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Dietary Habit and Physical Activity as Risk Factors of Metabolic Syndrome among Civil Servants in Jambi City

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ABSTRACT
The prevalence of Metabolic Syndrome (MetS) is an important health problem due to the association with increased cardiovascular disease as the main cause of death. Approximately 20-25% of the global adult population including Indonesia suffers from MetS. The high prevalence is attributed to several factors namely lifestyle changes such as dietary habit and physical activity. Therefore, this study aimed to investigate the relationship between dietary habit and physical activity with MetS incidence among civil servant employees in Jambi City, Indonesia. A cross-sectional design was used to assess the proportion of MetS, dietary habit, and physical activity. A total of 108 civil servant employees were selected as respondents from six agencies using a multistage random sampling technique. Data collection was carried out through physical examination and interviews using a questionnaire. The results showed that the prevalence of MetS was 60.2%, with three risk indicators, namely central obesity (74.1%), blood pressure (66.7%), and HDL (63%). Based on the chi-square test, dietary habit (OR=2.571, 95%CI=1.151-5.744) and physical activity (OR=3.692, 95%CI=1.625-8.388) were significantly related to MetS. The persistently high prevalence of MetS was significantly related to dietary habit and physical activity among civil servant employees in Jambi City-Indonesia. These results underscored the need to improve understanding of healthy diets by adopting a balanced nutritional intake, increasing the intensity of physical activity according to age, and engaging in regular exercise.

INTRODUCTION

Indonesia is currently facing a double burden challenge due to changes in disease patterns, especially the increase in Non-Communicable Diseases (NCDs). In particular, cardiovascular diseases and diabetes mellitus pose the biggest challenge. NCDs account for approximately 41 million deaths every year in the world or 71% of all global mortality, with 77% occurring in lower-middle-income countries.[1] Meanwhile, Metabolic Syndrome (MetS) refers to the occurrence of cardiovascular disease and diabetes concomitantly with increasing risk components including hyperglycemia, raised blood pressure, hypertriglyceridemia, low high-density lipoprotein (HDL) cholesterol levels, and abdominal obesity. This condition is now recognized by the World Health Organization (WHO) as a disease.[2,3]

MetS is currently considered a pandemic because it attacks 20-30% of the global population.[4] The prevalence is approximately 15% in Europe, 14.2% in South Korea, and 36.9% in America,[3,5] while in Indonesia, it is estimated at 21.66%.[6,7] This condition poses twice the risk of developing cardiovascular disease and five times the risk of type 2 diabetes.[8–10] One of the high-risk population groups for MetS in Indonesia is civil servant employees.

Among all cities and districts in the Province, Jambi City has the highest prevalence of diabetes mellitus, namely 2.19% higher than the national prevalence. The prevalence of hypertension diagnosed by health workers in Jambi Province is 7.43%, while in Jambi City, it is 8.62%. Furthermore, the groups with the highest prevalence of risk factors for MetS are workers, civil servants, the Indonesian National Army/Republic of Indonesia Police, and employees of State-Owned Enterprises. The repetitive activity patterns, sedentary lifestyle, irregular eating patterns, consumption of high-calorie and fat diet, as well as irregular sleep patterns make this productive age group the most vulnerable.[6]

Kalsum, et al (2020) reported that the leading causes of death for lecturers at Jambi University included diabetes mellitus (with or without complications), heart attack, hypertension, liver cancer, and autoimmunity. These NCDs were closely related to the risk of an unhealthy diet and lifestyle. Male lecturers with a master's degree, who worked for a period of more than 30 years, as well as hailing from the faculty of social and humanities had a higher percentage of deaths.[11]

MetS is a set of risk factors directly related to the occurrence of arteriosclerotic cardiovascular disease and type 2 diabetes mellitus.[12,13] Although the pathophysiology is still controversial, the most widely recognized primary cause is insulin resistance, which correlates with central obesity. These two components influence the development of various other factors including triglycerides, glucose metabolism, elevated blood pressure, and vascular inflammation.[14] Although the criteria for MetS have not been standardized globally, the most commonly used include WHO, National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP III), and International Diabetes Federation (IDF).[15–18]

Many factors influence the prevalence of MetS including dietary habit and physical activity.[19] Poor dietary habit without balanced energy secretion trigger obesity which is a risk component for MetS.[20] A “Western” diet with a high intake of whole grains and processed meats, fried foods, as well as red meat was associated with an increased prevalence of MetS, while adherence to a Mediterranean diet habit correlated with a lower prevalence. Furthermore, a correlation was established between Traditional Chinese dietary habit with weight loss and the prevalence of MetS.[21] Studies in Indonesia reported a prevalent risk attributed to high intakes of carbohydrates and fat.[17] Another study found a relationship between fast food consumption habits and MetS.[22] In general, physical activity plays an important role in the development of MetS, increasing energy requirement which affects weight loss, and triglyceride, and HDL cholesterol levels.[23] Currently, various conveniences have led to reduced physical activity, resulting in unbalanced calorie intake and use, which causes obesity. Several studies reported that physical activity was significantly related to the incidence of MetS.[12,24–26]

According to previous reports, dietary habit and physical activity have a significant influence on the prevalence of MetS. The national survey data in 2018, showed that Jambi City had the highest prevalence of cardiovascular diseases

and diabetes in the province.[6] Therefore, this study aimed to investigate the relationship between dietary habit and physical activity with the prevalence of MetS among public servant employees in Jambi City-Indonesia.

