ORIGINAL ARTICLE

Dietary Pattern in College Students and Its Corelation With Abdominal Fat

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ABSTRACT

Introduction: Abdominal obesity is an important risk factor for various diseases. Recently, there has been an increase in the prevalence of abdominal obesity in women. This reflects the strong influence of dietary intake. Dietary pattern is one of the recommended dietary intake analyzes to assess the relationship between food intake and various chronic diseases. This study aimed to determine the dietary patternss and it's relationship with abdominal fat among female college students. **Methods:** : Study was conducted in July-October 2020 with total subject were 156 (19-24 years old) female. Subjects were interviewed for their food intake using semi-quantitatif food frequency questionnaire (SQ-FFQ). Dietary patterns were identified using the principal component analysis (PCA) method. Abdominal fat was measured using waist circumference (WC), waist and height ratio (WHR), and sagittal abdominal diameter (SAD). **Results:** Two major dietary patterns were extracted named Dietary Pattern 1 (dessert, fast food, etc) and Dietary Pattern 2 (fruit, vegetables, etc). The percentage of subjects classified as central obesity based on WC were 48.7%, WHtR were 50.6%, and SAD were 9.0%. There was relationship between Dietary Pattern 1 with WC (r = 0.406), WHtR (r = 0.389), and SAD (r = 0.370), as well as a Dietary Pattern 2 with WC (r = -0.320), WHtR (r = -0.338), and SAD (r = -0.353) with p-value <0,001. **Conclusion:** Increased intake of Dietary Pattern 1 was associated with an increase in abdominal fat, whereas increased intake of Dietary Pattern 2 was associated with a decrease in abdominal fat.

Keywords: Abdominal obesity, Dietary patterns, Female college students

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INTRODUCTION

Abdominal obesity has been identified as an important risk factor for diabetes, dyslipidemia, hypertension, cardiovascular, and cerebrovascular disease, resulting in premature mortality.(1) Based on National Basic Health Research, the prevalence of abdominal obesity in Indonesia in 2013 was 26.6% and was increased to 31% in 2018.(2),(3) Abdominal obesity describes the presence of excess intra-abdominal fat tissue.(4) Excess intra-abdominal fat tissue, especially visceral fat tissue contributes to insulin resistance, metabolic abnormalities, dyslipidemia, and hypertension in individuals with abdominal obesity.(5)

Deposits of visceral fat tissue could be measured by anthropometric indicators include waist circumference (WC), waist-to-height ratio (WHtR), and sagittal abdominal diameter (SAD).(6) WC has a strong correlation with visceral fat tissue (r = 0.76). WHtR uses height to correct WC and is strongly correlated with visceral fat (r = 0.72) and SAD is a good marker for total visceral abdominal tissue (r = 0.76). Three of them are also strongly associated with various metabolic syndrome parameters and risk factors for metabolic syndrome.(1), (7)

Based on gender characteristics, the prevalence of abdominal obesity in women is two times higher than in men. The prevalence of abdominal obesity in women is 46.7%, while in men it is 15.7%.(3) High abdominal obesity prevalence in women may occurred due to the differences in fat deposits between men and women. Total fat in boys tends to decrease after puberty, while in girls total fat tends to increase. This increase in fat was followed by an increase in BMI and waist circumference in women. The percentage of fat in boys peaks at the age of 11 years, while in girls continues to increase until adolescence so that the percentage of fat in women is

1.5% higher than that of men at the age of 18 years. (8) Further research showed that abdominal obesity prevalence increased in both women and men. Although men have a greater central fat mass than women, the prevalence of abdominal obesity in Indonesia is higher in women than in men.(9) This further shows that women have a higher risk of obesity because they tend to store fat.

