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WORD COUNT 3180
TIME SUBMITTED 14-MAR-2024 04:57PM
PAPER ID 107561989

RESEARCH ARTICLE | MAY 08 2023

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AIP Conference Proceedings 2730, 070004 (2023)
https://doi.org/10.1063/5.0128172

The Correlation Between Macronutrient Intake with Risk Factors of Cardiometabolic Disease in Minangkabau Women Ethnicity

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Abstract. Macronutrients are the primary source of human energy. It also affects all processes that occur in the body, including risk factors for cardiometabolic disease. The study aimed to determine the relationship between macronutrient intake and risk factors for cardiometabolic disease in Minangkabau women ethnicity. This study used a cross-sectional design conducted on 118 women in Padang City, West Sumatera. Data of macronutrient intake were taken through guided interviews using a semiquantitative-food frequency questionnaire (SQ-FFQ). Blood pressure (BP) was measured by using a sphygmomanometer in a sitting position. Lipid profile and blood glucose was examined from venous blood. Data were analyzed by using the Rank-Spearman correlation test. The study results show that the average total energy intake was 1777.3 (1000.9 - 3548.9) Kcal; carbohydrate intake was 233.6 (120.9 - 436.4) grams; fat intake was 59.2 (15.4 - 191.5) grams, and protein intake was 76.9 (29.9 - 253.4) grams. BP and blood glucose were in the normal range, but there were some subjects with dyslipidemia. There was a significant correlation between total intake, fat intake, and protein intake with systolic blood pressure (BP) and fat intake correlated with diastolic BP. There was no significant correlation between macronutrient intake and lipid profile in Minangkabau women ethnicity. It can be concluded that macronutrient intake was correlated with systolic BP in Minangkabau women's ethnicity.

INTRODUCTION

The primary and the largest source of energy consumed by the entire world population is macronutrients. Macronutrients consist of carbohydrates, fats, and proteins. However, currently, there is a change in the total energy consumption pattern where there is less consumption of fruits and vegetables which accompanies the high consumption of sugar and fat. There is an increase in the energy function from 2803 kcals/d per capita in 1999 to 2940 kcals/d per capita in 2015 [1]. In Indonesia, the people's main energy source is carbohydrates. The results of the 2010 Primary Health Research (Riskesdas) showed that Indonesian people consume 255 grams of carbohydrates per day, equivalent to 61% of the total energy [2].

Carbohydrates are also the main source of energy for the people of West Sumatra, especially the Minangkabau ethnic group. Data in 2010 states that the people of West Sumatera have carbohydrates as much as 62%, fat as much as 26.6%, and protein as much as 13.5%. This is in line with the culture of the Minangkabau community, which states that they have not eaten if they have not eaten rice. The body's daily excess energy will be stored in energy reserves, especially in the form of fat, which is stored in adipose tissue. It causes obesity [3, 4]. In addition to obesity, high consumption of macronutrients affects various organs of the body. High carbohydrate consumption can cause a continuous increase in blood sugar so that the body can no longer compensate for one day so that diabetes mellitus occurs. Then high fat intake is associated with the incidence of dyslipidemia [5].

3rd International Conference of Bio-Based Economy for Application and Utility
AIP Conf. Proc. 2730, 070004-1–070004-5; https://doi.org/10.1063/5.0128172
Published by AIP Publishing. 978-0-7354-4474-4/$30.00

Dyslipidemia plays a role in the occurrence of atherosclerosis which is a precursor to cardiovascular and cardiometabolic diseases. Cardiometabolic disease is the leading cause of death in all countries in the world. Cardiometabolic disease is caused by various risk factors, including obesity, an unhealthy diet, and a sedentary lifestyle. Other risk factors of cardiometabolic diseases are hypertension, dyslipidemia, and high blood glucose [6]. All of these risk factors are thought to be related to macronutrient intake.

Several studies have stated that there is a relationship between total energy intake, carbohydrate intake, fat and protein intake with blood pressure, nutritional status, lipid profile, and blood sugar [7, 8, 9, 10, 12]. However, these results are still controversial because there are studies that state no relationship between macronutrient intake and blood pressure or lipid profile [13, 14]. In this study, we studied macronutrient intake and its relationship to risk factors for cardiometabolic disease in Minangkabau women's ethnicity.

MATERIALS AND METHODS

The study was conducted in Padang, West Sumatera, Indonesia, in 2021. This study used a cross-sectional design. The research respondents were 118 women from the Minangkabau ethnic group aged 19 - 55 years. The Minangkabau ethnic group is a tribe originating from West Sumatera. In this study, the Minangkabau ethnic boundaries are if the two lineages above are original Minangkabau people and there is no marriage with another ethnicity.

