity	1.739	0.012	5.689	1.472	21.98	
Street food consumption	-2.263	0.053	0.104	0.011	1.019	

Source: Primary data (2021). OR: Odds ratio, CI: Confidence interval.

obesity. Furthermore, the risk of obesity can be raised significantly around 0.289 times to teenagers who have a father with less education level and become 0.028 times if the teenagers have a mother with less education level. Although it was insignificant statistically, the excess income accepted by parents may cause an increase in the risk of obesity toward teenagers around 0.277. Meanwhile, the more food management is consumed by teenagers, the more risk leads to obesity in teenagers around 0.012.

Furthermore, light physical activity significantly increases the risk of obesity in teenagers 0.012 times. The risk of obesity tends to increase until it reaches 0.052 times when the street food consumption becomes highest consumed by teenagers. According to the Nagelkerke coefficient, parents' education level, parents' income, food management, physical activity, and street food consumption can be influenced obesity in teenagers around 37.2%, meanwhile the rest of 62.8% is influenced by another factor that is not conducted in the study.

Discussion

The influences of father education level toward obesity on teenagers

On the variable, the father's education level is finding the significant level (p -value) around 0.364 > 0.05 because the result of significant level is bigger than $\alpha = 0.05$; hence, hypothesis number 1 has been rejected. Furthermore, according to the variable, the mother's education level is finding the significant level (p -value) around 0.142 > 0.05. Because the result of the significant level of the variable is bigger than $\alpha = 0.05$; hence, hypothesis number 1 is rejected. It means the father's and mother's education level are not significantly influence obesity in teenagers. In addition, the result of this study does not support the first hypothesis, which stated that parents' education level influenced obesity in teenagers.

On the other hand, some factors can influence obesity in teenagers. Even though the parents have a good education level and enough information related to the nutrition that must be fulfilled, another factor that

comes from teenagers such as the ability to manage the food, lifestyle, physical activity, and street food consumption that often consumed by them have become the factors that can influence their nutritional status.

The study that has been done by Attorp *et al.* stated that the parent's education level and income do not have a significant relationship with the vegetable and fruit consumed by teenagers [12]. Parents' highest education level cannot influence obesity in teenagers because it cannot benchmark the knowledge about health, especially good nutrition and healthy food. In addition, the study that has been done by Putra *et al.* also stated there is no significant relationship between mother's occupation with the vegetable and fruit consumptions [13].

The influence of parents' income toward obesity on teenagers

On the variable of parents' income is found that there is significant level (p -value) around 0.601% > 0.05, which is bigger than $\alpha = 0.05$. Hence, the second hypothesis is rejected. It means that parents' income partially has not significantly influenced the obesity of teenagers. The result of this variable is not supported the second hypothesis, which stated that parents' income partially influenced obesity in teenagers.

Parents who have low income can often increase teenagers' body mass index because they do not have affordable healthy access. [14]. Furthermore, the statement above was contradicted alongside the following result, which stated that social-economic classes and levels also influence obesity. The family with the highest income tends to have food management with high fat intake, animal protein, and sugar. Furthermore, the food frequency from the outside also tends to give the high fat intake; therefore, family income can influence this matter [15].

According to the social demographics survey of the COVID-19 impact that the Indonesian Central Statistics Agency has done, household expenditure during the pandemic is dominated by food material expenditure around 51%. This case happened because communities choose to make their food in their house to save money, and it guarantees that the food will be secured. It can be understood that even the highest income accepted by parents cannot influence obesity during the pandemic because they will prioritize cooking healthy food in the house to maintain their optimal health by increasing the body immune with healthy food consumption that has processed in the house.

The influences of food management toward obesity on teenagers

On the variable food management is found the coefficient of contingency (Chi-square) around

9,671 with the significant value (p -value) $0.002 < 0.05$. Because the significant level is smaller than $\alpha = 0.05$, the third hypothesis is accepted. It means that food management partially has significantly influenced obesity in teenagers. The result of this study supports the third hypothesis, which stated that food management partially could influence obesity in teenagers.

Nisak and Mahmudiono (2017) stated that food management quantitatively could be seen from the type, portion, weight, and food frequency. On the other hand, food management qualitatively can be seen only through the type and composition of the food [8]. Furthermore, the genetic factor only takes a small part. It cannot explain the increase in obesity prevalence. The fact is that the environment has a larger role in shaping an individual's lifestyle, which leads to an unhealthy lifestyles [16].

Teenagers are also found like to consume snacks during the COVID-19 pandemic to prevent boredom. The respondent consumed snacks were three times a day at 03.00–06.00 pm. The type of snacks often consumed by respondents is salted snacks (chips and fries), with around 35%. Excessive food management can cause the sufferer to have difficulty to out from the overweight condition because they cannot control themselves and there is no motivation to decrease the weight [17]. Hence, food management that is unhealthy or excessive nutritional intake can lead to the risk of obesity.

The influences of physical activity toward obesity on teenagers

The variable of physical activity is found significant level (p -value) around $0.012 < 0.05$, because the significant level is smaller than $\alpha = 0.05$. Hence, the fourth hypothesis is accepted. It means that physical activity partially has significantly influenced obesity in teenagers. This study's result supports the fourth hypothesis, which stated that physical activity partially influences obesity in teenagers.

