ORIGINAL RESEARCH

Correlation between metabolic syndrome and uric acid level in the office workers of a BUMN company in Surabaya

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Article Info

Article history:
Received Apr 18, 2020
Revised Jul 18, 2020
Accepted Nov 8, 2020
Published Jan 1, 2021

Keywords:
Metabolic syndrome
Uric acid
Cardiovascular disease
Office worker
Risk factors
Obesity
Health risk
Healthy lifestyle

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ABSTRACT

Background: Metabolic syndrome is a cluster of risk factor which consists of central obesity, hypertriglyceride, low High Density Lipoprotein (HDL) level, hypertension, and hyperglycemia. Its incidence among the office workers is increasing. Uric acid is often associated with cardiovascular disease while risk factor of cardiovascular disease is associated with metabolic syndrome. **Objective**: To analyze the correlation between metabolic syndrome and uric acid level in office workers. **Materials and Methods**: This study used medical record of health examination of PT Wijaya Karya Divisi IV male office workers aged of 20 – 60 years. The data taken consisted of abdominal circumference, blood pressure, triglyceride, HDL, fasting blood glucose, and uric acid levels. The diagnostic criterion of metabolic syndrome used in this study was National Cholesterol Education Program's Adult Treatment Panel III (NCEP ATP III) that had been modified for Asians. The correlation of metabolic syndrome and serum uric acid level was analyzed by chi-square test with IBM SPSS Statistic 20 application. **Results**: There was no significant correlation (p=0.598) between metabolic syndrome and uric acid level in male office workers of PT Wijaya Karya Divisi IV. **Conclusion**: Metabolic syndrome and uric acid level among male office workers of PT Wijaya Karya Division IV had no correlation.

How to cite:
Fairuz, J.J., Sari, D.R., Soelistijo, S.A. 2021. Correlation between metabolic syndrome and uric acid level in the office workers of a BUMN company in Surabaya. Majalah Biomorfologi, 31(1): 11-17.

Majalah Biomorfologi (Biomorphology Journal) p.ISSN:0215-8833, e.ISSN: 2716-0920
doi: 10.20473/mbiom.v31i1.2021.11-17

BACKGROUND

Metabolic syndrome is a cluster of related metabolic conditions consists of unhealthy body measurements (abdominal obesity) and abnormal laboratory test results include atherogenic dyslipidemia, hypertension, glucose intolerance/hyperglycemia, proinflammatory state, and a prothrombotic state (Kaur, 2014). Metabolic syndrome (SM) is usually related to the risks of coronary heart disease, stroke, and mortality because each of the metabolic syndrome components is also the factor risk of cardiovascular disease (Kaur, 2014). The diagnostic criteria of metabolic syndrome,

adapted from National Cholesterol Education Program's Adult Treatment Panel III (NCEP ATP III) which had been modified for Asian, are central obesity measured from abdominal circumference of ≥ 90 cm for male and ≥ 80 cm for female, triglyceride level (TG) of ≥150 mg/Dl or during specific therapy for abnormal fats content, cholesterol level of high- density lipoprotein (HDL) of < 40 mg/dL for male and <50 mg/dL for female or during specific therapy for abnormal fats content, systolic blood pressure of ≥ 130 mmHg or diastolic blood pressure of ≥ 85 mmHg or during anti-hypertension therapy, and fasting blood glucose level of ≥ 100 mg/dL or during diabetes therapy. The diagnostic criteria of metabolic syndrome are fulfilled if there are at least 3 of 5 components contained (Chackrewarthy, et al., 2013).

Based on National Health and Nutrition Examination Survey (NHANES) data from 2003 – 2012 with United States population aged ≥20 years, overall prevalence of the metabolic syndrome using NCEP ATP III as diagnostic criteria is 33%. From 2003-2004 to 2011-2012, overall prevalence of the metabolic syndrome increased from 32.9% in 2003-2004 to 34.7% in 2011-2012 (Aguilar, et al., 2015). Meanwhile, Indonesia's prevalence based on urban study in every province with a total sample of 13,262 is 17.5% diagnosed metabolic syndrome (Bantas, et al., 2012). In Legian district, Kuta, Badung, Indonesia, the prevalence is 23.2% from 284 samples (Ayu, et al., 2011). This prevalence is discovered to be higher among office workers. Research in two companies in Riau Province with a total sample of 505 office workers had shown that the highest prevalence of metabolic syndrome is diagnosed among the male group with the age of >50 (Zahtamal, et al., 2014). Several studies also show that the enhancement of metabolic syndrome prevalence in office workers is related to lower productivity in the workplace (Alavi, et al., 2015; Strauß, et al., 2016). This phenomenon is affiliated with the lack of physical activities and unhealthy eating habits among office workers.

Uric acid is commonly associated with cardiovascular disease. In several studies, there is a belief that the elevated of the uric acid level is essentially associated with metabolic syndrome (Gonçalves, et al., 2012; You et al., 2014). However, there have also been arguments mentioned that uric acid is not a main risk factor of cardiovascular disease cultivation and fatality of cardiovascular disease aftermath (Wu, et al., 2016). The possibility of correlation between metabolic syndrome and uric acid level is discovered in several studies, they found the association between metabolic syndrome components such as BMI, central obesity, deterioration of HDL level, and the escalation of blood pressure with the uric acid level (Lu, et al., 2012; Nejatinamini, et al., 2015).