Data on the source of food ingredients' intake was taken through guided interviews by trained enumerators using a semiquantitative-food frequency questionnaire (SQ_FFQ). Blood pressure (BP) was measured twice using a sphygmomanometer in a sitting position. After the respondent finished registration, blood pressure was measured in a sitting position. Then the respondent was asked to rest for 10 minutes, and a second blood pressure measurement was taken. The blood pressure results used are the average values of the two sizes. Lipid profile dan blood glucose was examined from venous blood after 8 -10 hours fasting. Data were analyzed by using the Rank-Spearmen correlation test.

This research has received approval from the ethical committee of the Medical Faculty of Andalas University with registration number 491 / UN.16.2 / KEP-FK / 2021.

RESULTS AND DISCUSSION

Based on study results, the description of respondents' macronutrient intake can be seen in Table 1.

TABLE 1. Macronutrients intake of respondents (n = 118)

Variable	Mean	SD	Minimum	Maximum
Total energy intake (g)	1777.3		1000.9	3548.9
Carbohydrate Intake (g)	233.6		120.9	436.4
Fat Intake (g)	59.2		15.4	191.5
Protein Intake (g)	76.9		25.9	253.4
Systolic Blood Pressure (mmHg)	112.9	9.3		
Diastolic Blood Pressure (mmHg)	77.3	6.5		
Total Cholesterol (mg/dL)	208.4	43.3		
HDL Cholesterol (mg/dL)	59.1	10.2		
LDL Cholesterol (mg/dL)	127.7		11.00	238.0
Triglycerides (mg/dL)	97.4		33.00	271.0
Fasting Blood Glucose (mg/dL)	92.1		67.00	275.0

From Table 1, we can know that the average total energy intake was 1777.3 (1000.9 - 3548.9) Kcal; carbohydrate intake was 233.6 (120.9 - 436.4) grams; fat intake was 59.2 (15.4 - 191.5) grams, and protein intake was 76.9 (15.9 - 253.4) grams. This amount of intake is still in the normal range by the recommended nutritional adequacy rate.

Based on the recommended nutritional adequacy rate for the Indonesian people in 2019, the total amount of energy is 2100 kcal, carbohydrate intake is 280 - 360 grams/day, protein intake is 60 grams/day, and fat intake is 50 - 65% per day [15]. However, if assessed per individual, we obtained differences in the composition of macronutrients consumed. Some subjects consumed more fat or carbohydrates or both than others. Consumption of high carbohydrates and fats can continuously cause a buildup of energy in the body, leading to weight gain and

obesity. It is also a risk factor for various diseases such as hypertension, diabetes mellitus, dyslipidemia, coronary heart disease, and stroke [6, 7].

From above Table 1, we also know that blood pressure was in the normal range, but some subjects had dyslipidemia. The ATP III guidelines for determining lipoprotein profile say that the normal range of total cholesterol is under 200 mg/dL, triglycerides under 150 mg/dL, HDL-cholesterol above 45 mg/dL, LDL-Cholesterol under 130 mg/dL. The normal fasting blood sugar level is below 126 mg/dL [16].

TABLE 2. Correlation Between Macronutrient Intake With Blood Pressure (n=118)

Variable	Systolic BP		Diastolic BP	
	r	p-value	r	p-value
Total energy intake (g)	0.189	0.041*	-0.037	0.689
Carbohydrate Intake (g)	-0.131	0.156	0.099	0.286
Fat Intake (g)	0.185	0.045*	0.183	0.048
Protein Intake (g)	-0.189	0.040*	-0.091	0.328

r = correlation coefficient
** = significant at 0.05

In Table 2, we can see a significant weak positive correlation both on the systolic and diastolic BP. In the systolic BP, a significant weak positive correlation is found in the correlations with the intake of total energy, fat, and protein. In the diastolic BP, a significant weak positive correlation is found in the correlation with fat intake.

In this study, it was found that there was a relationship between macronutrient intake and blood pressure. This result is in line with the research of Mathew et al. [7], and Kadambi et al. [10], which stated that high-calorie intake increases blood pressure. Several other studies have also stated that fat intake is associated with hypertension. High fat intake will increase free fatty acids in the body [8, 9]. However, these results contradict the research of Najafian et al. [13], which showed that there was no relationship between high calorie intake and blood pressure.

Mafaza's research conducted in Padang, West Sumatera, also showed that there was a significant relationship between fat intake and hypertension. Excess fat intake will increase free fatty acids in the body, which play a role in increasing blood levels of Low-Density Lipoprotein (LDL). This LDL will trigger an increase in atherosclerosis and in blood vessels, which will lead to hypertension [11]. These results are also in line with Zainuddin and Yunawati that there is a relationship between fat intake and the incidence of hypertension [12].

