Biomedical Journal of Indonesia
Journal Homepage: http://bji.ejournal.fkunsri.id

Carbohydrate Intake Of Medical Students And Its Relation To Waist Circumference And Blood Pressure

Irinne Karina Putri[1], Ardesy Melizah Kurniati[2*], Swanny[3], Liniyanti D. Oswari[4], Veny Larasaty[5], Syarinta Adenina[6]

[1]Medical Program, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia
[2]Department of Nutrition, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia
[3]Department of Physiology, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia
[4]Department of Biochemistry, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia
[5]Department of Biomedicine, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia
[6]Department of Pharmacology, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

ARTICLE INFO

Keywords:
Metabolic syndrome
Carbohydrate
Waist circumference
Blood pressure

Corresponding author:
Ardesy Melizah Kurniati

E-mail address:
ardesy.gizi@fk.unsri.ac.id

All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.32539/BJI.v8i2.153

ABSTRACT

Introduction. Metabolic syndrome is the constellation of metabolic abnormalities that are associated with an increased risk of cardiovascular disease and diabetes melitus. The prevalence of metabolic syndrome in younger people is increasing along with the increased prevalence of obesity. Waist circumference and blood pressure measurement are simple examinations for early detection of metabolic syndrome. Excessive consumption of carbohydrates is one of the factors that cause health problems. But the data of these measurements and food records of medical students in Universitas Sriwijaya were not documented yet. **Methods**. This study was an observational analytic cross-sectional study with proportionate stratified random sampling. This study used primary data from forms, questionnaires, food records, and physical examinations collected from 275 medical students. The data were analyzed with an independent t-Test for normally distributed data or with Mann Whitney for not normally distributed data. **Results**. There was a significant relationship between carbohydrate intake and waist circumference (p-value = 0.048) but no relationship between carbohydrate intake and blood pressure (p-value for systolic blood pressure = 0.720 and diastolic blood pressure = 0.847). **Conclusion**. These findings show an association between carbohydrate intake and waist circumference, but no association between carbohydrate intake and blood pressure (systolic and diastolic blood pressure).

1. Introduction

Metabolic syndrome is a collection of metabolic disorders associated with an increased risk of cardiovascular disease and diabetes mellitus. There are several criteria for diagnosing metabolic syndrome. The most recent criteria is the 2006 IDF criteria, but the criteria proposed by the NCEP-ATP III are more widely used. Based on NCEP-ATP III and IDF criteria, metabolic syndrome components are central obesity, hypertriglyceridemia, low HDL cholesterol, hyperglycemia, and hypertension[1].

Metabolic syndrome prevalence varies around the world, both by age group and gender. Metabolic syndrome is actually a condition that is often found in adults, but nowadays there has been an increase in the prevalence of metabolic syndrome in younger age groups in line with the increasing prevalence of obesity[2]. The prevalence of metabolic syndrome gets higher along with age[3].

Research in Europe (using IDF criteria) showed metabolic syndrome prevalence for the age group 19-39 years was 5.3% in the male group and 7.4% in the female group[4]. Studies in Norway show metabolic syndrome prevalence in the age group of 20-29 years (using IDF criteria) is 11% in the male group and 9.2% in the female group[5]. Research in Gujarat, India (using NCEP-ATP III criteria) showed prevalence for age group 20–30 years was 9.56% (men 64.6% and women 35.4%)[6]. Reports in Makassar (using NCEP-ATP III criteria) show the prevalence of metabolic syndrome in the age group of 16-24 years is 11%[7].

Research on the younger age range (based on NCEP-ATP III criteria) has also been conducted. Studies in Jakarta reported metabolic syndrome prevalence was 34% in 50 obese adolescents aged 10-19 years[8], while a study in Malang (using IDF criteria) conducted on 73 adolescents with metabolic syndrome reported 26.03% (age 12-14 years) and 73.97% (age group 15-19 years)[9].

Food intake is one of the determining factors for obesity which can subsequently turn into metabolic

syndrome. Excess food which has the potential to cause obesity are fat and carbohydrates, because excess fat and carbohydrates in the body will be stored in fat cells. High-carbohydrate diets have a greater effect on improving fat profiles. This condition will occur continuously, especially if the energy expenditure is not balanced. This will cause obesity which has an impact on increasing cardiovascular disease and diabetes mellitus risk.[9]

A study conducted in Chicago showed high carbohydrate and low fiber consumption is associated with an increased risk of metabolic syndrome[10]. Research conducted in China shows that foods intake with a high glycemic index is associated with the incidence of hyperlipidemia and metabolic syndrome[11]. High carbohydrate consumption is related to weight gain, obesity (which is characterized by increased waist circumference), and hyperinsulinemia which are components of metabolic syndrome[12]. High carbohydrate consumption is also significantly associated with increased systolic and diastolic blood pressure[13].