MATERIAL AND METHOD

A cross-sectional study was conducted in Jambi City, Indonesia from June to August 2022. A total of 108 respondents working as civil servant employees were selected from six government agencies through a multistage random sampling technique. Among the 30 offices, six clusters of Jambi city government offices were randomly selected as primary sampling units (PSU). These include Health Service, Education Service, Social Service, Government Office Jambi City Environment, Fire and Rescue Service, as well as Civil Service Police Unit. The number of samples (respondents) from the six government office clusters was calculated using a proportional sample size. Respondents from each cluster were selected at simple random according to the proportion of the predetermined sample size.

The inclusion criteria for the study respondents include those aged 20 years or above, who have fasted for at least 8 hours before blood sample examination and communicated well. Respondents who were pregnant or had a disease that could preclude participation such as cancer, and liver disease, or did not complete three visits during the study were excluded.

Data was collected using the physical examination results form for the five MetS criteria from NCEP ATP-III, namely abdominal circumference, blood pressure, glucose levels, triglycerides, and HDL cholesterol levels. This study used the NCEP-ATP III criteria to identify the five risk components of MetS with several cut points adapted from Alberti, et al. (2009) and Grundy, et al. (2016). These consisted of central obesity (abdominal circumference >90 cm for Asian men and >80 cm for women); hypertension (systolic >130 mmHg or diastolic >85 mmHg) or being treated for hypertension; hypertriglyceridemia (>150 mg/dL or 1.7 mmol/L) or being treated for hyper-triglyceridemia; low HDL (<40 mg/dL or 1.03 mmol/L in men) and (<50 mg/dL or 1.29 mmol/L in women) or on treatment for elevated HDL–C levels; and hyperglycemic (GDP > 100 mg/dL or 5.6 mmol/L) or have type 2 diabetes. A participant was declared to have MetS when three of the five risk components were met.[27,28]

Abdominal circumference was measured using a tape around the participant's abdomen standing straight with feet together and arms relaxed on either side. Measurement of blood pressure was carried out using digital sphygmomanometers on respondents in relaxed positions for at least two measurements. A third measurement of blood pressure was taken when the difference between the two readings for systolic blood pressure was more than 10 mmHg, or diastolic blood pressure was more than 5 mmHg.

The fasting glucose level was measured using the glucometer, while the measurement of HDL cholesterol and triglyceride levels was performed with a lipid profile device, according to standard guidelines. After physical examination, data was also collected through interviews with a questionnaire about respondents' dietary habit using the Food Frequency Questionnaire (FFQ) to obtain the frequency of food consumption in the last month classified into two categories namely "not good' and "good" based on the cut-off point (median) value. Physical activity status was determined using the validated Global Physical Activity Questionnaire (GPAQ) developed by WHO, consisting of 16 simple questions to estimate the level of physical activity during the past week using four domains. These include work, travel, recreational, and sedentary activities converted to Metabolic Equivalent Task minutes per week (MET) according to the GPAQ scoring protocol. Based on participant responses, the level of physical activity was classified into two categories namely low (total activity < 600 MET) and high (total activity ≥ 600 MET). A chi-square test was performed to analyze the relationship between dietary habit and physical activity with MetS. This study obtained ethical approval from the Research Ethics Commission Jambi Health Polytechnic with letter number: LB.02.06/2/649/2022.

RESULTS

This study acquired a response rate of 100%, and based on Table 1, the majority of respondents were 41-50 years old (41.70%),

male (54.60%), married (94.40%), had undergraduate education (50.00%), and earned family income of > Rp. 5 million to Rp. 10 million (50%) per month.

Table 2 shows the average results of MetS risk component measurement in the respondents including average abdominal circumference of 90.7 cm (SD = 12.14 cm), fasting blood glucose of 108 mg/dl (SD = 50.39 mg/dl), systolic blood pressure of 134.6 mmHg (SD= 18.65 mmHg), diastolic blood pressure of 88.7 mmHg (SD= 11.98 mmHg), triglyceride level of 151.2 mg/dl (SD= 84.45 mg/ dl), HDL level of 41.6 mg/dl (SD= 11.52 mg/dl).