The increasing prevalence of abdominal obesity in women reflects a strong influence on lifestyle factors such as dietary intake and physical activity.(10) Food intake is an important factor in the occurrence of abdominal obesity. However, reducing one type of food or the total intake of certain nutrients in the diet does not show any significant change in weight loss. The low effect of reducing one type of food and nutrients indicates the existence of biological interactions between foods and how strong the effects between foods is.(11) Based on these considerations, the relationship between food and various chronic diseases is better assessed in the form of a comprehensive patterns and considering the relationship between foods.(12)

Analysis of dietary intake as a patterns is recommended because dietary patterns can describe the complex interactions between nutrients, can change according to food availability and change of preferences, and are influenced by culture and background.(12) Dietary patterns describes the overall diet including the synergistic effects of food and nutrients, and besides that, studying diet as a patterns is a realistic approach because a person eats in the form of a combination of various foods consisting of various nutrients.(13) One way to determine the dietary patterns in a population is to use Principal Component Analysis (PCA).(11) The use of multivariate analysis in determining dietary patterns is increasingly being carried out in nutritional epidemiological research. Dietary patterns is an important part because it summarizes the total diet, considering that food is eaten in complex combinations with various interactions between nutrients, and the balance between foods that function as protective factors and risk factors to assess the relationship between various diseases.(14)

Another lifestyle factor that influence abdominal obesity is physical activity. Physical activity combined with diet affects body composition by increasing fat burning and maintaining lean tissue. Strategies for weight loss were associated with significant reductions in both subcutaneous and abdominal visceral fat. 10% weight loss leads to 30-35% decrease in visceral fat. Physical activity not only keeps the body at an ideal weight but also prevents fat from storing fat in the abdominal area. (15)

Students have a very practical lifestyle, decrease physical activity, and often buy food outside. The food purchased tends to be less healthy and is associated with high fat intake and obesity.(16),(17) This is supported by the college environment which provides a variety of high-fat foods and high energy density foods. The high intake frequency of these foods is related to low-quality diets including low intake of fruits and vegetables and high intake of total fat, trans fat, sodium, and soft drinks.(18) These dietary patternss are risky and are associated with increased visceral fat and make students more susceptible to abdominal obesity.(19),(20) The aims of this study are to examine how the existing dietary patternss in female students in Semarang are related and how the dietary patterns is related to various anthropometric profiles related to abdominal fat (WC, WHtR, and SAD).

MATERIALS AND METHODS

This study used an observational method with a cross-sectional study design. The study was conducted in July-October 2020. The process of collecting anthropometric data was carried out at the CITO Laboratory Setiabudi Semarang. This study has obtained the ethical clearance of the Bioethics Commission of the Sultan Agung Islamic University Semarang Number 210/VII/2020/Bioethics Commission.

The target population was female students aged 19-24 who live in Semarang from various universities in Semarang City. The minimum sample size based on these calculations was 100 female students. Sampling was done using the purposive sampling technique. A total of 163 students attended the screening process. There were 156 women meet the inclusion criteria, such as willing to be research subjects, aged 19-24 years,(21) having the ability to communicate, not being on a certain diet program in the past month, not having diseases related to kidney, liver, thyroid, hypothalamus, cancer, diabetes, hypertension, stroke, and cardiovascular disease, not taking drugs that cause a decrease in body fat or weight, not smoking, not pregnant, and not having anatomical abnormalities.

The dependent variable was waist circumference measured using the OneMed metline, height was measured using GEA microtoise, and SAD was measured using caliper with a precision of 0.1 cm. WC, height, and SAD were measured using standard techniques. All anthropometric measurements were done twice and the value was the average of the first and second measurements. Subjects with a waist circumference > 80 cm are categorized as abdominal obesity,(3) WHtR value > 0.5 cm are categorized as abdominal obesity,(22) SAD values >20 cm are categorized as abdominal obesity and at risk of developing cardiovascular disease.

The dietary intake data for the past month were obtained using SQ-FFQ which was asked to subjects by telephone. SQ-FFQ has contained food items featuring typical Indonesian food.(23) Furthermore, modifications were

created to the food list and made it more represented the society's diet in Semarang especially in female college students. Subjects are given the SQ-FFQ form along with a drawing of cutlery and a picture of food portions in the form of a word document to reduce bias. The author recorded and converted the food intake of the subjects in grams/day. The food intake data based on the FFQ are grouped and summed up into 21 modified food groups from previous studies which can be seen in Appendix 1. This food group was made based on similarity of their nutrient profiles, culinary usage among the foods, or specific nutrients as study interests and has been adapted to the food that is usually consumed in Semarang.(24) Composite food was a combination of processed food from animal and plant sources such as ketoprak, Indonesian chicken soup. Staple food with additional meat, chicken, and seafood also was grouped as composite food. Rujak and salad were grouped separately with their dressing and sauce.

