SRIWIJAYA JOURNAL OF MEDICINE

Evaluation of University Student Eating Pattern Based on "Isi Piringku" [My Plate] Guideline and Their Correlation to Increased Body Weight during Pandemic

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Abstract

The Ministry of Health has issued dietary guidelines, namely *"Isi Piringku"* [My Plate]. However, few studies have evaluated the implementation and its relationship to nutritional status in the university student population, especially during the COVID-19 pandemic. The objectives of this study include (1) evaluating student eating patterns during the pandemic based on the *"Isi Piringku"* guidelines; (2) analyze the correlation of diet to changes in body weight during the pandemic. This research was conducted using an online survey of 110 students spread throughout Indonesia in the first to eighth semesters. The analysis was carried out by descriptively comparing the median portion of the type of food to the *"Isi Piringku"* recommendations and analyzing the correlation using Spearman's analysis. In 4 types of food (staple food, side dish, vegetables, and fruit), there is a gap between the median proportions eaten by respondents and recommendations including staple foods (29% and 33%), side dish (38% and 17%), vegetables (17% and 33%), and fruit (14% and 17%), respectively. However, staple food intake correlates significantly with weight gain (r=0.24, p=0.012). Conversely, protein intake mainly from vegetable products negatively correlated with weight gain (r=-0.28, p=0.030). In conclusion, there is a large gap in vegetable consumption among Indonesian students. The proportion of staple foods is considered sufficient and needs to be maintained in moderation to avoid the risk of weight gain during the pandemic.

Keywords: COVID-19, Eating Patern, Isi Piringku, Weight Gain, University Student

1. Introduction

Obesity is a condition that can worsen the symptoms of Coronavirus Disease (COVID-19) infection. It is reinforced by the relationship between obesity and COVID-19, which can increase chronic pro-inflammatory, excessive oxidative stress response, and impaired immunity.[1] Weight gain can be influenced by various factors, ranging from diet, activity, and metabolism.[2] Unbalanced eating habits can significantly increase body weight which is exacerbated by the COVID-19 pandemic. This obesity condition affects the metabolic balance, decreases lung function, and causes a poor response to mechanical ventilation in COVID-19 survivors.[1] This condition can prolong the duration of healing or worsen the symptoms of COVID-19 infection.

The results of 40 systematic reviews and 20 meta-analyses show that there has been an increase in obesity rates in various countries throughout the pandemic, including in European countries, the United States, Mexico, and China.[3] The phenomenon of the global increase in the incidence of obesity needs to be addressed immediately to avoid metabolic diseases in the future. World Health Organization (WHO) states that obesity and metabolic diseases are priority issues that need to be addressed after the pandemic.

Young adult age groups, especially university students, need more attention in the problem of increasing obesity prevalence. Obesity that occurs in this period affects not only themselves but also their offspring. Obesity in this period causes fat accumulation in the ovum follicles in women, decreased

sperm motility in men, increased DNA and mitochondrial damage, and epigenetic disorders that increase the risk of metabolic diseases in themselves and their offspring.[4-5]

Modifiable factors that can be done to avoid obesity include improving diet. Minister of Health Regulation Number 41 of 2014 states that *pedoman gizi seimbang* [balanced nutrition guidelines] are intended to provide guidelines for daily food consumption and healthy behaviour based on consuming various foods, higiene and sanitation, physical activity, and monitoring normal weight.[6] The food portion guidelines that were previously *4 sehat 5 sempurna [4 healthy and 5 perfect]* have now turned into "*Isi Piringku*" [My Plate]. This new concept aims to regulate a healthy and balanced diet, from the composition of carbohydrates, proteins, fats, vitamins, and minerals.

"Isi Piringku" is a program promoted by the Ministry of Health of the Republic of Indonesia since 2017 to campaign for visualized food consumption to make it easier for people to implement balanced nutritional foods. The portion rules in *"Isi Piringku"* are staples foods with a portion of two-thirds of half a plate, side dishes with one-third portion of half a plate, vegetables with a portion of two-thirds of half a plate and fruits with one-third portion of half a plate.[6]

Therefore, this study aims to (1) evaluating student eating patterns during the pandemic based on the "Isi Piringku" guidelines; (2) analyze the correlation of diet to changes in body weight during the pandemic.

2. Method

This cross-sectional study was conducted using an online survey through a *google form*. The questionnaire consisted of several questions regarding demographics, body weight before and after the pandemic, and the proportion of food on the plate. Food proportions are divided according to the *"Isi Piringku"* standard covering staple foods, side dishes (animal and plant-based dishes), vegetables, and fruit.

The questionnaires that have been tested and refined are then distributed to students spread across Indonesia (n=110) in the first to eighth semesters from all kinds of majors, both social science and science, technology, engineering, and mathematics (STEM). The distribution of respondents has been grouped based on research subjects, namely university, region, major, age and sex. For age, we analyze based on median (IQR). The online survey was distributed in August 2021 through several platforms, including Instagram, Line, Twitter, WhatsApp. It aims to expand and improve the accuracy of the data in reaching a large population. Filling out the questionnaire is voluntary, and an explanation of the research objectives and procedures and informed consent to fill out the questionnaire are listed on the first page.

