

Relationship between Carbohydrate, Protein, and Fat Consumption with Obesity Incidence in 2014 UKI Faculty of Medicine Students

Hubungan Asupan Karbohidrat, Protein, dan Lemak dengan Kejadian Obesitas pada Mahasiswa Fakultas Kedokteran UKI 2014

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ARTICLE INFO

Received: 04-03-2022

Accepted: 31-03-2022

Published online: 24-11-2022

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 DOI:

[10.20473/amnt.v6i4.2022.385-391](https://doi.org/10.20473/amnt.v6i4.2022.385-391)

Available online at:

<https://e-journal.unair.ac.id/AMNT>

Keywords:

Obesity, Carbohydrate, Protein, Fat

ABSTRACT

Background: Obesity is an excessive fat accumulation in the body. Excessive consumption of carbohydrates, protein, and fat can increase the risk of obesity. It occurs when there is an imbalance between the energy number that goes through food and the energy that comes out through physical activity.

Objectives: This study aimed to know the relationship between carbohydrate, protein, and fat consumption and obesity among the 2014 UKI Faculty of Medicine Students.

Methods: This study was analytical observational research with a case-control design. The samples were 68 students from batch 2014. The data are analyzed by SPSS using Chi-square and logistic regression.

Results: A total of 27.9% of students were obese, of which 33.3% were male and 25.5% were female. Based on the results of bivariate analysis, there was a significant relationship between obesity and protein consumption ($p=0.048$) and fat consumption ($p=0.035$), while there was no correlation between obesity incidence and carbohydrate consumption ($p=0.373$).

Conclusions: The incidence of obesity in UKI Medicine Students batch 2014 was caused by the high consumption of fat and protein. It was not caused by the consumption of carbohydrates.

ABSTRAK

Latar Belakang: Obesitas adalah penimbunan lemak yang berlebihan di dalam tubuh. Konsumsi karbohidrat, protein, dan lemak berlebih dapat meningkatkan resiko obesitas. Hal ini terjadi ketika ada ketidakseimbangan antara jumlah energi yang masuk melalui makanan dengan jumlah energi yang keluar.

Tujuan: Penelitian ini bertujuan untuk mengetahui hubungan antara asupan karbohidrat, protein, dan lemak dengan kejadian obesitas pada mahasiswa Fakultas Kedokteran Universitas Kristen Indonesia tahun 2014.

Metode: Metode penelitian yang digunakan adalah analitik kuantitatif dengan desain studi case control. Jumlah sampel yang diambil sebanyak 68 orang. Teknik analisis menggunakan SPSS dengan uji Chi-square dan regresi logistik.

Hasil: Sebanyak 27,9% siswa mengalami obesitas, dimana 33,3% adalah laki-laki dan 25,5% adalah perempuan. Berdasarkan hasil analisa bivariat, terdapat hubungan antara kejadian obesitas dengan konsumsi protein ($p=0,048$) dan konsumsi lemak ($p=0,035$) sementara tidak ada hubungan antara obesitas dengan asupan karbohidrat ($p=0,373$).

Kesimpulan: Insiden obesitas pada mahasiswa kedokteran UKI angkatan 2014 disebabkan oleh tingginya konsumsi lemak dan protein, bukan karena konsumsi karbohidrat.

Kata Kunci: Karbohidrat, Lemak, Obesitas, Protein

INTRODUCTION

Obesity is an abnormal or excessive accumulation of fat in the body and poses a health risk. "Excess body fat can increase the risk of hypertension, cardiovascular disease, stroke, type 2 diabetes mellitus, some types of cancer, including breast, colon, prostate,

pancreatic, and kidney cancers, and conditions such as obstructive sleep apnea and osteoarthritis"^{1,2}. The overweight and obesity which is highly increased has been recognized as a global problem by the World Health Organization (WHO) and is a primary problem in developing countries. Increasing income, urbanization

and changing lifestyles clearly show that developing countries face the same problem of being overweight and obese³. According to the Body Mass Index (BMI) classification from the Indonesian Ministry of Health, a person is obese if the BMI calculation result is > 27.0. In the BMI classification, a person with a BMI value of 25.0-27.0 is said to have a lighter weight level. Normal body weight has a BMI value of 18.5-25.0. A BMI value below 18.5 is said to be underweight. Based on WHO data, "in 2014, there were >1.9 billion adults (≥18 years) worldwide overweight, 600 million of whom were obese. As much as 39% of the world's population aged 18 years are overweight, in which 38% are men, 40% are women"⁴. Meanwhile, 13% of the world's population aged 18 years are obese, of which 11% are male, and 15% are female⁵. The prevalence of obese adults is 15.4% of the entire population of Indonesia, of which 19.7% are adult men, and 32.9% are adult women. In the same year in the DKI Jakarta area, the total obese male adult population was 15.8%, and the obese adult female population was 26.2%⁶.