Food groups that were suitable and feasible for use in the factor analysis were analyzed using Principal Component Analysis (PCA) with varimax rotation. Determination of the dietary patterns that will be used in the next analysis was based on eigenvalue ≥ 1.5. The formed dietary patterns will be named sequentially based on the eigenvalues of each dietary pattern starting from the highest to the lowest. The dietary pattern with the highest eigenvalue will be named Diet 1 and so on. The food group with a factor loading ≥ 0.5 was considered to have a significant correlation with the established dietary patterns.(25) The process of establishing a dietary patterns was done with SPSS software. After the dietary pattern was estabilished, The factor scores were grouped into each quartile. The higher the quartile of the dietary patterns, the higher the consumption of this patterns in the diet of a person.(26) The values of WC, WHtR, and SAD were shown in the distribution based on the established dietary patterns quartile groups. The confounding variable, namely physical activity was measured using the Global Physical Activity Questionnaire (GPAQ) using the online form (Google form).

The data of WC, WHtR, SAD, dietary score, and physical activity were tested for normality using the Kolmogorov-Smirnov test. Physical activity and dietary score were normally distributed, while WC, WHtR, and SAD are not normally distributed so that the dietary relationship tests with WC, WHtR, and SAD were analyzed respectively with the Spearman Rank test, as well as the relationship between physical activity and WC, WHtR, and SAD. Different tests on WC, WHtR, and SAD were also carried out in the lowest (Q1) and highest (Q4) quartiles of each dietary patterns established by the Mann-Whitney test. The level of accuracy in data analysis is 95% or a p-value of 0.05. All statistical tests were performed with SPSS 17.0 windows software.

RESULT

Characteristics of the Subject

Table I shows the characteristic of the subject of this research. The percentage of subjects classified as central obesity based on WC and WHtR is much higher than subjects classified as central obesity based on SAD. Based on the GPAQ questionnaire, 82.1% of the subjects have a moderate level of activity.

Table I. Distribution and Category of WC, WHtR, SAD, and Physical Activity

Variable	n	%	mean±DS	Median (Min-Max)
Age (year)			21.2±1.1	21(19-24)
Waist circumference (cm)				
Normal ≤80cm	80	51.3%	79.8±10.9	80(58-112)
Abdominal obesity >80cm	76	48.7%		
WHtR				
Normal ≤0,5	77	49.3%	0.51±0.07	0.5(0.37-0.71)
Central besity >0,5	79	50.6%		
SAD (cm)				
Normal ≤20 cm	142	91.0%	16.9±2.5	16.7(11.4-25.5)
Central obesity >20 cm	14	9.0%		
Physical activity MET minutes/week				
Low <600 MET minutes/week	11	7.1%	1642±1000	1310(80-4800)
Moderate 600 ≤ n < 3000 MET min/ week	128	82.1%		
High ≥3000 MET min/week	17	10.8%		

WHtR = Waist height ratio , SAD = Sagittal Abdominal Diameter ,DS= Deviation Standar, Min= minimum score, max = maximum score

Dietary patterns

Based on the results of PCA analysis, two dietary patternss are established with the eigenvalues of 4.4 named Dietary Pattern 1 and 2.1 named Dietary Pattern 2 which contribute 38.67% of variance to the established dietary patterns. This value means that the two dietary patternss represent 38.67% of all dietary patternss among female students in Semarang. Offal food groups, eggs, fried soybeans, and biscuits cannot be analyzed by PCA because they do not meet the requirements for the relationship with other variables.

