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Food Calory Intake and Physical Activity in Obesity Risk among College Students in Surabaya City

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Abstract

Productive age is at the peak of its activities, physical activities carried out tend to be heavier than other ages and one of the characteristics of developed countries is a country that has a high level of health, intelligence, and work productivity, which is influenced by nutritional intake and diet. Diet and excess tend to be owned by obesity. Obesity is also included in the condition of malnutrition. The research aimed to know the effect of diet and physical activity on the risk of obesity in students at a university in Surabaya. The method used in this study is case-control with 152 obese and non-obese adult respondents at a university in Surabaya using a 24-hour recall questionnaire, IPAQ for physical activity, and measurement of BMI (body mass index). The results of the study on average food calorie intake in obese adult respondents were higher than non-obese. The most consumed type of food obesity group (60 people) is chicken meat (mean: 348.55 kcal), while the most consumed food non-obese group (60 people) is white rice (mean: 753.71 kcal). The biggest calorie consumed in obese groups (34 people) is pizza (1,925.48 kcal), while those that are most consumed by non-obese groups are white rice. The results of statistical analysis using the chi-square test showed that there were significant differences in food intake between obese adult groups and non-obese adult groups (p=0.000). The results of the analysis of physical activity obtained in the obese group showed that most

Introduction

The highest level of physical activity is usually at productive age which is in optimal condition both physically and biologically. Physical activity also tends to be heavier than other ages (Szychowska and Drygas, 2021). Busy activities often trigger stress and irregular eating patterns can also cause health instability to diseases that are often experienced by people, the emergence of stress can change the normal functions of the body and in the long run this condition will cause hormonal changes. that occurs in the body unconsciously. If intake is not maintained properly, it can cause disease to decrease productivity (Yaribeygi *et al*., 2017). Productive age is very important. A significant reduction in productive age can cause losses to the state so the state needs migratory workers from other countries to stabilize productivity (Prokopenko, 2021).

High productivity will be greatly influenced by a balanced nutritional state. This is closely related to one's diet because the quality and quantity of food/beverage consumption will affect one's level of health. Good and balanced nutritional intake makes the body weight normal (healthy), the body's resistance to disease is high, work productivity increases and it has a lower risk of chronic disease and premature death (Kim, 2021).

Overeating patterns tend to be owned by someone who is overweight or obese (based on BMI/body mass index calculations). This causes the person to be more sensitive than someone with a normal BMI to external hunger cues that arise from the taste and smell of food

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(Reents and Pedersen, 2021). In addition, they also tend to eat when they feel like not just when they feel hungry. Some of the causes of obesity are excessive food intake but lack of activity (Belfort-DeAguiar and Seo, 2018), genetic factors (through hormonal and neural mechanisms) (Mahmoud *et al*., 2022), dietary changes with age (Villani, 2022), and behavior (Olateju *et al*., 2021). Therefore, obesity should be avoided as early as possible because obesity harms the quality of health, health costs, and productivity in society. A person's nutrition at an earlier age (children and adolescents) will reflect nutrition at a later adult age so nutritional status needs to be considered from an early age (Purnell, 2018).

Obesity is also included as a condition of malnutrition because malnutrition is defined as having too little nutritional intake (undernourishment) or too much to cause obesity (Kobylińska *et al*., 2022; Lorensia *et al*., 2022). Conditions such as students or students tend to have limitations in choosing healthy food other than ready-to-eat food outside the home. The impact of the double burden of malnutrition is not only felt by the people themselves but also the wider economic burden, where losses due to stunting and malnutrition are estimated to be equivalent to 2-3% of Indonesia's GDP (Sogari *et al*., 2018).

Significant weight changes are also associated with an imbalance between the energy content of food intake and the energy expended when a person is doing physical activity (Lorensia *et al*., 2021; Suryadianta *et al*., 2020). Maintaining food intake is one of the precautions that must be carried out because it is important to maintain the balance of calories in the body. Calories consumed must also be compared with calories burned into energy through physical activity. The higher a person's physical activity, the more calories they burn (Aditama *et al*., 2022; Kim, 2021). The imbalance of calories is the cause of obesity because this can be seen from the law of thermodynamics or called the law of conservation which states the balance of calories, namely 'calories in the body must be equal to calories out'. Therefore, if you gain weight, it can be caused by eating too much and not doing enough physical activity (Camacho and Ruppel, 2017).

Measuring the level of obesity can be done using a method that is more often used to measure the level of obesity in adults, namely BMI, compared to standard criteria (Gutin, 2018; Khanna *et al*., 2022). BMI is calculated from body weight (kg) divided by the square of height (meters square). Measurement of Body Mass Index which is a method used to determine a person's nutritional status (Gutin, 2018; Khanna *et al*., 2022), then to see the food intake obtained each day will be obtained by using the 24-hour Multiple Food Recall method which has better reliability for measuring food intake or consumption because this method will record all types of food intake consumed for 1x 24 hours for 3 days so food consumption can be pictured (Bailey, 2021). This research was focused on productive age with student status because the level of education and one's employment status as a student (Gamage *et al*., 2021), can affect diet. The purpose of this study was the effect of diet and physical activity on the risk of obesity in students at a university in Surabaya.