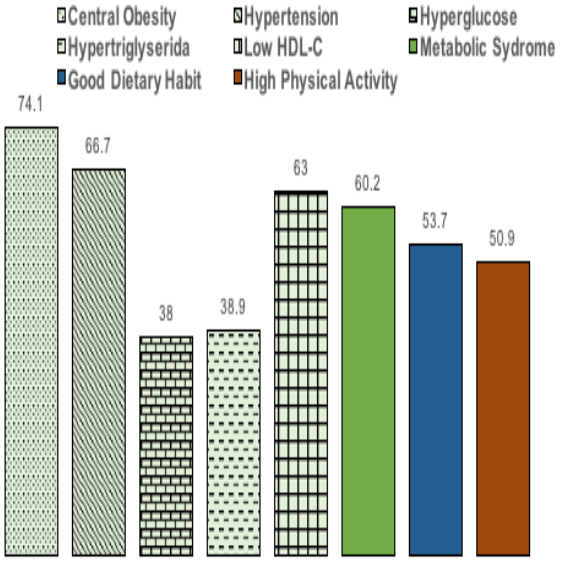
Figure 1 shows that the prevalence of MetS in the study population was 60.2%, with the three most common risk components being central obesity (74.1%), hypertension (66.7%), and low HDL cholesterol (63%). Moreover, the majority of respondents had good dietary habit (53,7%) and a high level of physical activity (50,9%). The average MET-minutes/week was 808.15 (SD= 600.7) with the lowest score being 60 and the highest being 2,760, while the estimated interval ranged from 693.5 to 922.7.

Table 3 shows the comparative association of dietary habit and physical activity with MetS. Based on the chi-square analysis results, there was a significant difference in the prevalence of MetS between respondents with not good and good dietary habit (p=0.033), as well as low and high physical activity (p=0.003).

Table 1. Characteristics of Respondents

Characteristics	n = 108	%
Age (Years) Mean = 46,2		
29-30	3	2.80
31-40	22	20.30
41-50	45	41.70
51-58	38	35.20
Sex		
Male	59	54.60
Female	49	45.40
Marital Status		
Not yet married	3	2.80
Married	102	94.40
Divorced	3	2.80
Education		
Senior High School	22	20.40
Undergraduate	54	50
Master/Doctoral	32	29.60
Income (Rp) Mean = Rp 8.278.004,-)		
2.000.000 – 5.000.000	34	31.50
> 5.000.000 – 10.000.000	54	50
> 10.000.000 – 20.000.000	18	16.70
> 20.000.000	2	1.80

Source: Primary Data, 2022



Source: Primary Data, 2022

Figure 1. Proportion of MetS Component, Dietary Habit, and Level of Physical Activity

Table 2. Measurement of MetS Risk Components

MS Criteria	Mean	SD	Min-Max	95% CI
Abdominal Circumference	90.7	12.14	60-132	88.4-93.0
Blood Glucose	108.1	50.39	69-399	98.5-118
Blood Pressure				
Systolic	134.6	18.65	88-179	131-138
Diastolic	86.4	11.98	59-114	84.1-88.7
Triglyceride	151.2	84.45	50-482	135-167.3
HDL-C	41.6	11.52	25-83	39.4-43.8

Source: Primary Data, 2022

Table 3. Association of Dietary Habit and Physical Activity with MetS

Variable	MetS		Non-MetS		*p-value*	OR	95% CI
	n	%	n	%			
Dietary Habit							
Not good	36	72	14	28	0.033	2.571	1.151– 5.744
Good	29	50	29	50			
Physical Activity							
Low	40	75.5	13	24.5	0.003	3.692	1.625– 8.388
High	25	45.5	30	54.5			

Source: Primary Data, 2022

DISCUSSION

Metabolic Syndrome (MetS) is a group of symptoms with the criteria of central obesity, hypertension, low High-Density Lipoprotein (HDL), high Fasting Blood Glucose (GDP), and High Triglyceride (TG) levels.[29] Affected individuals are characterized by twice the risk of death and three times the risk of having a heart attack or stroke compared to normal. Moreover, MetS has become a public health problem and clinical challenge globally. It is related to urbanization, excessive energy intake, increased incidence of obesity, and sedentary lifestyles as well as other associated impacts.[13,29]