Based on the factor loadings in Table II, fried snacks (maklor, cilor, gorengan, include deep-fried snacks and packaged foods), unfried snacks (cilok, dumplings, boba), poultry and red meat (fried chicken, opor ayam, rendang, satay), composite food (seblak, beef noodle soup, chicken fried noodle), dessert, staple food (rice

Table II.Factor loadings and Dietary Pettern made by PCA based on FFQ

The Food Group	Dietary Pattern 1	Dietary Pattern 2
Fruit	-0.132	0.758 *
Rujak dan Salad	-0.000	0.619*
Fried Snack	0.701*	-0.109
Unfried Snack	0.587*	-0.046
Meat and Poultry	0.503*	0.099
Fish and Seafood	-0.193	0.684*
Peanut	0.068	0.294
Fat and Oil	0.229	0.088
Composite Food	0559*	-0.086
Desert	0.677*	-0.101
Staple food	0.695*	-0.112
Fast food	0.637*	-0.267
Sweet drink	0.773*	-0.191
Vegetables	-0.103	0.771*
Unfried soy product	-0.051	0.639*
Milk and dairy product	0.240	-0.155
Tea, coffee, and mineral water	-0.314	0.490

* the food group have significant correlation with the dietary pattern

and noodles), fast food, and sweet drinks (Thai tea, milk tea, juice with sugar and milk), have a significant correlation (factor loading > 0.5) with the first patterns. The Dietary Pattern 1 is characterized by high energy density, high glycemic index, high in saturated fat and cholesterol, and low in fiber than Dietary Pattern 2.

Fruit (juice without added milk/sugar, fruit salad, *rujak*), fish and seafood (stir-fried and fried without flour), vegetables (stir-fried and boiled), unfried soy product (boiled, stir-fried, soy sauce) are significantly correlated (factor loadings > 0.5) with Dietary Pattern 2. Dietary Pattern 2 is characterized by low energy density, high fiber, and complex carbohydrates, low fat, and high in omega-3 fatty acids than Dietary Pattern 1.

The higher the quartile, the higher the amount of Dietary Pattern 1 intakes. The difference in WC, WHtR, and SAD values in the lowest intake group (Q1) and the highest intake group (Q4) is statistically significant (p <0.001). (Table III)

The increase in the quartile means that the Dietary Pattern 2 intakes of the subjects increases. The increase in the number of subjects with Dietary Pattern 1 intakes results in differences in the number of subjects who are obese as well as differences in the mean values of WC, WHtR, and SAD in each quartile. Difference tests in the lowest intake group (Q1) and the highest intake group (Q4) show that there are differences in WC, WHtR, and SAD (p <0.005). (Table IV)

Table III. WC, WHtR, SAD, Distribution Score Based on Quartile Group of Dietary Pattern 1 Score and and Different Test between Lowest Quartile and Highest Quartile

		Dietary Pattern 1				
Indicator of abdominal fat		**Q1 n=39**	**Q2 n=39**	**Q3 n=39**	**Q4 n=39**	***p*[a]**
WC	≤80cm	26	27	14	13	<0.001*
	>80cm	13	12	25	26	
Mean ± DS		74.9±9.0	75.5±8.3	82.6±9.0	86.1±13.0	
Median (Min – Max)		75(59.0-92.0)	76(58.0-91.9)	84(63.0-101.6)	85(60.0-112.1)	
WHtR	≤0,50	25	25	13	13	<0.001*
	>0,50	14	14	26	26	
Mean ± DS		0.48±0.06	0.48±0.06	0.53±0.06	0.55±0.083	
Median (Min – Max)		0.48(0.38-0.60)	0.49(0.37-0.59)	0.53(0.42-0.66)	0.55(0.37-0.71)	
SAD	≤20cm	39	39	36	28	<0.001*
	>20cm	0	0	3	11	
Mean ± DS		15.76±1.82	16.1±2.07	17.4±1.90	18.3±3.0	
Median (Min – Max)		15.4(12.6-19)	16.1(11.4-19.7)	17.6(14-20.9)	17.5(13.9-25.5)	

DS= Deviation Standard, Min= minimum score, max= maximum score, Q= factor score quartile, P[a]= mann whitney test on Q1 and Q4, *= there are significant difference abdominal fat score between Q1 and Q4