Method

This study used a case-control research design with a retrospective approach. The research was conducted from March 2018 to May 2018. The ethical test for this research was number 034/KE/I/2018 from the University of Surabaya. The independent variables in this study were: obese and non-obese adult patients. The dependent variable in this study was food calorie intake for 24 hours. Sources of calories from food are produced from fat (1 gram = 9 calories) (largest), carbohydrates and protein (each 1 gram = 4 calories). The number of carbohydrates, proteins and fats consumed in a day expressed in grams and the amount of food intake translated into energy is calculated based on the results of a 3×24-hour food recall from a 24-hour food recall interview processed using the Nutrisurvey program. The classification level of calorie intake includes deficit (<70% DRA); not enough (70-80% DRA); enough (80-100% DRA); good (100-110% DRA); and more (>110% DRA) (DRA=Deficit Reduction Act) (Peraturan Menteri Kesehatan RI, 2019; Kim, 2021). Obesity is an imbalance due to the consumption of calories that is greater than the

burning of energy in the body, many factors cause obesity, for example, genetic and lifestyle factors. People were said to be obese if they had a BMI >25.0 kg/m^2 (Camacho and Ruppel, 2017).

The population in this study were students at a private campus in the city of Surabaya, East Java. The sample used in this study was active students who met the inclusion and exclusion criteria. This study used a purposive sampling technique. The research criteria included: (1) Filling in informed consent; (2) Do not have certain diseases such as renal and hepatic disorders; (3) Not experiencing digestive problems (eg toothache, etc.); (4) Not following a diet/fasting; (5) Not currently pregnant/breastfeeding. The national prevalence of obese adults was 15.4%. The prevalence of obese adults in the city of Surabaya in 2013 was 27.3% (Ministry of Health and Health, 2018). To calculate the sample size in this study, the Lemeshow formula was used, namely: n = (Zα2.P.Q)/(d2). The P value used was 27.3% obtained from RISKESDAS in East Java province in 2013 regarding the prevalence of obese adults with a value of Zα=1.96 due to α=0.05 with a value of d=10%. n=76.24 people~76 people. Then the minimum sample size (n) for each group in this study was 76 adults.

The measuring instrument used in the study was a 24-hour recall questionnaire given for 3 days (1 weekend day and 2 weekdays), namely by recording the type and amount of food consumed in the past 24-hour period through direct interviews. Then the food/beverage intake data is included in the nutrition survey program to obtain the total amount of energy and protein per day. And for measuring weight and height, digital weight scales and a microtoise stature meter were used for height. The data collection technique in this study used a quantitative structured interview method. In preparing the questions the researcher will use an interview guide for measuring food consumption, namely the 24-hour recall method. The 24-hour recall method was carried out three times, and days representing workdays and holidays were chosen. If the measurement is only done once (1 x 24 hours), the data obtained is not representative enough to describe a person's eating habits. So, it should be done repeatedly on non-consecutive days (Freedman *et al*., 2017).

Questionnaires that have been given to the respondents were then analyzed. Analysis of nutritional intake data was carried out using the average of each 24-hour recall calculation from three meetings. Calorie calculations use the nutritional survey application which will describe the level of food consumption in the form of calories, then will be assessed by looking at the calorie intake requirements recommended by the Deficit Reduction Act (DRA). Then it will classify the level of calorie intake based on the minimum size value divided into five, which has been determined, from these results will describe the level of food calorie intake.

Physical activity in adults can be measured using the International Physical Activity Questionnaire (IPAQ) (Cleland *et al*., 2018). Measurements of weight and height were carried out using a digital weight scale and a Microtoise stature meter, respectively. The original IPAQ was available in English. The validation process was carried out by translating the questionnaire into Indonesian and then giving it to three professional judges in the field of community pharmacy. The validity was enforced in the analysis step based on the opinion of professional judges in the field of community pharmacy. The IPAQ instrument used has been validated and previously used in Indonesia by Lorensia *et al*. (2021) and Lorensia *et al*. (2022). This can be measured by asking seven questions related to daily activities. The data scale obtained from the measurement of physical activity was an ordinal data scale, where the results obtained from the patient questionnaire were categorized into low, medium, and high physical activity. The variables in this study are ordinal and nominal scales, so this analysis was carried out using the Chi-square test. If the probability value was ≤0.05, then it is significant, in other words, the variable number of food calorie adequacy levels and physical activity levels can be associated with obese and non-obese adult respondents.

Result and Discussion

This research was conducted from March to July 2018 located at the University of Surabaya, Kalirungkut, East Surabaya, where 152 adult student respondents were obtained. The respondents were grouped into two groups, namely the obese group of 76 respondents and the non-obese group of 76 respondents. Respondents in this study were grouped based on obesity or non-obesity. Of the 152 respondents, the most common age was 23 years. The highest BMI in the obese group was 26.09 while in the non-obese group, it was 19.00. It was known that there was a significant difference in the distribution of age and BMI factors between the two groups (Table 1).

The average types of food consumed by obese respondents are rice, chicken, wheat bread and crackers. The drinks most often drunk by the respondents were milk and tea (Table 2). While the data from Table 3, the average types of food consumed by non-obese respondents are rice, tempeh, chicken meat, eggs and chilli sauce with the number of respondents being 60.53, 66, 45 and 49 respondents respectively. As for the beverage most often drunk by respondents was tea with a total of 67 respondents. The average 24-hour calorie recall in both groups was highest in the third measurement (holidays) the caloric value in the obese group was greater (average=3.001,35kcal) than that of the non-obese (average=2.352,62kcal). The results obtained on the chi-square test for ordinal data scales, namely the value of p0.000 with a P-value<0.05, there was a significant difference in the intake of food calories in the obese adult group and the adult group non-obese (Table 4).