It is accepted globally that the cause of the obesity is the imbalance between expenditure and energy intake, besides, it is related to the dietary intake and lifestyle. Overeating energy from carbohydrates and fats and excess protein can lead to over-nutrition problems, seen in obesity. The habit of consuming unhealthy snacks with high-calorie content without consuming moderate vegetables and fruit as a source of fiber increases the risk of obesity⁷. In addition, consumption of food containing many artificial sweeteners, such as soda, could also increase the risk of obesity⁸. Restaurants that serve fast food are increasingly widespread and easy to find, so this high-calorie food is the choice of most people today because of its easy and fast access. A study conducted in Brunei Darussalam found that "most university students had poor eating habits (skipped breakfast, frequent snacking, fried food consumption at least three times per week and low intake of daily fruits and vegetables), and those with overweight/obesity had a significantly higher frequency of visits to fast food restaurants"⁹. Medical students are commonly known to experience challenging and stressful learning environment, hence it might affect their day-to-day routine, which includes choice of food. Among Indian medical students, "BMI was significantly associated with evening and night time fast food eating, along with less physical activity and intake of soft drinks"¹⁰.

Based on the data above, it is noted that many adults are obese. The authors are interested in researching the relationship between carbohydrate, protein and fat consumption on obesity in the 2014 UKI Faculty of Medicine Students. Based on the background

described above, the formulation of the problem in this study is how is the relationship between carbohydrate, protein and fat consumption on the incidence of obesity in 2014 UKI Faculty of Medicine students?

In general, this study is aimed at determining whether there was a relationship between carbohydrate, protein and fat consumption on the incidence of obesity in 2014 UKI Faculty of Medicine students.

METHODS

This study was conducted with a quantitative analytical design with a case-control approach to determine the relationship between carbohydrate, protein and fat consumption on obesity in students of Medical Faculty, Universitas Kristen Indonesia batch 2014. The study was conducted at the Faculty of Medicine, Universitas Kristen Indonesia, Jalan Mayjend Sutoyo No. 2, Cawang, East Jakarta, in November 2018. The population of this study was the 2014 UKI Faculty of Medicine students, which amounted to 210 students. The sample is part of the number and characteristics possessed by the population. The conclusions learned from the sample will be applied to the population. The Slovin formula was used to calculate the total studied samples. The formula found that the sample size needed for the study was 67.75, which was fulfilled to be 68. The data for this study were primary data covering the characteristics of the respondents (age, sex, weight, and height), eating menu and eating frequency, and Body Mass Index (BMI) to see obesity. Then secondary data include the number of 2014 UKI Medical Faculty students and data on the results of health examinations regarding weight and height, which were carried out during the survey so that the number of obese and non-obese students is known. The instruments of this research are a list of questionnaires, a 24-hour food recall form, a height measuring instrument (microtome), and a weight scale.

Obesity was assessed by measuring Body Mass Index (BMI). BMI is the most frequent and practical indicator to measure the population level of adults' overweight and obesity. The BMI value does not depend on age or gender⁷. What is assessed from BMI is the proportion of body weight to height. The BMI formula is:

$$BMI = \frac{Weight (kg)}{Height (m^2)}$$

After measuring weight and height, the measurement results are entered into the BMI formula. The interpretation of BMI results can be seen from the following classification table.