Obesity's trend on the teenagers has increased following the decreasing of physical activity [18]. It is reported that 50% of teenagers had less physical activity during pandemics. This group experienced overweight (OR = 1.8; confidence interval [CI] = 1.2–2.7) and obesity (OR = 2.2; CI=1.2–4.0) [19]. The availability of electronic goods (television and smartphones) makes teenagers choose lazy behavior, so that only light energy is emitted from these electronic goods [20]; this statement is similar to the study of Hendra et al. [1] that stated teenagers often spend their time sitting, playing on a smartphone, and computer [1]. Besides, the enactment of online distance learning makes the students tend to be lazy and become inactive, which may lead to the obesity [21]. Suraya et al. stated that body movement is important to physical health and mentality [22]. The statement before is the same as the

following statement by Suryadinata and Sukarno 2019 which stated that less physical activity could cause accumulation on the fat tissue and increase the risk of obesity, especially an adult and teenager [7].

Physical activity partially influences obesity in teenagers. The teenagers with less physical activity tend to experience obesity, and teenagers with moderate physical activity tend to have an ideal body between the high and weight, which has balanced. In this study, the average of teenagers that experience obesity has less physical activity; meanwhile, the average of respondents who have the ideal body tends to do moderate physical activities.

The influences of street food consumption toward obesity on teenagers

On the variable of street food consumption, it is found the significant level (p -value) around $0.028 < 0.05$, which means, the fifth hypothesis is accepted because the result of significant level is smaller than $\alpha = 0.05$. The result of this study supports the fifth hypothesis, which stated that street food consumption partially influences obesity in teenagers.

The availability of food types that are processed instantly, such as pizza, hot dogs, and burgers, has become one of the causes that increase the activity of communities' consumptive behavior. Those types of food generally have high calories which are not balanced with the fiber from vegetables and fruits; therefore, it can cause the human body to obtain unhealthy stage [23]. On the other hand, overeating habits can lead someone to obesity [8]. Types of foods included in the snacks are contributed around 10%–25% toward human nutrition intake [22].

Moreover, the changes on millennial habitual life that often consume the junk food and caffeine [24] is dominated by women. They are more attracted to consume unhealthy food and junk food, since the taste, color, shape, and the food are promoted in a very eye-catching ads for twice a week. They usually consume the food at night [25]. This fact appears during the isolation or lockdown; it makes people active to see the advertisement on the television, which causes the management of consumption to excess [26]. The study that Horta done stated that environment distribution of food digital advertisement that represented by the platform content known as online food delivery and Mobile Food Ordering Application are proven to be obesogenic in Brazil because the existence of expressive advertisement of unhealthy food which has been increasing during COVID-19 pandemic [27].

Furthermore, frequent consumption of high fat, preservative-containing, high sugar, and salt by teenagers can indicate that they consuming excessive street food. If the respondents continuously consume the food mentioned before and are not managing the

physical activity, even if they also consume fiber from vegetables and fruit, hence, the nutrition intake of the respondents can be changed from normal weight become obesity.

The influences of father's education level/ mother, parents' income, food management, physical activity, and street food consumption toward obesity on teenagers

As shown in Table 4, the result value of multivariate analysis is found around 0.372, which means that independent variables around 37.2% can explain the dependent variable, meanwhile the rest of the result around 62.8%, which another variable of this study can explain. It shows that independent variables (the father's education level/mother, parents' income, food management, physical activity, and street food consumption) simultaneously can explain the variation of obesity variables on the teenagers around 37.2. This study's result supports the sixth hypothesis, which stated that the father's education level/mother, parents' income, food management, physical management, and street food consumption simultaneously influence obesity in teenagers.

Conclusion

The education level of parents is found significant level (p -value) around $0.364 > 0.05$ (father) and $0.142 > 0.05$ (mother). It means that parents' education level cannot significantly influence obesity in teenagers. Then, parent income finds a significant level (p -value) around $0.601 > 0.05$, which means that parents' income partially cannot significantly influence the obesity of teenagers. Furthermore, food management finds a significant level (p -value) around $0.002 < 0.05$, which means that food management partially influences obesity in teenagers. Not only food management but also physical activity is partially significant influence to the obesity on teenagers. It has proven by the significant level that found around $0.012 < 0.05$.

Moreover, street food consumption also becomes the factor assumed to influence obesity; hence, it found the significant level (p -value) around $0.028 < 0.05$. It means that the result of street food is partially has significant influence of obesity in teenagers. In addition, it can conclude that parents' education level, income, food management, physical activity, and street food management can explain the variation of obesity variable to teenagers around 37.2%.

Suggestions

The study's findings hope to improve the researcher's ability to apply science and knowledge,

as well as provide empirical evidence about the social (parents' education level), economic (parents' income), and health determinant (physical activity, food management, street food consumption) that influence obesity in teenagers during the COVID-19 pandemic. For the subsequent study that will concern the same focus and scope, it hopes that the subsequent study is willing to do research toward the factor that can influence obesity in teenagers, especially psychological factors, circadian cycle, stress, and accidents. Hence, the subsequent study is also willing to do research in various schools to illustrate the obesity sample in Malang. In addition, the researcher can use the data collection by using food model to equalize the perception in the portion of each food.

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