The method of collecting calorie intake data in this study used the 24-hour food recall method. A person's nutritional intake can be influenced by knowledge about nutrition (Bailey, 2021), and certain habits or restrictions in choosing food. and economic status (Sogari *et al.*. 2018). A low level of knowledge regarding nutritional intake can increase the risk of a lack of balanced nutrition and a low level of health (Afina and Retnaningsih. 2018). While the habit of choosing food. such as dietary

Table 1. Characteristics of Respondents

Characteristics		Group				Difference Test
		Obese (n: 76)		Non-Obesity (n: 76)		
		Frequency	Percentage (%)	Frequency	Percentage (%)	P value
Age (years)	Late adolescence (17-25)	55	72.36	72	94.73	0.00
	Early adulthood (26-35)	21	27.63	4	5.26	
BMI (kg/m2)	Underweight (< 18.5)			11	14.47	0.00
	Normal (18.5-<24.9)			59	77.63	
	Overweight-obese (25.0-<27)	70	100			

The P-value <0.05 means there is a difference between the obese and non-obese groups
Source: Primary Data, 2018

Table 2. Calorie Type Profile of Respondents from the Obese Group

Food consumed	Number of respondents	Means (kcal)	Standard Deviation	CI 95%	Minimum (kcal)	Maximum (kcal)
White rice	56	762.37	177.03	118.93	520.1	975.1
Tempeh	46	184.77	24.84	16.69	164.8	247.2
Chicken meat	60	348.55	48.80	32.78	306.68	412.97
Shrimp crisp	55	77.93	17.13	15.84	64.2	96.25
Pizza	34	1925.48	385.22	296.11	1656.8	2563.8
Know	43	47.78	7.2729	4.88	38.5	56.23
Potato	21	210.37	141.00	117.87	128.71	542.21
Wheat bread	55	452.38	85.61	106.30	374.5	543.25
Indomie	55	621.19	147.03	154.29	439.45	739.45
Meatball	47	189.5	61.67	153.19	135.3	256.6
Chilli sauce	53	50.5	12.08	15.00	38.7	67.3
Vegetable soup	34	170.02	35.43	56.39	118.2	198.16
Milk	41	264.66	19.10	12.83	239.71	294.17
Tea	56	24.70	7.00	4.70	22.10	45.07

Source: Primary Data, 2018

Table 3. Calorie Type Profile of Respondents from the non-obese group

Food consumed	Number of respondents	Means (kcal)	Standard Deviation	CI 95%	Minimum (kcal)	Maximum (kcal)
White rice	60	753.71	212.53	54.90	432	990
Egg	45	250.60	28.32	8.50	214	294.17
Tempeh	53	76.06	15.91	4.38	52	96.25
Chicken meat	66	180.49	20.70	5.08	164.8	247.2
Shrimp crisp	34	35.62	5.54	1.61	31	38.5
Tofu	38	48.66	9.31	3.06	40	69
Catfish	25	180	27.46	11.33	134	198
Soup	37	80.22	4.92	1.64	64	96.3
Indomie	41	657.54	147.03	46.40	439.45	739.45
Chicken stew	28	171.66	19.13	5.96	164	192
Meatball	34	465.5	13.85	4.83	432	787
Sauteed kale	27	45.85	5.43	2.14	25	65
Chilli sauce	49	29.2	5.67	1.98	22	34
Tea	67	48.66	12.39	3.17	40	69

Source: Primary Data, 2018

Table 4. Test for Differences in Caloric Intake Levels between the Two Groups

Calorie Intake Level Classification*	Group				Chi-Square test	
	Obese (n: 76)		Non-Obesity (n: 76)			
	Frequency	Percentage (%)	Frequency	Percentage (%)	P value	Conclusion
Deficit	0	0	1	1.31%	0.000	Significantly different
Not enough	0	0	9	11.84%		
Enough	7	9.21%	54	71.05%		
Good	29	38.15%	12	15.78%		
More	40	52.63%	0	0		

*) Calorie Intake Level based on Table 1

Source: Primary Data, 2018

restrictions. excessive preference for certain foods. cause a poor variety of food so that the body does not get nutrition from other sources. In addition, alcohol use due to excessive alcohol consumption can contribute to nutritional deficiencies (Barve *et al.*. 2017). In this study, nutritional intake was found between obese adult respondents and non-obese adult respondents by looking at food nutrition intake. And the lack of food nutrition intake is possible because of the factors mentioned above but the above were not examined in this study.

Nutrients function to maintain and repair body tissues. meet energy requirements for metabolic processes. and growth at an early age. The nutritional condition of a person's food intake is called nutritional status which is categorized into four, i.e.: bad, not enough, good, and more. Nutritional status will not only affect one's body health but also work productivity. growth and development of the brain in childhood (Woldehanna *et al.*, 2017). Nutritional conditions are largely determined by a person's eating habits. namely, the quality and quantity of food consumed by a person and when nutritional needs are optimally met, good nutritional levels can be achieved. The nutrients needed by the body consist of six kinds namely. carbohydrate. proteins. fat. vitamin. minerals and water (Morris *et al.*, 2023). A person's diet is influenced by economic factors (Bloom *et al.*, 2017), socio-cultural (Buksh *et al.*, 2022), education and environment (Gubbels, 2020), and age (Bloom *et al.*, 2017).