Table 1. Classification of BMI

Classification	BMI (kg/m ²)	
	Principal cut-off points	Additional cut-off points
Underweight	<18.50	<18.50
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49

Classification	BMI (kg/m ²)	
	Principal cut-off points	Additional cut-off points
Normal range	18.50 - 24.99	18.50 - 22.99 23.00 - 24.99
Overweight	≥25.00	≥25.00
Pre-obese	25.00 - 29.99	25.00 - 27.49 27.50 - 29.99
Obese	≥30.00	≥30.00
Obese class I	30.00 - 34.99	30.00 - 32.49 32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49 37.50 - 39.99
Obese class III	≥40.00	≥40.00

Source: World Health Organization¹

Data analysis was carried out after all data were collected. The researcher analyzed the data through several stages. First, editing, to check the completeness of the data. Food recall data that were collected were analyzed through the Nutri Survey 2007 program. Consumption data (carbohydrate, protein, and fat) were categorized into three groups: a) Less, if the consumption level was below 80% of Indonesian recommended dietary allowance (RDA), b) Moderate, if the consumption level was 80 to 120% RDA, and c) High, if the consumption level was more than 120% RDA. All data variables were then analyzed using the SPSS 24.0 (Statistic Package for the Social Science) program. The analysis technique used was univariate, bivariate, and multivariate analysis. Univariate analysis is used to describe a research result. In this study and consisted of frequency distribution and percentage of respondents' identities such as gender and age, and BMI, which were divided into two categories, namely obese and not obese, carbohydrate consumption, protein consumption, and fat consumption. Bivariate analysis was used to analyze two variables that were thought to

be related. The statistical test used is the test of Chi-square. If the p -value < 0.05 , H_0 is rejected, which means there is a relationship between the two variables. If the p -value > 0.05 , H_0 fails to be rejected, which means there is no relationship between the dependent and independent variables.

RESULTS AND DISCUSSION

The research was conducted at UKI Faculty of Medicine, in February 2018, with the population in this study was batch 2014 students, totaling 210 students. The sample taken for the study amounted to 68 students. Distribution based on the subject's characteristics, including the age and gender of the subject, is presented in Table 2. It shows that most of the respondents in this study were female (69.1%). The highest proportion of respondents in this study were 58.8% (40 people) of 21 years of age, 19 years of age had a proportion of 4.4% (3 people), 20 years of age 16.2% (11 people), and 22 years old as much as 20.6% (14 people).

Table 2. Characteristics of students in the 2014 UKI Medical Faculty

Characteristics	n	%
Gender		
Male	21	30.9
Female	47	69.1
Age		
19 years old	3	4.4
20 years old	11	16.2
21 years old	40	58.8
22 years old	14	20.6

Table 3 shows that the male and female respondents BMI who have a normal BMI (24 subjects) has a total which is more than respondents who have a BMI of underweight, overweight, and obesity. Even though it has a smaller number, the results of this measurement also show that the problem of BMI status, both less and too much among young adults, is still a problem. This figure is even higher than the 2013 RISKESDAS, where the prevalence of BMI in adults (>18 years) is found to be 8.7% underweight, 13.5% overweight and 15.4% obese.¹¹ The proportion of

respondents who are obese is 27.9%, and respondents who are not obese are 72.1%. The obesity prevalence among university students was also higher compared to other Asian countries such as Malaysia (5.2%)¹², India (10.7%)¹³, and Thailand (13%)¹⁴. In this study, males' obesity was higher (33.3%) compared to the female students' obesity (25.5%). This is consistent with a study in university students aged 18 to 22 years population from Turkey. It was found that male gender as independent predictor of obesity/overweight, and as much as 78.5% of male students had obesity (BMI ≥ 25

kg/m²)¹⁵. In private universities, “females were more likely to adopt the vegetarian/low calorie diet than males, while males were more prone to adopt a westernized diet, which is high loadings of fried potatoes and chips, fast foods, carbonated beverages, and desserts with slightly lower but still a positive loading of hot beverages such as coffee, tea”¹⁶.

For the average level of carbohydrate consumption adequacy for three measurements, it was found that the male and female respondents who were included in the less category had a greater number of 29 people (42.6%), while for the moderate category it was twenty-three people (33.8%) and high category amounted to 16 people (23.5%). In the average level of protein consumption adequacy for three measurements, it was found that male and female respondents belonging to the high category had a greater number of 27 people (39.7%), while for the less category it was 24 people (35.3%) and the moderate category 17 people (25.0%). Meanwhile, in the average level of fat consumption adequacy for three measurements, it was found that male and female respondents who were included in the high category had a higher number of 33

people (48.5%), while for the less category there were 21 people (30.9%) and the moderate category amounted to 14 people (20.6%). In this study, we found high average level of fat consumption in male and female; however, in other similar study it was found males were particularly more prone to adopt high calories meals than females¹⁶.