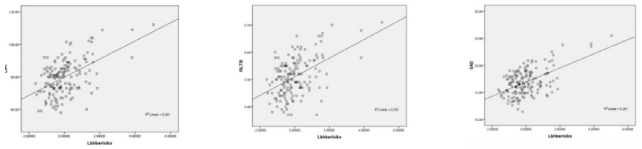
Table IV. WC, WHtR, SAD, Distribution Score Based on Quartile Group of Dietary Pattern 2 Score and and Different Test between Lowest Quartile and Highest Quartile

Indicator of abdominal fat		Dietary Pattern 2				
		Q1 n=39	Q2 n=39	Q3 n=39	Q4 n=39	p[a]
WS	≤80cm	17	13	21	26	0.002*
	>80cm	22	26	18	13	
Mean ± DS		82.2±11.1	83.3±10.8	79.7±9.6	73.8±10.0	
Median (Min – Max)		80(59.0-109.0)	84(59.0-108.8)	80(61-112.1)	73(58.0-95.0)	
WHtR	≤0.50	16	13	22	26	0.002*
	>0.50	23	26	17	13	
Mean ± DS		0.53±0.07	0.53±0.07	0.51±0.06	0.47±0.06	
Median (Min – Max)		0.52(0.38-0.68)	0.54(0.37-0.70)	0.49(0.38-0.71)	0.47(0.37-0.59)	
SAD	≤20cm	33	34	36	39	<0.001*
	>20cm	6	5	3	0	
Mean ± DS		17.4±2.4	17.6±2.2	17.4 ±2.4	15.0±1.9	
Median (Min – Max)		16.8(13.9-24.0)	18(13.9-23.8)	16.9(13.9-25.5)	14.9(11.4-18.6)	

Waist circumference , WHtR = Waist height ratio , SAD = Sagittal Abdominal Diameter, SD= Standart deviasi, Min= minimum score, max= maximum score, Q= factor score quartile, P[a]= mann whitney test on Q1 and Q4, *= there are significant difference abdominal fat score between Q1 and Q4

Relationship between Dietary Pattern 1 with Abdominal Fat

Increasing the score of Dietary Pattern 1 intakes will increase the value of WC (r = 0.406), WHtR (r = 0.389), and SAD (r = 0.370) (Fig. 1) with a level of significance <0.001. The correlation coefficient between WC and Dietary Pattern 1 is the highest and shows a moderate correlation. (Fig.1)

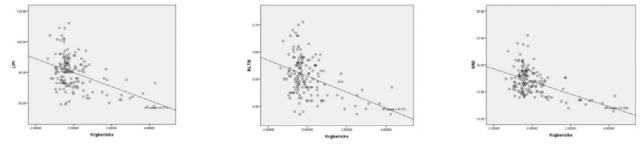


r = 0.406 p < 0.001 r = 0.389 p < 0.001 r = 0.370 p < 0.001

Figure 1: Relationship between Dietary Pattern 1 and WC, WHtR, and SAD

The Relationship between a Dietary Pattern 2 and Abdominal Fat

Increasing the score of Dietary Pattern 2 will reduce the value of WC (r = -0.320), WHtR (r = -0.338) and SAD (r = -0.353) (Fig. 2) with a level of significance <0.001. The correlation coefficient between SAD and Dietary Pattern 2 is the highest and shows a moderate correlation. (Fig.2)



r = -0.320 p < 0,.001 r = -0.338 p < 0.001 r = -0.353 p < 0.001

Figure 2: Relationship between Dietary Pattern 2 and WC, WHtR, and SAD

Relationship between Physical Activity and Abdominal Fat

The results of the correlation test of physical activity with WC, WHtR, and SAD are shown in Table V. Increased physical activity will be followed by a decrease in the value of WC (r = -0.140), WHtR (r = -0.160), and SAD (r = -0.134), but the strength is weak (r < 0.2). (Table V) Only the correlation between physical activity and WHtR has a significant relationship. Meanwhile, the correlation between physical activity and WC and SAD is not significant (p > 0.05).