From the results of the study, it was found that 3 types of food were most often consumed, namely: white rice. chicken eggs, and tempe. White rice, based on the food pyramid, is at the bottom. This means that it includes the type of food that can be consumed every day. namely grains. White rice has lower fiber than rice cooked from mixed (whole grain) rice. Adult men need about 2,200 calories which can be increased to 2,800 calories according to daily activities and work. The heavier the physical activity, the higher the calorie requirement (Capurso, 2021).

Egg consumption is not a risk factor for

Table 5. Test for Differences in Caloric Intake Levels between the Two Groups

Physical activity level	Group				Chi-Square test	
	Obese (n: 76)		Non-Obesity (n: 76)			
	Frequency	Percentage (%)	Frequency	Percentage (%)	P value	Conclusion
Low physical activity	47	61.84%	32	42.11%	0.047	Significantly different
Moderate physical activity	23	30.26%	42	55.26%		
High physical activity	2	2.63%	2	2.63%		

Source: Primary Data, 2018

CVD in healthy people. However. people at high risk of developing CVD such as diabetic or hypertensive patients should be careful with dietary cholesterol intake. especially eggs. Also. some people seem to be more sensitive to dietary cholesterol as their blood cholesterol levels are highly correlated with food intake. On the other hand. studies on egg components impacting CVD risk suggest that some egg components have a potential protective effect against CVD. while others may have adverse effects (Kuang *et al*., 2018). Consumption of tempeh which is a food rich in protein is beneficial for the health of the digestive tract (intestines). reduce the risk of heart and blood vessel disease. prevent cancer. and maintain bone health. Long-term consumption of tempeh does not show any side effects so it is relatively safe at the level seen in Central Java (Astuti *et al*., 2000).

The results of the analysis of physical activity obtained in the obese group showed that most of them had low physical activity (61.84%). Meanwhile, in the non-obese group, most of them had moderate physical activity (55.26%) (Table 5). Based on the results of the analysis with the Chi-Square Test, with P value of 0.047 was obtained (p value <0.05) so that it could be concluded that there was a significant difference in physical activity between the non-obese and obese respondent groups. This was supported by previous research evidence in which the results showed that there were significant differences in physical activity in the normal group compared to the obese group, where the obese group had a longer sitting time compared to the overweight group, and obesity had a relationship with low physical activity and physical function (Suliga *et al*., 2018).

Several factors affect physical activity for overweight or obese adolescents, the following were some of these factors: age, diet, disease, and measurement of physical activity. The physical activity of adolescents to adulthood increases until it reaches a maximum at the age of 25-30 years, then there will be a decrease in the functional capacity of the whole body, approximately 0.8-1% per year, but if you are diligent in exercising this decrease can be reduced by up to half (Sluijs *et al*., 2021). Food is one of the factors that affect activity, because if the amount of food and the portion of food is more, the body will feel tired easily, and does not want to do activities such as exercise or carry out other activities. The content of fatty foods also influences the body to carry out daily activities or exercise, it is better if the food consumed is considered for its nutritional content so that the body does not experience excess energy but cannot expel it optimally (Azzolino *et al*., 2020). Affects the capacity of the heart and lungs, body posture, obesity, haemoglobin/ blood cells and muscle fibers. If there are abnormalities in the body as above it will affect the activities to be carried out. Like a shortage of red blood cells, the person is not allowed to do strenuous exercise. Obesity also makes it difficult to do physical activity (Joyner and Casey, 2015). Physical activity is usually assessed using subjective self-reported measures such as diaries, physical activity, recall surveys, and questionnaires; these methods have been used in studies and epidemiological surveys conducted until now (Sattler *et al*., 2020).

Conclusion

Based on the results of research that has been done by looking at food calorie intake and physical activity in obese and non-obese adults, it can be concluded that in the different tests, the average food intake in obese adult respondents is higher than that of non-obese adult respondents. Most of the adult respondents in the obese group had a higher adequacy than the non-obese adult respondents. There is a

significant difference between food intake in obese and non-obese adults. Therefore. High-calorie intake is at risk of causing obesity. The average level of physical activity in non-obese is higher than in the obese group. By increasing physical activity and reducing food calorie intake, the risk of obesity in adulthood can be reduced.

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Food Calory Intake and Physical Activity in Obesity Risk among College Students in Surabaya City