Majority of male students consumed less carbohydrate (52.4%), less protein (38.1%), and high fat (57.1%). Meanwhile, female students consumed less carbohydrate (38.3%), but had high consumption for protein (42.6%) and fat (44.7%). A study of 231 students from Central Michigan University discovered that both male and female students had high consumption of fat, but females had lower saturated fat intake compared to those of males due to better nutritional knowledge¹⁷. Moreover, “male students consumed a higher energy content from fat and engaged less often in various healthful eating habits (e.g., reading food labels, having breakfast) than female students”¹⁸. Another possible reason is that “female students pay more attention to their physical appearance and body figure and try to restrict caloric food consumption than that of males”¹⁹.

Table 3. Body mass index and nutritional intake based on recommended dietary allowance

Variables	Male		Female		Total	
	N	%	N	%	N	%
BMI Status						
Underweight	4	19.1	7	14.9	11	16.1
Normal	7	33.3	17	36.2	24	35.3
Overweight	3	14.3	11	23.4	14	20.6
Obese	7	33.3	12	25.5	19	28
Obesity Status						
Not Obese	14	66.7	35	74.5	49	72.1
Obese	7	33.3	12	25.5	19	27.9
Carbohydrate Consumption						
Less	11	52.4	18	38.3	29	42.6
Moderate	7	33.3	16	34.0	23	33.8
High	3	14.3	13	27.7	16	23.5
Protein Consumption						
Less	8	38.1	16	34.0	24	35.3
Moderate	6	28.6	11	23.4	17	25.0
High	7	33.3	20	42.6	27	39.7
Fat Consumption						
Less	5	23.8	16	34.0	21	30.9
Moderate	4	19.0	10	21.3	14	20.6
High	12	57.1	21	44.7	33	48.5

The study found no relationship between carbohydrate consumption level with obesity ($p>0.05$) (Table 4). Research at the East Java Provincial Health Office showed the same results with a p -value of 0.523²⁰. Based on the theory, excessive consumption of carbohydrates will cause obesity. Carbohydrates consumed will be broken down into glucose. If the body no longer needs glucose, excess glucose will be stored in glycogen in the liver and fat. When needed, for example, in a state of hypoglycemia, glycogen will be broken down through the process of gluconeogenesis. The study results were different from the theory because the respondents did not fill out the complete food recall

questionnaire completely. On the other hand, several studies have shown a significant relationship between carbohydrate consumption and obesity, as conducted by Grace Duma²¹ and Rian Diana et al²². “Moderate low-carbohydrate diet (M-LCD) has shown significant effect on obesity status after three months intervention and decrease in carbohydrate intake (g/day) and %carbohydrate were correlated with decrease (%) in visceral adipose tissue (VAT), and the correlations were significant in men even after adjusting for age and changes in energy intake in multiple regression analysis”²³.

Table 4. Relationship between carbohydrate, protein, and fat consumption level with obesity incidence in 2014 UKI Medical Faculty students

Consumption Level	BMI				Total	%	p-value
	Not Obese	%	Obese	%			
Carbohydrate							
Less	19	65.5	10	34.5	29	100.0	0.373
Moderate	19	82.6	4	17.4	23	100.0	
High	11	68.8	5	31.2	16	100.0	
Protein							
Less	20	83.3	4	16.7	24	100.0	0.048
Moderate	14	82.4	3	17.6	17	100.0	
High	15	55.6	12	44.4	27	100.0	
Fat						100.0	
Less	18	85.7	3	14.3	21	100.0	0.035
Moderate	12	85.7	2	14.3	14	100.0	
High	19	57.6	14	42.4	33	100.0	

Abbreviations: BMI, Body Mass Index.