Based on the results, the prevalence of MetS among civil servant employees in Jambi City was 60.2%. This value was unexpectedly higher than the range reported by several previous studies in Indonesia. According to Samodro, et al. (2020), the prevalence of MetS among 36 inpatients at Prof. Dr. Margono Soekarjo Hospital was 30%.[28] A study in Palangkaraya conducted on students reported that the proportion of respondents in the MetS risk category was 33.77%.[24] Another study by Listyandini, et al (2020) on workers at Tanjung Priok Port recorded a prevalence of 38.7%.[12] However, the results were in line with a study conducted in Surakarta districts, which reported a value of 64.7%.[27] A study carried out in the US on 12,047 adults found a MetS prevalence of 61.6%, 33.2%, and 8.6% in the obese, overweight, and normal weight groups.[18] Another investigation in Iran stated that the prevalence of MetS among respondents was 32.2%.[20] In Japan, residents of semi-mountainous areas were found to have a prevalence of 28.5%.[26] Meanwhile, in Malaysia, MetS had a prevalence of 32.2% among people aged 18 years and above. The condition was more common in Indians (51.9%), followed by Malays (36.7%) and Chinese (20.2%).[23]

The high prevalence of MetS in this study poses a clinical and public health challenge to prevent and control the risk factors, specifically central obesity, hypertension, and low HDL cholesterol. This is important considering that MetS has the potential to increase the risk of cardiovascular disease as the main cause of death in Indonesia.[7]

Based on the results, dietary habit was significantly related to the prevalence of MetS among civil servant employees in Jambi City (p= 0,033; OR= 2.571), suggesting poor dietary habit can increase the risk by 2.571 times. These results were consistent with several previous studies which also found a significant relationship between dietary habit and MetS. Godala, et al (2022) investigated the relationship between dietary behavior and MetS parameters. Among the three behavioral patterns identified, the strongest associations and the highest risk of MetS development were demonstrated in the Western-Sedentary group characterized by a high intake of fast-food products, white bread, red meat, and sweetened beverages.[19] A study by Samodro (2020) also reported a relationship between consumption patterns (fast food) with the incidence of MetS. Most food available in different regions often prioritizes delicious taste without considering the suitability of calorie and nutritional content.[28] However, other studies reported different results stating that dietary habit was not related to MetS. For example, Bil Khair and Harvianto (2021) proved that there was no significant relationship between diet and MetS among students.[24]

These results proved that diet was an important factor affecting nutritional condition and health status. Excessive food intake has been

associated with the incidence of MetS, particularly in terms of total calories, fat, and carbohydrates.[20] Specifically, excessive calories stimulate very low-density lipoproteins (VLDL) in the liver which causes hyper triglycerides, increased LDL, and decreased HDL levels.[22] The stimulation also leads to abdominal obesity due to the accumulation of visceral fat, elevated blood glucose levels (hyperglycemia), increased blood pressure (hypertension), and dyslipidemia caused by insulin resistance.[16] Dietary habit, such as rapid consumption of meals, frequent dining out, late eating, and skipping breakfast are reportedly associated with MetS according to studies in the East Asian region. For example, rapid consumption of meals is one of the risk factors for MetS among Koreans.[23]

Based on the results, there was a significant relationship between physical activity and MetS among civil servant employees in Jambi City (p= 0,003; OR= 3.692), suggesting that low physical activity increased the likelihood of developing MetS. Similarly, several previous studies have proven that physical activity was significantly related to the prevalence of MetS.[12] Godala, et al (2022) reported a relationship between low to moderate levels of physical activity with MetS.[19]

Regular physical activity can increase the expenditure of calories, thereby contributing to maintaining physical health, and reducing the risk of MetS.[24] Meanwhile, low physical activity causes the accumulation of excess calories and fatty acids, triggering the occurrence.[28]

CONCLUSION AND RECOMMENDATION

In conclusion, this study found a significant relationship between dietary habit and physical activity with the prevalence of MetS among civil servant employees in Jambi City. This suggests the need to improve understanding of healthy diet and physical activity to prevent MetS, by adopting a balanced nutritional diet, increasing the intensity of physical activity according to age, and engaging in regular exercise.

The chief of government institutions should adopt policies that allow staff to have sufficient time to move around at work, such as stretching exercises while working and joint healthy exercises. Staff are also recommended to transition from sugar, fat, and animal-based diets to more traditional plant-based diets, which can reduce health risks associated with MetS. Disseminating appropriate information about the dangers of a sedentary lifestyle through all available media is also crucial.

The health office can develop a health program policy in government institutions by establishing an Integrated Services Post (Posbindu) to provide regular health services and early detection of MetS risk factors for the prevention of PTM among civil servant employees. In addition, efforts should be made to provide health education to raise awareness in the prevention and control of MetS risk factors through the socialization of "CERDIK" behavior, namely regular health checks, cessation of cigarette smoking, frequent physical activity, healthy diet with balanced calories, sufficient rest, and stress management.

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AUTHOR CONTRIBUTIONS

G conceived and designed the experiments; ZN and PS performed the experiments; INI and G analyzed the data; All authors have read and approved the final manuscript. G = Guspianto; INI = Ismi Nurwaqiah Ibnu; ZN = Zafira Nadwa; PS = Puspita Sari.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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