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Abstract

Productive age is at the peak of its activities, physical activities carried out tend to be heavier than other ages and one of the characteristics of developed countries is a country that has a high level of health, intelligence, and work productivity, which is influenced by nutritional intake and diet. Diet, excess tend to be owned by obesity, obesity is also included in the condition of malnutrition.The research aimed knowing effect of diet and physical activity on the risk of obesity in students at a university in Surabaya.The method used in this study is case control with 152 obese and non obese adult respondents at a university in Surabaya using a 24-hour recall questionnaire, IPAQ for physical activity, and measurement of BMI (body mass index). The results of the study on average food calorie intake in obese adult respondents were higher than non-obese. The most consumed type of food obesity group (60 people) is chicken meat (mean: 348.55 kcal), while the most consumed food non-obese group (60 people) is white rice (mean: 753.71 kcal). The biggest calories consumed in obese groups (34 people) are pizza (1,925.48 kcal), while those that are most consumed by non-obese groups are white rice. The results of statistical analysis using the chi-square test showed that there were significant differences in food intake between obese adult groups and non-obese adult groups (p=0.000). The results of the analysis of physical activity obtained in the obese group showed that most of them had low physical activity (61.84%). Meanwhile, in the non-obese group, most of them had moderate physical activity (55.26%). Based on the results of the analysis with the Chi-Square Test, with P value of 0.047 was obtained (p value <0.05) so that it could be concluded that there was a significant difference in physical activity between the non-obese and obese respondent groups. The average level of physical activity in non-obese is higher than the obese group. By increasing physical activity and reducing food calorie intake, the risk of obesity in adulthood can be reduced.

Keywords

adult, calories, physical activity, obesity

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Food Calory Intake and Physical Activity in Obesity Risk among College Students in Surabaya City

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Abstract

Productive age is at the peak of its activities, physical activities carried out tend to be heavier than other ages and one of the characteristics of developed countries is a country that has a high level of health, intelligence, and work productivity, which is influenced by nutritional intake and diet. Diet and excess tend to be owned by obesity. Obesity is also included in the condition of malnutrition. The research aimed to know the effect of diet and physical activity on the risk of obesity in students at a university in Surabaya. The method used in this study is case-control with 152 obese and non-obese adult respondents at a university in Surabaya using a 24-hour recall questionnaire, IPAQ for physical activity, and measurement of BMI (body mass index). The results of the study on average food calorie intake in obese adult respondents were higher than non-obese. The most consumed type of food obesity group (60 people) is chicken meat (mean: 348.55 kcal), while the most consumed food non-obese group (60 people) is white rice (mean: 753.71 kcal). The biggest calorie consumed in obese groups (34 people) is pizza (1,925.48 kcal), while those that are most consumed by non-obese groups are white rice. The results of statistical analysis using the chi-square test showed that there were significant differences in food intake between obese adult groups and non-obese adult groups (p=0.000). The results of the analysis of physical activity obtained in the obese group showed that most

Introduction

The highest level of physical activity is usually at productive age which is in optimal condition both physically and biologically. Physical activity also tends to be heavier than other ages (Szychowska and Drygas, 2021). Busy activities often trigger stress and irregular eating patterns can also cause health instability to diseases that are often experienced by people, the emergence of stress can change the normal functions of the body and in the long run this condition will cause hormonal changes. that occurs in the body unconsciously. If intake is not maintained properly, it can cause disease to decrease productivity (Yaribeygi *et al*., 2017). Productive age is very important. A significant reduction in productive age can cause losses to the state so the state needs migratory workers from other countries to stabilize productivity (Prokopenko, 2021).

High productivity will be greatly influenced by a balanced nutritional state. This is closely related to one's diet because the quality and quantity of food/beverage consumption will affect one's level of health. Good and balanced nutritional intake makes the body weight normal (healthy), the body's resistance to disease is high, work productivity increases and it has a lower risk of chronic disease and premature death (Kim, 2021).

Overeating patterns tend to be owned by someone who is overweight or obese (based on BMI/body mass index calculations). This causes the person to be more sensitive than someone with a normal BMI to external hunger cues that arise from the taste and smell of food

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(Reents and Pedersen, 2021). In addition, they also tend to eat when they feel like not just when they feel hungry. Some of the causes of obesity are excessive food intake but lack of activity (Belfort-DeAguiar and Seo, 2018), genetic factors (through hormonal and neural mechanisms) (Mahmoud *et al.*, 2022), dietary changes with age (Villani, 2022), and behavior (Olateju *et al.*, 2021). Therefore, obesity should be avoided as early as possible because obesity harms the quality of health, health costs, and productivity in society. A person's nutrition at an earlier age (children and adolescents) will reflect nutrition at a later adult age so nutritional status needs to be considered from an early age (Purnell, 2018).

Obesity is also included as a condition of malnutrition because malnutrition is defined as having too little nutritional intake (undernourishment) or too much to cause obesity (Kobylińska *et al.*, 2022; Lorensia *et al.*, 2022). Conditions such as students or students tend to have limitations in choosing healthy food other than ready-to-eat food outside the home. The impact of the double burden of malnutrition is not only felt by the people themselves but also the wider economic burden, where losses due to stunting and malnutrition are estimated to be equivalent to 2-3% of Indonesia's GDP (Sogari *et al.*, 2018).

Significant weight changes are also associated with an imbalance between the energy content of food intake and the energy expended when a person is doing physical activity (Lorensia *et al.*, 2021; Suryadianta *et al.*, 2020). Maintaining food intake is one of the precautions that must be carried out because it is important to maintain the balance of calories in the body. Calories consumed must also be compared with calories burned into energy through physical activity. The higher a person's physical activity, the more calories they burn (Aditama *et al.*, 2022; Kim, 2021). The imbalance of calories is the cause of obesity because this can be seen from the law of thermodynamics or called the law of conservation which states the balance of calories, namely 'calories in the body must be equal to calories out'. Therefore, if you gain weight, it can be caused by eating too much and not doing enough physical activity (Camacho and Ruppel, 2017).