In this study, protein was significantly correlated with protein intake ($p < 0.05$). As much as 42.4% of obese students had high protein intake. Theoretically, protein consumption, especially animal protein, can be a risk factor for obesity. Animal protein contains high levels of fat, cholesterol, and sugar. So that excessive consumption and lasting for a long time will increase the risk of obesity. A study conducted in 1804 adolescents aged 12.5 to 17.5 years from 10 cities in Europe (Stockholm, Athens, Heraklion, Rome, Zaragoza, Ghent, Lille, Dortmund, Vienna, and Pecs) found that BMI and body fat percentage were positively associated with energy percentage of animal protein²⁴. It should be emphasized, nevertheless, that their average total protein intakes exceeded the World Health Organization (WHO) recommendations (10.0 – 15.0% of the total energy intake) and the estimated average requirements (EAR) and population reference intake (PRI) of the European Food Safety Authority (EFSA)²⁴. Significant positive associations between intakes of total protein, animal protein, branched-chain amino acids (BCAAs), and sulfur-containing amino acids (SCAAs) with general body adipose which indicated by body-mass-index-for-age z-scores (BMIz). Animal protein and SCAAs were also associated with central obesity which indicated by waist-to-height ratios (WtHR). Total and animal protein and BCAA and SCAA were also significantly associated with fat mass²⁵. A study in Belgium showed that in males aged ≥ 15 years, animal protein intake was positively associated with BMI and waist circumference²⁶. Meat consumption of ≥ 1 kg for 28.5 months could increase the risk for weight gain²⁷. In a randomized controlled lifestyle intervention, reducing the consumption of red meat could lower the mean BMI value among Chinese students²⁸. Among females, those who consume more eggs tended to consume more red meat and higher energy and protein intake, resulting in the significant dose-response relationships between egg consumption and overweight with excessive body fat/central obesity. It was notable that every 10 g/day increment of egg reduces 23% risk overweight and central obesity and overweight and excessive body fat²⁹.

Fat intake was also correlated with obesity in university students ($p < 0.05$), in which almost a half of obese students consume more than 120% RDA of fat. It is in line with a study conducted that showed a relationship between fat consumption and obesity with a Chi-square analysis value of $p = 0.001$ ²⁰. A study analyzing the effect of different amount of fat intake to body fatness (body weight, body mass index, or waist circumference) further supported this finding and showed that diets lower in total fat were associated with lower relative body weight by 1.6 kg, lower body mass index (-0.51 kg/m²), and lower waist circumference by 0.3 cm³⁰. High intake of dietary saturated fatty acids (SFA) and low intake ratio of polyunsaturated fatty acids (PUFA) to SFA (< 0.38) could increase the risk of having a BMI ≥ 25 kg/m², which is overweight according to WHO indicator, and being abdominal obese³¹. Frequent consumption of meat (> 3 -4 times a week) and eggs ($> \text{once a day}$) were associated with a significantly higher risk of obesity/overweight owing to the associated higher intake of total fat, saturated fat, and total calories. High intake of total fat and saturated fat might be the main cause of increased risk for central obesity¹⁵. High energy % of saturated fat could lead to increased risk of obesity in Bahraini children³². Compared with carbohydrates that use 23% of energy to be converted into fat stores in adipose tissue, fat only requires 3% of energy. Therefore, fat consumption tends to cause obesity more quickly than carbohydrates and protein³³. In this study, fat and protein consumption were the etiologies of high incidence of the obesity. Knowledge about type of meals should be known before eating.

CONCLUSIONS

After all of the data were analyzed, then it a conclusion was formed. From the result found it is known that the variables of protein consumption and fat consumption are significantly related to the incidence of obesity in the 2014 UKI Faculty of Medicine students ($p < 0.05$). However, the variable of carbohydrate consumption was not significantly related to the

incidence of obesity in students of the 2014 UKI Faculty of Medicine students ($p>0.05$). Detection of the nutritional status of adolescents and adults can be carried out periodically at schools or campuses for all adolescents and students to prevent under-nutrition and over-nutrition in adolescents and young adults due to incorrect consumption of carbohydrates, fats, and proteins. The campus must provide counselling about the importance of adequate nutrition and activity or other risk factors that cause obesity to prevent increased obesity rates among productive age. This can be done by providing the material included in the lecture module and counseling about the importance of nutritional intake or other risk factors that cause obesity to prevent the increase in obesity rates among productive age.

ACKNOWLEDGMENTS

We would like to express our special thanks to the Dean of Medical Faculty, Universitas Kristen Indonesia for his support and to all of the medical students who became our subjects of this study.

CONFLICT OF INTEREST

All authors have no conflict of interest in this article.

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