Measurement of waist circumference and blood pressure is the simplest way to detect metabolic syndrome early. This study wants to confirm previous studies stating that carbohydrate intake is associated with increased waist circumference (central obesity) and increased blood pressure (hypertension) which are components of metabolic syndrome. There is no data on the food intake of medical students, Faculty of Medicine, Universitas Sriwijaya, so this study needs to be done to determine the relationship between carbohydrate intake, circumference waist, and blood pressure as well as to obtain food intake data on Medical Students, Faculty of Medicine, Universitas Sriwijaya. Food intake data from previous study using data taken for 2 days using food recall, while in this study food intake data was taken for 7 days using food records that were reconfirmed by food recall.

2. Methods

This study was an observational analytical study with a cross-sectional design conducted on medical students, Faculty of Medicine, Universitas Sriwijaya. The sample of this study was 275 people who met the inclusion and exclusion criteria. The students who are willing to be respondents sign informed consent. Exclusion criteria are subjects with diseases related to the thyroid gland (hyperthyroidism, hypothyroidism, etc.) or Polycystic Ovary Syndrome (SOPK), heavy physical activity, corticosteroid drugs consumption and/or have parents who have a history of diabetes mellitus or cardiovascular disease.

The data that has been collected will be analyzed using an independent t-Test (unpaired t-test) and the Mann-Whitney test. The results will be presented descriptively in the form of tables and narratives. This study received ethical approval from Health Research Review Committee of Mohammad Hoesin Central Hospital and Faculty of Medicine Universitas Sriwijaya number 190/kepkesmhfkunsri/2017 dated 13 September 2017.

3. Results

This study has been conducted on September 8–27, 2017. Data collection is carried out by filling out food record forms, questionnaires and physical examinations.

Table 1. shows the characteristics of research respondents. Out of 275 respondents, the majority of respondents were women (72.4%) and were ≥ 18 years (89.8%). Based on Body Mass Index (BMI), 190 people (69.1%) respondents were classified in the normal BMI category. Physical activity is categorized into light and moderate physical activity. From the results of the study, respondents with light physical activity (67.3%) were more than moderate physical activity (32.7%).

Table 2. showed the average waist circumference of respondents was 75.948 cm with the smallest waist circumference at 54 cm and the largest at 137.5 cm. The average pelvic circumference of respondents was 92.476 cm with the smallest pelvic circumference at 61 cm and the largest at 149.5 cm. Average systolic blood pressure is 110.75 mmHg and diastolic blood pressure 69.71 mmHg. The lowest systolic blood pressure is 81 mmHg and the highest is 150 mmHg. The lowest diastolic blood pressure is 51 mmHg and the highest is 99 mmHg.

Table 1. Respondents Characteristic

Characteristics	n	%
Gender		
Female	199	72.4
Male	76	27.6
Age		
<18 years	28	10.2
≥ 18 years	247	89.8
IMT		
	12	4.4

Very underweight	19	6.9
Underweight	190	69.1
Normal	17	6.2
Overweight	37	13.5
Obesitas		
Physical Activity	186	67.3
Light Physical Activity	90	32.7
Moderate Physical Activity		

Table 2. Waist Circumference, Pelvic Circumference and Blood Pressure of Respondents (N=275)

	Mean	SD	Median	Min.	Max.
Waist Circumference	75.948	10.0668	74.000	54.0	137.5
Pelvic Circumference	92.476	9.8977	92.000	61.0	149.5
Blood Pressure					
Systolic	110.75	11.587	110	81	150
Diastolic	69.71	7.465	70	51	99

Table 3. Relationship respondents' Carbohydrate Intake with waist circumference (N=275)

	n	%	*Mean*	SD	*Med.*	*Min.*	*Max.*	p
Carbohydrate intake								
Sufficient	234	85.1	75.212	8.997	74.0	54	111	0.048
Excess	41	14.9	80.146	14.192	75.0	60	137.5	

Table 4. Relationship respondents' Carbohydrate Intake with systolic blood pressure (N=275)

	n	%	*Mean*	SD	*P*
Carbohydrate intake					
Sufficient	234	85,1	110,64	11,470	0,720
Excess	41	14,9	111,39	12,362	

Table 5. Relationship respondents' Carbohydrate Intake with diastolic blood pressure (N=275)

	n	%	*Mean*	SD	*P*
Carbohydrate intake					
Sufficient	234	85.1	69.75	7.560	0.847
Excess	41	14.9	67.26	6.986	

Table 3. shows respondent's carbohydrate intake. 85.1% were found to have sufficient carbohydrate intake. This research show there is a significant relationship between carbohydrate intake and waist circumference (p value 0.048, table 3). Meanwhile there is no relationship between carbohydrate intake, systolic blood pressure (p value 0.720, table 4) and diastolic blood pressure (p value 0.847, table 5).