Measuring the level of obesity can be done using a method that is more often used to measure the level of obesity in adults, namely BMI, compared to standard criteria (Gutin, 2018; Khanna *et al.*, 2022). BMI is calculated from body weight (kg) divided by the square of height (meters square). Measurement of Body Mass Index which is a method used to determine a person's nutritional status (Gutin, 2018; Khanna *et al.*, 2022), then to see the food intake obtained each day will be obtained by using the 24-hour Multiple Food Recall method which has better reliability for measuring food intake or consumption because this method will record all types of food intake consumed for 1x 24 hours for 3 days so food consumption can be pictured (Bailey, 2021). This research was focused on productive age with student status because the level of education and one's employment status as a student (Gamage *et al.*, 2021), can affect diet. The purpose of this study was the effect of diet and physical activity on the risk of obesity in students at a university in Surabaya.

Method

This study used a case-control research design with a retrospective approach. The research was conducted from March 2018 to May 2018. The ethical test for this research was number 034/KE/I/2018 from the University of Surabaya. The independent variables in this study were: obese and non-obese adult patients. The dependent variable in this study was food calorie intake for 24 hours. Sources of calories from food are produced from fat (1 gram = 9 calories) (largest), carbohydrates and protein (each 1 gram = 4 calories). The number of carbohydrates, proteins and fats consumed in a day expressed in grams and the amount of food intake translated into energy is calculated based on the results of a 3×24-hour food recall from a 24-hour food recall interview processed using the Nutrisurvey program. The classification level of calorie intake includes deficit (<70% DRA); not enough (70-80% DRA); enough (80-100% DRA); good (100-110% DRA); and more (>110% DRA) (DRA=Deficit Reduction Act) (Peraturan Menteri Kesehatan RI, 2019; Kim, 2021). Obesity is an imbalance due to the consumption of calories that is greater than the

burning of energy in the body, many factors cause obesity, for example, genetic and lifestyle factors. People were said to be obese if they had a BMI >25.0 kg/m^2 (Camacho and Ruppel, 2017).

The population in this study were students at a private campus in the city of Surabaya, East Java. The sample used in this study was active students who met the inclusion and exclusion criteria. This study used a purposive sampling technique. The research criteria included: (1) Filling in informed consent; (2) Do not have certain diseases such as renal and hepatic disorders; (3) Not experiencing digestive problems (eg toothache, etc.); (4) Not following a diet/fasting; (5) Not currently pregnant/breastfeeding. The national prevalence of obese adults was 15.4%. The prevalence of obese adults in the city of Surabaya in 2013 was 27.3% (Ministry of Health and Health, 2018). To calculate the sample size in this study, the Lemeshow formula was used, namely: n = (Zα2.P.Q)/(d2). The P value used was 27.3% obtained from RISKESDAS in East Java province in 2013 regarding the prevalence of obese adults with a value of Zα=1.96 due to α=0.05 with a value of d=10%. n=76.24 people~76 people. Then the minimum sample size (n) for each group in this study was 76 adults.

The measuring instrument used in the study was a 24-hour recall questionnaire given for 3 days (1 weekend day and 2 weekdays), namely by recording the type and amount of food consumed in the past 24-hour period through direct interviews. Then the food/ beverage intake data is included in the nutrition survey program to obtain the total amount of energy and protein per day. And for measuring weight and height, digital weight scales and a microtoise stature meter were used for height. The data collection technique in this study used a quantitative structured interview method. In preparing the questions the researcher will use an interview guide for measuring food consumption, namely the 24-hour recall method. The 24-hour recall method was carried out three times, and days representing workdays and holidays were chosen. If the measurement is only done once (1 x 24 hours), the data obtained is not representative enough to describe a person's eating habits. So, it should be done repeatedly on non-consecutive days (Freedman *et al.*, 2017).

Questionnaires that have been given to the respondents were then analyzed. Analysis of nutritional intake data was carried out using the average of each 24-hour recall calculation from three meetings. Calorie calculations use the nutritional survey application which will describe the level of food consumption in the form of calories, then will be assessed by looking at the calorie intake requirements recommended by the Deficit Reduction Act (DRA). Then it will classify the level of calorie intake based on the minimum size value divided into five, which has been determined, from these results will describe the level of food calorie intake.

Physical activity in adults can be measured using the International Physical Activity Questionnaire (IPAQ) (Cleland *et al.*, 2018). Measurements of weight and height were carried out using a digital weight scale and a Microtoise stature meter, respectively. The original IPAQ was available in English. The validation process was carried out by translating the questionnaire into Indonesian and then giving it to three professional judges in the field of community pharmacy. The validity was enforced in the analysis step based on the opinion of professional judges in the field of community pharmacy. The IPAQ instrument used has been validated and previously used in Indonesia by Lorensia *et al.* (2021) and Lorensia *et al.* (2022). This can be measured by asking seven questions related to daily activities. The data scale obtained from the measurement of physical activity was an ordinal data scale, where the results obtained from the patient questionnaire were categorized into low, medium, and high physical activity. The variables in this study are ordinal and nominal scales, so this analysis was carried out using the Chi-square test. If the probability value was ≤0.05, then it is significant, in other words, the variable number of food calorie adequacy levels and physical activity levels can be associated with obese and non-obese adult respondents.