Protein intake also has a significant correlation with blood pressure. This result is in line with Candra et al. [8], which stated that high protein intake can cause blood pressure to increase (hypertension occurs). Like carbohydrates and fats, excess protein intake is also stored in the form of fat. This will certainly affect various organs, including increasing the risk of hypertension [17].

TABLE 3. Correlation between macronutrient intake with BMI and WC.

Variable	BMI		Waist Circumference	
	r	p-value	r	p-value
Total energy intake (g)	-0.059	0.522	-0.150	0.106
Carbohydrate Intake (g)	0.057	0.543	-0.023	0.808
Fat Intake (g)	0.193	0.036*	0.252	0.006**
Protein Intake (g)	-0.113	0.221	-0.215	0.019*

r = correlation coefficient
* = significant at 0.05
** = significant at 0.01

From Table 3. above, we can see a significant correlation between fat intake and BMI and WC, while the intake of other macronutrients is not related. Kim and Song's research states that there is no evidence that macronutrient intake is associated with BMI, WC, and other risk factors for metabolic disease [18]. Previous research has shown that macronutrient intake, both high and low, is associated with total body fat and obesity. This shows that variations

in carbohydrate, fat, and protein intake can affect obesity. In addition, macronutrient intake is also associated with metabolic abnormalities that can increase the risk of cardio-metabolic disease [19, 20, 21].

TABLE 4. Correlation between Macronutrient Intake with Lipid Profile and Blood Glucose

Variabel	Total Cholesterol		HDL-Cholesterol		LDL-Cholesterol		Triglyseride		Fasting Blood Glucose	
	r	p	r	p	r	p	r	p	r	p
Total energy Intake (g)	0.075	0.420	0.229	0.013*	0.005	0.956	-0.012	0.895	-0.137	0.140
Carbohydrate Intake (g)	0.195	0.034*	0.211	0.022*	0.122	0.189	0.074	0.429	-0.046	0.624
Fat Intake (g)	-0.132	0.154	0.148	0.109	-0.180	0.052	-0.121	0.192	0.203	0.027*
Protein (g) Intake (g)	0.060	0.515	0.202	0.028**	0.022	0.814	-0.017	0.853	-0.119	0.201

r = correlation coefficient
* = significant at 0.05
** = significant at 0.01

From Table 4, we can see a significant weak positive correlation between carbohydrate intake and total cholesterol levels of research subjects. Total energy intake, carbohydrate, and protein intake were significantly correlated with HDL-cholesterol levels. In addition, fat intake was correlated with fasting blood sugar levels.

Research in Korea states that a high intake of carbohydrates is associated with a decrease in HDL-C levels and an increase in triglyceride levels [17]. The affiliations between carbohydrate intake and HDL-C include advance proof of the complex and unfavorable part that dietary carbohydrates play in serum lipid profile [20,21]. A high carbohydrate intake is also related to lower HDL-C and higher TAG concentrations in adults. Other studies have shown that high protein intake reduces cholesterol and triglyceride levels, while fat intake causes an increase in LDL-C and triglyceride levels. One of the essential things is identifying individual problems and taking a personal approach to providing nutritional advice [22-26].

It is vital to consider that we did not segregate among the sorts of carbohydrates, i.e., simple and complex carbohydrates, meaning that the observed affiliations may have varied among the subtypes of carbohydrates. Be that as it may, it is known that serum lipid levels are controlled not by dietary carbohydrates but by dietary proteins. Although accessible information tending to the affiliations between dietary protein admissions and serum lipids is still constrained, vegetal protein sources per se have appeared to lower plasma cholesterol concentrations [24, 26].

Besides, Appel et al.[27] showed that a respondent who eats less, wealthy in protein and moo in saturated fat, altogether diminished the concentrations of LDL-C, TAG, and TC among grown-ups compared with carbohydrate-rich count calories and calories wealthy in unsaturated fat. The converse affiliation between protein intake and TAG concentration is somewhat concordant with these findings. The part of fat admissions in serum lipid levels varies concurring to the sort of fat expended. Undoubtedly, the fatty acid profile of the diet appears to be the primary determinant of serum cholesterol concentrations [24].

CONCLUSION

Macronutrient intake has a significant correlation with risk factors of cardiometabolic risk in Minangkabau women, especially between fat intake with blood pressure, BMI, WC, and Fasting Blood Glucose.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

ACKNOWLEDGMENT

The authors would like to thank all respondents who participated in this research, and Andalas University as a provider of research funding.

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