4. Discussion

The majority of respondents were women (72.4%). This research is in accordance with research by Jannah, Bebasari and Ernalia (2015) at the Faculty of Medicine, University of Riau which states that the most respondents are women (80.67%)[14].

From this study, more respondents were found to have a normal BMI (69.1%). This is in accordance with research conducted on medical students of Faculty of Medicine, Udayana University Bali, which stated that 65.4% of study

respondents had a normal Body Mass Index (BMI)[15]. Another study conducted abroad also showed similar results, where 75.2% of medical students of Faculty of Medicine, Istanbul Cerrahpasa University had a normal BMI[16].

Majority of respondents had light physical activity (67.3%) compared to moderate physical activity (32.7%). Based on research conducted by Serly, Sofian and Ernalia (2015) on medical students of Faculty of Medicine, University of Riau, more students have light physical activity (44%), compared to moderate physical activity (25.9%) and heavy physical activity (30.1%).[17] Research conducted by Alissa et al. (2015) at King Abdul Aziz University, Jeddah also showed 66% respondents with light physical activity[18].

Carbohydrate intake is considered excessive if the average intake exceeds 60% of the total energy needed by individuals which are calculated using the Harris-Benedict formula. There were more respondents with sufficient carbohydrate intake (85.1%) than those who were excessive (14.9%). This study is in accordance with research conducted in Gõteborg, Sweden which states that 51% (for women) and 53% (for men) respondents usually consume carbohydrates of total energy[19].

Respondents with excess carbohydrate intake tend to have a larger waist circumference than respondents with adequate carbohydrate intake. This is in accordance with Sartorius et al. (2016) who state high carbohydrate consumption is directly related to obesity characterized by increased waist circumference. Waist circumference is a component of metabolic syndrome.[12]

Excessive food consumption leads to a greater proportion of food being converted to fat. This increase in fat mass is always accompanied by physiological changes in the body. One of the changes is fat accumulation in the abdomen (central obesity) which is characterized by an increase in waist circumference. [20]

From this study, it was found that excessive carbohydrate consumption is not always followed by an increase in blood pressure. Heseltine et al. (1990) state high carbohydrate consumption does not show significant changes in blood pressure in both lying and standing positions[21], but more recent research by Shah et al. (2007) states that high carbohydrate consumption is significantly associated with increased systolic and diastolic blood pressure[13].

Excess carbohydrate consumption can cause increased insulin production (hyperinsulinemia). Hyperinsulinemia can increase sodium reabsorption in the kidneys, affecting cation transport, and resulting in hypertrophy of vascular smooth muscle cells as well as increased sympathetic nervous system activity. All these things lead to an increase in blood pressure and eventually lead to hypertension[3]. Insulin's other role is as a regulator of magnesium, which plays a role in determining vascular tone (relaxation). If insulin resistance occurs, over time magnesium storage will be decreased. Blood vessels will tend to contract (vasoconstriction) and eventually increase blood pressure which leads to hypertension[22]. In this study, unrelated results were obtained because all study respondents did not experience insulin resistance (diabetes mellitus).

Nutrition is indeed one of the factors that affect a person's blood pressure. Compared to carbohydrates, other sources of nutrients that play a more important role in determining blood pressure are salt and alcohol[23]

5. Conclusion

Based on the results of research that has been conducted, it can be concluded that the majority of students aged more than 18 years, female, classified as normal BMI and light physical activity. Students of the Medical Education Study Program, Faculty of Medicine, Universitas Sriwijaya have adequate carbohydrate intake. In addition, the average waist circumference and pelvic circumference of students are 75.948 cm and 92.476 cm. The results also showed that the average blood pressure was 111/70 mmHg. Furthermore, a relationship was found between carbohydrate intake and waist circumference in students of the Medical Education Study Program, Faculty of Medicine, Universitas Sriwijaya. However, there was no relationship between carbohydrate intake and blood pressure.