Result and Discussion

This research was conducted from March to July 2018 located at the University of Surabaya, Kalirungkut, East Surabaya, where 152 adult student respondents were obtained. The respondents were grouped into two groups, namely the obese group of 76 respondents and the non-obese group of 76 respondents. Respondents in this study were grouped based on obesity or non-obesity. Of the 152 respondents, the most common age was 23 years. The highest BMI in the obese group was 26.09 while in the non-obese group, it was 19.00. It was known that there was a significant difference in the distribution of age and BMI factors between the two groups (Table 1).

The average types of food consumed by obese respondents are rice, chicken, wheat bread and crackers. The drinks most often drunk by the respondents were milk and tea (Table 2). While the data from Table 3, the average types of food consumed by non-obese respondents are rice, tempeh, chicken meat, eggs and chilli sauce with the number of respondents being 60.53, 66, 45 and 49 respondents respectively. As for the beverage most often drunk by respondents was tea with a total of 67 respondents. The average 24-hour calorie recall in both groups was highest in the third measurement (holidays) the caloric value in the obese group was greater (average=3.001,35kcal) than that of the non-obese (average=2.352,62kcal). The results obtained on the chi-square test for ordinal data scales, namely the value of p0.000 with a P-value<0.05, there was a significant difference in the intake of food calories in the obese adult group and the adult group non-obese (Table 4).

The method of collecting calorie intake data in this study used the 24-hour food recall method. A person's nutritional intake can be influenced by knowledge about nutrition (Bailey, 2021), and certain habits or restrictions in choosing food. and economic status (Sogari *et al.*. 2018). A low level of knowledge regarding nutritional intake can increase the risk of a lack of balanced nutrition and a low level of health (Afina and Retnaningsih. 2018). While the habit of choosing food. such as dietary

Table 1. Characteristics of Respondents

Characteristics		Group				Difference Test
		Obese (n: 76)		Non-Obesity (n: 76)		
		Frequency	Percentage (%)	Frequency	Percentage (%)	P value
Age (years)	Late adolescence (17-25)	55	72.36	72	94.73	0.00
	Early adulthood (26-35)	21	27.63	4	5.26	
BMI (kg/m2)	Underweight (< 18.5)			11	14.47	0.00
	Normal (18.5-<24.9)			59	77.63	
	Overweight-obese (25.0-<27)	70	100			

The P-value <0.05 means there is a difference between the obese and non-obese groups

Source: Primary Data, 2018

Table 2. Calorie Type Profile of Respondents from the Obese Group

Food consumed	Number of respondents	Means (kcal)	Standard Deviation	CI 95%	Minimum (kcal)	Maximum (kcal)
White rice	56	762.37	177.03	118.93	520.1	975.1
Tempeh	46	184.77	24.84	16.69	164.8	247.2
Chicken meat	60	348.55	48.80	32.78	306.68	412.97
Shrimp crisp	55	77.93	17.13	15.84	64.2	96.25
Pizza	34	1925.48	385.22	296.11	1656.8	2563.8
Know	43	47.78	7.2729	4.88	38.5	56.23
Potato	21	210.37	141.00	117.87	128.71	542.21
Wheat bread	55	452.38	85.61	106.30	374.5	543.25
Indomie	55	621.19	147.03	154.29	439.45	739.45
Meatball	47	189.5	61.67	153.19	135.3	256.6
Chilli sauce	53	50.5	12.08	15.00	38.7	67.3
Vegetable soup	34	170.02	35.43	56.39	118.2	198.16
Milk	41	264.66	19.10	12.83	239.71	294.17
Tea	56	24.70	7.00	4.70	22.10	45.07

Source: Primary Data, 2018

Table 3. Calorie Type Profile of Respondents from the non-obese group

Food consumed	Number of respondents	Means (kcal)	Standard Deviation	CI 95%	Minimum (kcal)	Maximum (kcal)
White rice	60	753.71	212.53	54.90	432	990
Egg	45	250.60	28.32	8.50	214	294.17
Tempeh	53	76.06	15.91	4.38	52	96.25
Chicken meat	66	180.49	20.70	5.08	164.8	247.2
Shrimp crisp	34	35.62	5.54	1.61	31	38.5
Tofu	38	48.66	9.31	3.06	40	69
Catfish	25	180	27.46	11.33	134	198
Soup	37	80.22	4.92	1.64	64	96.3
Indomie	41	657.54	147.03	46.40	439.45	739.45
Chicken stew	28	171.66	19.13	5.96	164	192
Meatball	34	465.5	13.85	4.83	432	787
Sauteed kale	27	45.85	5.43	2.14	25	65
Chilli sauce	49	29.2	5.67	1.98	22	34
Tea	67	48.66	12.39	3.17	40	69

Source: Primary Data, 2018

Table 4. Test for Differences in Caloric Intake Levels between the Two Groups

Calorie Intake Level Classification*	Group				Chi-Square test	
	Obese (n: 76)		Non-Obesity (n: 76)			
	Frequency	Percentage (%)	Frequency	Percentage (%)	P value	Conclusion
Deficit	0	0	1	1.31%	0.000	Significantly different
Not enough	0	0	9	11.84%		
Enough	7	9.21%	54	71.05%		
Good	29	38.15%	12	15.78%		
More	40	52.63%	0	0		

*) Calorie Intake Level based on Table 1

Source: Primary Data, 2018

restrictions. excessive preference for certain foods. cause a poor variety of food so that the body does not get nutrition from other sources. In addition, alcohol use due to excessive alcohol consumption can contribute to nutritional deficiencies (Barve *et al.*. 2017). In this study, nutritional intake was found between obese adult respondents and non-obese adult respondents by looking at food nutrition intake. And the lack of food nutrition intake is possible because of the factors mentioned above but the above were not examined in this study.