Table V. Corelation Test between Physical Activity and WC, WHtR and SAD

		WC	WHtR	SAD
Physical Activity	r	-0.140	-0.160	-0.134
	p	0.082	0.046*	0.095

*= significant corelation (p<0,05)

DISCUSSION

The results of the study show the different percentage of subjects classified as abdominal obesity based on the WC, WHtR, and SAD. The difference occurs because subjects with a waist circumference < 80 cm with a low height, will produce a WHtR value > 0.5 which is based on the WHtR included in abdominal obesity. The difference in the percentage of subjects who are obese based on indicators of waist circumference and SAD is because waist circumference measures total abdominal fat both subcutaneous fat tissue and abdominal visceral fat tissue. The WHtR is an alternative anthropometric index whose threshold can be used widely because it is taken into account that subjects with lower height will have higher abdominal fat than taller subjects.(6) SAD is a strong anthropometry indicator for visceral abdominal and is a better predictor than WC.(27)

The two dietary patternss in this study describe 38.67% of the dietary patternss among female students in Semarang. The variance value is acceptable and feasible for further analysis.(25),(28) The Dietary Pattern 1 is a combination of fried snacks or not fried, poultry and red meat, composite food, dessert, staple food, and fast food. This dietary pattern is a combination of food groups wich having the characters of high energy density, high glycemic index, high in saturated fat and cholesterol, and low fiber. These food characteristics have a positive relationship with abdominal obesity.(24)

The Dietary Pattern 2 is a combination of, fish and seafood, vegetables, and non-fried soy products. This dietary patterns has characteristics that is low in calories and fat and has a high percentage of fiber which increases satiety and reduces total food intake.(29) This dietary patterns consists of a group of vegetables and fruit which are complex carbohydrates that can increase satiety and reduce the glycemic index of food. (30) This dietary pattern also have protective factors characteristics against abdominal obesity

The results of this study indicate a relationship between Dietary Pattern 1 and Dietary Pattern 2 with abdominal fat (WC, WHtR, SAD). These results are also confirmed by the significant differences in WC, WHtR, and SAD in the groups with the lowest (Q1) and highest (Q4) intakes. The increase in the amount of intake of Dietary Pattern 1 and Dietary Pattern 2 with abdominal fat is associated with an increase in the value of WC (r = 0.406), WHtR (r = 0.389), and SAD (r = 0.370). The Dietary Pattern 1 in this study is similar to those of unhealthy dietary patterns in Iran. They lead to over-consumption of foods with a high glycemic index. Food with a high glycemic index will cause an increased response to fat synthesis and fat accumulation, one of which is in the stomach and increases the waist circumference. These types of carbohydrates also increase hunger and cause overeating. That mechanism causes an increase in Dietary Pattern 1 intakes is associated with an increase in abdominal fat. (31)

Dietary Pattern 1 also tend to be high in fat due to the frying process and high in saturated fat and cholesterol because of the red meat group. Excessive meat intake is also reported to be positively associated with waist circumference.(32) These results are in line with studies in Chinese adults which show that animal food patternss (staple food, meat, fat/oil) are associated with abdominal obesity.(33) Dietary Pattern 1 has the characteristics of high energy density because it is influenced by the snack group, fast food, and composite food.(34) Fat in the meat and the frying process cause this food group to have a high energy density which causes excessive energy intake and increases abdominal obesity. Dietary Pattern 1 also have high characteristics of industrially-produced trans-fatty acids (IP-TFA) which increase the risk of abdominal obesity.

Inversely related to Dietary Pattern 1, an increase in the amount of intake of Dietary Pattern 2 is associated with a decrease in the value of WC (r = -0.320), WHtR (r = -0.338), and SAD (r = -0.353). This result is in line with a similar study on women in Iran which shows that a healthy dietary patterns (high in vegetables and fruit, low-fat food, and low in dairy products) is associated with a reduction in the incidence of abdominal obesity based on waist circumference anthropometric indicators. (31) Similar results are also found in adults in China. The traditional Chinese dietary patterns (high intake of fruits, vegetables, fish, and shrimp) is associated with decreased waist circumference values. (33)