The data cleaning process is carried out by sorting and eliminating invalid responses so that data that is already valid and meets the qualification standards will be continued into the coding process. There were three incomplete body weight data, so that they were excluded from the analysis of weight changes.

The data were analyzed descriptively to get the demographic distribution of the research respondents. A normality test was conducted to evaluate the distribution of the data. Data that are not normally distributed are presented in the median, and some categorical data are presented in proportion. Food proportions are shown in the median (IQR), and the proportions are then compared with the *"Isi Piringku"* recommendation.

The proportion of food data was analyzed for correlation to changes in body weight using Spearman's analysis. The data is considered significant if the p-value is <0.05.

The value of *r* represents a positive correlation coefficient (r>0) and a negative correlation (r<0). Data were analyzed using Stata 13 software.

3. Results

The comparison of the median portion of food types with the *"Isi Piringku"* recommendations was carried out with a population distribution of 110 students spread throughout Indonesia in the first to eighth semesters from all kinds of majors, both social and science, technology, engineering, and mathematics (STEM). The distribution of respondents has been grouped based on research subjects, namely university, region, major, age and sex. The origin of the university is almost evenly distributed both public and private universities. The distribution of respondents was spread across universities in Indonesia, which is more dominated by universities on Java, compared to others. The median age of the respondents is 20 years, and the prevalence of respondents was 82% for female that shown more dominate from all respondents. (Table 1).

Table 2 describes the proportion of food on the plate and its comparison based on the "*Isi Piringku*" guideline. In staple foods, the median consumption proportion was 29% (21-38%), with the proportion exceeding the recommendation only 32%. Side dish intake (38%) is higher than the recommended proportion of "Isi *Piringku"* (17%). Comparison of the proportion of university students eating pattern and the "*Isi Piringku*" recommendation is also depicted in Figure 1.

Table 1. Demographic Characteristic of University Student

Demographic Characteristic	n	(%)
University		
Public	48	43.6%
Private	62	56.4%
Region		
Java	104	96.3%
Others	4	3.7%
Major		
STEM*	58	52.8%
Social Science	52	47.2%
Age, Median IQR (Year)	110	20 (19, 20)
Sex		
Male	21	18%
Female	89	82%

*STEM: Science Technology Engineering Mathematics

Table 2. Student eating pattern based on "*Isi Piringku*" (n=110)

Food Component	Median (IQR)	*"Isi Piringku"* Recommendation	Proportion below recommendation	Proportion exceed recommendation
Staple food	29 (21-38)	33% (1/3 of plate)	67.27 %	32.73 %
Side dish*	38 (31-45)	17% (1/6 of plate)	2.73 %	97.27 %
Animal-source dish	21 (17-25)	-	-	-
Plant-based dish	17 (14-20)	-	-	-
Vegetables	17 (13-22)	33% (1/3 of plate)	97.27 %	2.73 %
Fruit	14 (0-21)	17% (1/6 of plate)	64.55 %	35.45 %

* Animal or plant-based dishes cannot be compared with the "Isi Piringku" recommendation because the guideline does not explicitly distinguish the protein source.

Table 3. Correlation of eating pattern with changes in body weight during the pandemic (n=107)

Food Component	Median (IQR)	Correlation with weight gain (r)	P-value	Correlation with weight during pandemic (r)	P-value
Staple food	29 (21-38)	0.2421	0.0120*	0.1225	0.2045
Side dish	38 (31-45)	-0.1302	0.1815	-0.1389	0.1496
Animal-source dish	21 (17-25)	-0.0973	0.3186	0.0259	0.7891
Plant-based dish	17 (14-20)	-0.1027	0.2925	-0.2075	0.0304*
Vegetables	17 (13-22)	-0.1459	0.1338	0.1510	0.1170
Fruit	14 (0-21)	-0.0583	0.5509	-0.0646	0.5045

*Value is considered significant with p-value <0.05

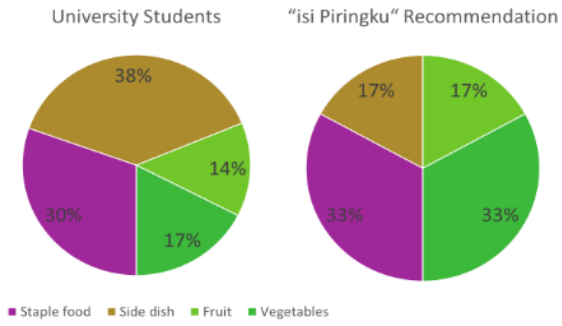

Figure 1. Comparison of University Student Eating Pattern with "*Isi Piringku*" Recommendation

Moreover, the food sources on the side dish consist of 21% animal-sourced food and 17% plant-based dish. Almost all respondents did not meet the recommendation for vegetable consumption (17% vs 33%). More than half consume fewer vegetables, according to the recommendations. One-third of respondents did not eat fruit at all (data not shown).