6. Acknowledgements

Thank you to all respondents who have participated in this study. We also would like to express our gratitude to the NuStaMeFSStudy team who have provided a lot of assistance.

7. References

1. Grundy SM. Diagnosis and management of the metabolic syndrome. AHA/NHLBI Scientific Statement 2015: 2735–2752.
2. Ikatan Dokter Anak Indonesia. Diagnosis dan Tatalaksana Sindrom Metabolik pada Anak dan Remaja. Ikatan Dokter Anak Indonesia, Jakarta, 2014: 1–2.
3. Eckel RH. The Metabolic Syndrome. Dalam: Kasper, D. L. et al.. Harrison's Principile of Internal Medicine 19th Edition Volume 2. Amerika Serikat: Mc Graw Hill Education, 2015: 2449-2454.
4. Vishram J., et al. Impact of age and gender on

the prevalence and prognostic importance of the metabolic syndrome and its components in Europeans. PLoS One 2014; 9 (9): 1–12.
5. Hildrum B., et al. Age-specific prevalence of the metabolic syndrome defined by the International Diabetes Federation and the National Cholesterol Education Program: the Norwegian HUNT 2 study. BMC Public Health 2007; 7 (1): 220.
6. Jain S., et al. Prevalence and predictors of metabolic syndrome in young asymptomatic Gujarati population. International Journal of Chronic Diseases 2015; 365217: 1–7.
7. Adam, dkk. Prevalence of metabolic syndrome in young adults. International Journal of Science and Research (IJSR) 2013; 4 (4): 1320–1323.
8. Gultom LC., et al. Metabolic syndrome and visceral fat thickness in obese adolescents. Paediatrica Indonesiana 2013; 47 (3): 124–129.
9. Sargowo, D., Andarini S. Pengaruh Komposisi Asupan Makanan Terhadap Komponen Sindrom Metabolik pada Remaja. Jurnal Kardiologi Indonesia 2011; 32 (1): 14–23.
10. Carnethon MR., et al. Risk factors for the metabolic syndrome. American Diabetes Association 2004; 27 (11): 2707–2715.
11. Feng R., et al. High carbohydrate intake from starchy food is positively associated with metabolic disorders: a cohort study form a Chinese Population. Scientific Reports 2015; 5 (16919): 1-8.
12. Sartorius B., et al. Carbohydrate intake, obesity, metabolic syndrome and cancer risk? A two-part systematic review and meta-analysis protocol to estimate attributability. BMJ Open 2016; 6 (1): 1–6.
13. Shah M., Adams-Huet B., Garg A. Effect of high-carbohydrate or high-cis-monounsaturated fat diets on blood pressure: a meta-analysis of intervention trials. American Society for Clinical Nutrition 2007; 85 (5): 1251-1256.
14. Jannah, W., Bebasari E., Ernalia Y. Profil Status Gizi Mahasiswa Fakultas Kedokteran Universitas Riau Angkatan 2012 dan 2013 Berdasarkan Indeks Massa Tubuh, Waist Hip Ratio dan Lingkar Pinggang. JOM FK 2015; 2 (1).
15. Karunia, NLP., Wibawa A., Adiputra. Hubungan Indeks Massa Tubuh (IMT) dengan Keseimbangan Statis pada Mahasiswa Fakultas Kedokteran Universitas Udayana. Majalah Ilmiah Fisioterapi Indonesia 2016; 2(1): 29–33.
16. Yilmaz Y., et al. The Relationship between Medical Education and Eating Habits Along with Mental Condition in Medical Students. Erciyes Med J 2014; 36 (2): 75–81.
17. Serly, V., Sofian A., Ernalia Y. Hubungan Body Image, Asupan Energi dan Aktivitas Fisik dengan Status Gizi pada Mahasiswa Fakultas Kedokteran Universitas Riau Angkatan 2014 JOM FK 2015; 2(2).
18. Alissa EM., et al. Food Consumption Pattern and Their Association with Physical Activity Level among Medical and Para-Meidical Students. Austin Journal of Nutrition and Metabolism 2015; 2(3): 1023.
19. Tengvall M., Ellegård L. Dietary intake in Swedish medical students. Scandinavian Journal of Food and Nutrition 2007; 51 (2): 79–84.
20. Volk B., et al. Effects of step-wise increases in dietary carbohydrate on circulating saturated fatty acids and palmitoleic acid in adults with metabolic syndrome. PLoS One 2014; 9 (11): 1–16.