Nutrients function to maintain and repair body tissues. meet energy requirements for metabolic processes. and growth at an early age. The nutritional condition of a person's food intake is called nutritional status which is categorized into four, i.e.: bad, not enough, good, and more. Nutritional status will not only affect one's body health but also work productivity. growth and development of the brain in childhood (Woldehanna *et al.*, 2017). Nutritional conditions are largely determined by a person's eating habits. namely, the quality and quantity of food consumed by a person and when nutritional needs are optimally met, good nutritional levels can be achieved. The nutrients needed by the body consist of six kinds namely. carbohydrate. proteins. fat. vitamin. minerals and water (Morris *et al.*, 2023). A person's diet is influenced by economic factors (Bloom *et al.*, 2017), socio-cultural (Buksh *et al.*, 2022), education and environment (Gubbels, 2020), and age (Bloom *et al.*, 2017).

From the results of the study, it was found that 3 types of food were most often consumed, namely: white rice. chicken eggs, and tempe. White rice, based on the food pyramid, is at the bottom. This means that it includes the type of food that can be consumed every day. namely grains. White rice has lower fiber than rice cooked from mixed (whole grain) rice. Adult men need about 2,200 calories which can be increased to 2,800 calories according to daily activities and work. The heavier the physical activity, the higher the calorie requirement (Capuano, 2021).

Egg consumption is not a risk factor for

Table 5. Test for Differences in Caloric Intake Levels between the Two Groups

Physical activity level	Group				Chi-Square test	
	Obese (n: 76)		Non-Obesity (n: 76)			
	Frequency	Percentage (%)	Frequency	Percentage (%)	P value	Conclusion
Low physical activity	47	61.84%	32	42.11%	0.047	Significantly different
Moderate physical activity	23	30.26%	42	55.26%		
High physical activity	2	2.63%	2	2.63%		

Source: Primary Data, 2018

CVD in healthy people. However. people at high risk of developing CVD such as diabetic or hypertensive patients should be careful with dietary cholesterol intake. especially eggs. Also. some people seem to be more sensitive to dietary cholesterol as their blood cholesterol levels are highly correlated with food intake. On the other hand. studies on egg components impacting CVD risk suggest that some egg components have a potential protective effect against CVD. while others may have adverse effects (Kuang *et al.*, 2018). Consumption of tempeh which is a food rich in protein is beneficial for the health of the digestive tract (intestines). reduce the risk of heart and blood vessel disease. prevent cancer. and maintain bone health. Long-term consumption of tempeh does not show any side effects so it is relatively safe at the level seen in Central Java (Astuti *et al.*, 2000).

The results of the analysis of physical activity obtained in the obese group showed that most of them had low physical activity (61.84%). Meanwhile, in the non-obese group, most of them had moderate physical activity (55.26%) (Table 5). Based on the results of the analysis with the Chi-Square Test, with P value of 0.047 was obtained (p value <0.05) so that it could be concluded that there was a significant difference in physical activity between the non-obese and obese respondent groups. This was supported by previous research evidence in which the results showed that there were significant differences in physical activity in the normal group compared to the obese group, where the obese group had a longer sitting time compared to the overweight group, and obesity had a relationship with low physical activity and physical function (Suliga *et al.*, 2018).

Several factors affect physical activity for overweight or obese adolescents, the following were some of these factors: age, diet, disease, and measurement of physical activity. The physical activity of adolescents to adulthood increases until it reaches a maximum at the age of 25-30 years, then there will be a decrease in the functional capacity of the whole body, approximately 0.8-1% per year, but if you are diligent in exercising this decrease can be reduced by up to half (Sluijs *et al.*, 2021). Food is one of the factors that affect activity, because if the amount of food and the portion of food is more, the body will feel tired easily, and does not want to do activities such as exercise or carry out other activities. The content of fatty foods also influences the body to carry out daily activities or exercise, it is better if the food consumed is considered for its nutritional content so that the body does not experience excess energy but cannot expel it optimally (Azzolino *et al.*, 2020). Affects the capacity of the heart and lungs, body posture, obesity, haemoglobin/ blood cells and muscle fibers. If there are abnormalities in the body as above it will affect the activities to be carried out. Like a shortage of red blood cells, the person is not allowed to do strenuous exercise. Obesity also makes it difficult to do physical activity (Joyner and Casey, 2015). Physical activity is usually assessed using subjective self-reported measures such as diaries, physical activity, recall surveys, and questionnaires; these methods have been used in studies and epidemiological surveys conducted until now (Sattler *et al.*, 2020).

Conclusion

Based on the results of research that has been done by looking at food calorie intake and physical activity in obese and non-obese adults, it can be concluded that in the different tests, the average food intake in obese adult respondents is higher than that of non-obese adult respondents. Most of the adult respondents in the obese group had a higher adequacy than the non-obese adult respondents. There is a

significant difference between food intake in obese and non-obese adults. Therefore. High-calorie intake is at risk of causing obesity. The average level of physical activity in non-obese is higher than in the obese group. By increasing physical activity and reducing food calorie intake, the risk of obesity in adulthood can be reduced.

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