The correlation of food proportion with changes in body weight during the pandemic can be seen in Table 3. The body weight gain indicator is used to see the correlation of diet only during the pandemic period. In comparison, the weight indicator during the pandemic describes the correlation of diet both before and during the pandemic. Staple food showed a significant positive correlation (r=0.242, p=0.012) between the proportion of consumption and weight gain during the pandemic, and foods other than staples had a negative correlation with weight gain.

Plants' protein consumption was significant negatively correlated (r=-0.208, p=0.030) with bodyweight during the pandemic. However, there is a different

pattern between the impact of food consumption during and before the pandemic. Staple foods consistently have a positive correlation with body weight. Side dishes, especially protein from plants, and fruit consistently have a negative correlation with body weight.

4. Discussion

This study found a low intake of vegetables and fruit; even a one-third of the respondents did not eat fruit at all. In addition, there are food consumption patterns that are known to be positively and negatively associated with weight gain. These findings might be a recommendation in the effort to formulate policies to prevent obesity in the future.

This research observes a correlation between the proportion of types of food to weight gain. A positive correlation was found consistently in the proportion of staple food intake, which represents carbohydrates, to weight gain. This finding is in line with the Carbohydrate-Insulin Model (CIM) framework, where the theory explains that the type of food has a role in weight gain compared to the amount of food that is often measured using calorie units. This model suggests that increased consumption of processed, high-glycemic carbohydrates can cause hormonal changes resulting in calorie deposition in adipose tissue, increase hunger, and decrease energy expenditure.[7] Other research has also found a positive correlation between an increase in the glycemic index and weight gain.[8] This finding underscores that the quality of carbohydrates is essential in ensuring ideal body weight.

Respondent's proportion of staple food consumption is close to the recommendation, which is one-third of a plate. A different finding was seen in the female population, who reported consuming up to 70% of staple foods.[9] This condition may be due to differences in the population age and life cycle stage and also context in which this study was conducted during the pandemic. Increased consumption of staple foods during the pandemic can put students at risk of weight gain. The low level of physical activity also supports this due to the shift from offline to online lecture modes. Studies on weight gain have confirmed this condition during the pandemic, suggesting that high calories consumed and low physical activity lead to weight gain during the COVID-19 pandemic.[10]

The consumption of side dishes in this study was sufficient compared to the recommendations. Research looking at proportions based on the whole plate is still rare, but quite a lot of research explores the diversity of foods consumed. Research that observes adolescent diets sees a relatively good trend of side dish consumption patterns where almost one-third of respondents consume side dishes.[11] Among the side dishes consumed, eggs were only eaten by almost 50% of respondents, and only one third consumed milk.

This study found a negative correlation between the consumption of side dishes from plants and weight gain. This finding is in line with other research, which states that the combination of food with protein can lower the glycemic index and could be especially relevant for long-term weight gain. Protein is known to be protective against obesity. This is also supported by the finding that consumption of legumes and peanuts correlated with weight loss in 4 years long.[8]

Vegetables and fruits are essential in the daily food consumption of every individual for a healthy life.[12] Vegetable consumption in all respondents in this study is still below the recommendation, whereas one-third of respondents reported not consuming fruit. In general, as many as 97.1% of the Indonesian population have a low consumption pattern of vegetables and fruit compared to the

recommended consumption of vegetables and fruit in the 2014 balanced nutrition guidelines.[13] The same gap exists in other countries such as America. This finding is of concern because it is known that regular consumption of vegetables and fruit can prevent chronic diseases. A growing body of evidence suggests that the health benefits of fruits and vegetables are associated with synergies or interactions of bioactive compounds and other nutrients in whole foods.[14] Therefore, this study recommends increasing the intake of vegetables and fruits as a better and more effective source of nutrients than nutrients obtained from supplements.

This study has several strengths, including 1) seeks to evaluate diet using local guidelines so that it can be one of the government's program evaluation efforts; 2) succeeded in showing a correlation between eating patterns based on the portion of food in the plate and bodyweight so the community can easily adopt the knowledge. The limitations of this study including 1) the study design is a one-time point survey so that there is the potential for recall errors to occur in obtaining weight data before the pandemic; 2) food proportion data obtained based on self-reported. Further research is needed with a longitudinal design and a more rigorous dietary assessment method to obtain information about changes during the pandemic.

5. Conclusion

There is a large gap in vegetable and fruit consumption among Indonesian students. The proportion of staples was positively correlated with body weight and, conversely, the proportion of plants' protein was negatively correlated with body weight. The proportion of staple foods consumption is considered sufficient and needs to be maintained in moderation to avoid the risk of weight gain during the pandemic.

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