Dietary Pattern 2 in this study is slightly similar to the principles of the Mediterranean diet (MD).(35) Many studies have considered MD to be a healthy dietary patterns and a protective factor against various chronic, metabolic, and cardiovascular diseases. Adherence to MD is also associated with a reduction in the risk of abdominal obesity.(36) The characteristics of the MD contain foods with low energy density such as vegetables and fruits that cause satiety so that the amount of energy intake is lower to prevent weight gain and an increase in waist circumference. Nutritional characteristics that are high in fiber and complex carbohydrates which are slowly absorbed and digested lead to decreased postprandial glycemia and insulinemia. This characteristic is associated with an increase in satiety and fat oxidation which causes a decrease in abdominal fat.(37)

Seafood and nuts also contain omega-3 polyunsaturated fatty acids (PUFA), which are widely known to be beneficial for the heart. High omega-3 PUFA intake is known to be negatively associated with abdominal obesity. High omega-3 PUFAs are protective against abdominal obesity because they increase basal fat oxidation which results in decreased fat mass.(38) These principles and characteristics cause a Dietary Pattern 2 in this study to be associated with a decrease in abdominal fat.

Aerobic exercise with or without weight loss is associated with decreased intra-abdominal fat.(39) This study shows that there is a relationship between physical activity and WHtR, but there is no significant relationship between WC and SAD. The absence of a relationship between physical activity and WC can be caused by other factors that influence the two variables, such as food intake. Another thing that affects the GPAQ measures physical activity for one week that does not necessarily reflect a long-term physical activity.(40)

The dietary patterns that is established based on the data allows the subject to adopt a dietary patterns easily because the dietary patterns is really around the subject. Dietary Pattern 2 can be implemented by increasing the intake of fruit (unsweetened fruit juice, salad, *rujak)*

and vegetables (stir-fried, boiled) and increasing protein intake through fish and seafood (stir-fried, seasoned, and fried) and soy products which are not fried (marinated, baked, boiled tempeh and tofu) to prevent the increase in central obesity. Dietary Pattern 1 such as high intake of snacks around campus (cilok, fried foods, dumplings, batagor), fast food (crispy fried chicken, burgers, nuggets), composite foods (meatballs, chicken noodles, seblak), and staple food intake (instant noodles, rice) which are excessive should be reduced to prevent central obesity. Policies related to the management of food sold in canteens around campus need to be implemented in a structured and sustainable manner with the direction of a dietitian. Management of the type of food sold must pay attention to the fulfillment of balanced nutrition. In addition, education also needs to be given to both sellers and students about abdominal obesity and various ways to avoid it, one of which is through food selection according to the recommendations of "Piring Makanku" and "Tumpeng Gizi Seimbang".

The application of "Piring Makanku", a campaign for a balanced nutrition diet from the Indonesian Ministry of Health at every meal is a good recommendation and suitable for this study. The recommendation of "Piring Makanku", vegetables and fruit fill half the plate, while the main food and side dishes are only parts of the plate,(21) and for the side dishes, such as fish and seafood or tofu and tempeh that are marinated, cooked with yellow spices, or stir-fried can be selected.

This study described the relationship between dietary patterns and various anthropometric indicators that have a strong relationship with visceral fat. In a pandemic condition, we continued to carry out comprehensive procedures to estimate the portion of food to obtain a portion that was accordance with subject consumed food. However, there are some weaknesses in this research. Offal food groups, eggs, fried soybeans, and biscuits cannot be analyzed by PCA and were not included in any of the food groups and also the cross-sectional design makes this study unable to explain the causal relationship between dietary patterns and abdominal obesity. Measurement of physical activity carried out a week also cannot describe activity in the long term. The Further research is needed to investigate the effect dietary patterns, physical activity and exercise habits on the abdominal obesity. Research using longitudinal studies with wider range and large number of subjects is deemed necessary to explain the causal relationship between these variables.

CONCLUSION

Based on the results of factor analysis, there were two dietary patternss among female students in Semarang City. Dietary Pattern 1 includes fried and non-fried snacks, poultry and red meat, composite food, dessert, staple food, fast food, while the Dietary Pattern 2 includes fruit, rujak/salad, fish and seafood, vegetables, and soy products that are not fried. Increasing the amount of food intake in Dietary Pattern 1 increases the values of WC, WHtR, and SAD, while increasing the amount of food intake in Dietary Pattern 2 reduces the values of WC, WHtR, and SAD.

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