According to the explanation above, the study about the correlation between metabolic syndrome and the uric acid level is still controversial and there are not many studies focused on the office workers group. Therefore, a study concerning with the correlation between metabolic syndrome and the uric acid level needs to be done, specifically for the office workers group.

OBJECTIVE

The objective of this study is to analyze the correlation between metabolic syndrome and uric acid level among the male office workers group with metabolic syndrome diagnostic criteria adapted from NCEP ATP III which had been modified for Asians.

MATERIALS AND METHODS

This study used observational analytic with a cross-sectional approach. The sampling technique of this study used purposive sampling. The sample of this study is the male office workers of BUMN PT. Wijaya Karya Divisi IV who attended the medical examination in October 2016 period with a complete medical record consisted of metabolic syndrome component data. Meanwhile, the male office workers with incomplete medical records and the ones with comorbidity of inducing hyperuricemia such as malignancy or kidney failure are excluded from this study. The data would be obtained, processed, and analyzed using the chi-square test with IBM SPSS Statistics 20 application.

RESULTS

The numbers of sample attended the medical examination were 70 office workers with 11 medical records excluded, so that there were 59 complete medical records of PT. Wijaya Karya Divisi IV

Surabaya male office workers. The data concerning metabolic syndrome prevalence in this study is shown in Table 1.

Table 1. The office workers' prevalence of metabolic syndrome

Category	Frequency	Percentage (%)
Normal	40	68%
Metabolic Syndrome	19	32%

As shown in Table 1, the office workers with metabolic syndrome were less than normal office workers with 32%.

The characteristics of the office workers with metabolic syndrome consisted of age, metabolic syndrome criteria, and uric acid levels which are shown in Table 2.

Table 2. The characteristics of office workers with metabolic syndrome

Variables	Frequency	Percentage
Ages		
20 – 29	2	10%
30 – 39	6	32%
40 – 49	6	32%
50 – 59	5	26%
The total criteria of metabolic syndrome		
3 criteria	11	58%
4 criteria	8	42%
5 criteria	0	0
Uric acid level		
< 7 mg/dL	9	47%
≥ 7 mg/dL	10	53%

According to the data in Table 2, the most frequent age range with metabolic syndrome is 30 – 49 years old and the least frequent age range is 20 – 29 years old. The highest number of metabolic syndrome criteria was found in the office workers who had 3 metabolic syndrome components while there were none of the office workers who had 5 metabolic syndrome components. The number of office worker with metabolic syndrome was similar between the hyperuricemic and normal groups.

The metabolic syndrome component distribution consisted of high fasting blood glucose level, high TG level, low HDL level, abnormal abdominal circumference, and high blood pressure in the office workers with metabolic syndrome which are shown in Figure 1.

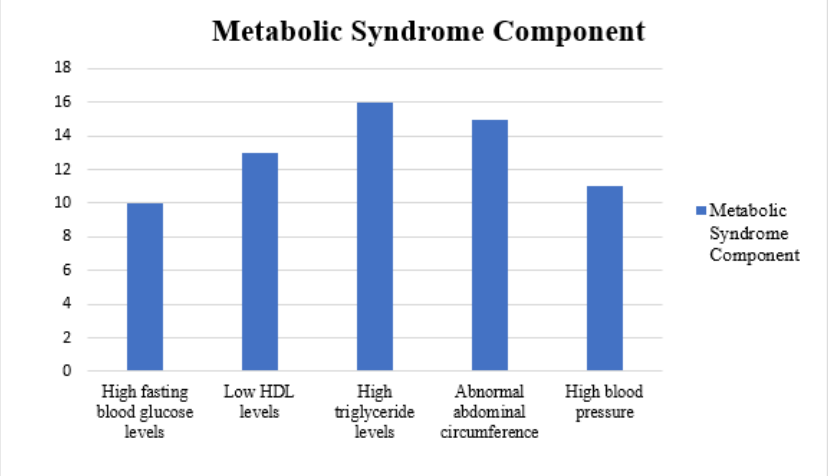

Figure 1. The Metabolic Syndrome Component Distribution in Office Workers with Metabolic Syndrome

As shown in Figure 1, the metabolic syndrome component with the highest distribution in 19 office workers with metabolic syndrome is high TG levels, followed with abnormal abdominal circumference. The least distribution is high fasting blood glucose level and abnormal blood pressure. The data concerning the result of correlation between metabolic syndrome and uric acid level with chi-square test are shown in Table 3.

Table 3. The analysis of correlation between metabolic syndrome and serum uric acid level

Independent Variable		Dependent Variable: Uric Acid Level		P Value
		Normal	High Uric Acid Level	
Metabolic Syndrome Component	< 3 of 5 criteria (Not Metabolic Syndrome)	25	15	0.414
	≥ 3 of 5 criteria (Metabolic Syndrome)	10	9	

Based on Table 3, there is no significant correlation between metabolic syndrome and uric acid level.

DISCUSSION

The sample only consisted of male office workers group because the type of job in PT. Wijaya Karya is related to building construction. Therefore, the office workers are dominated by men. The prevalence of male office workers who suffered from metabolic syndrome in PT. Wijaya Karya Division IV Surabaya, Indonesia is 32% of the total of 59 male office workers. This result is similar to the Alavi, et al's (2015) study with the metabolic syndrome prevalence is 35,9% with total sample 1488 office workers in the manufacturing company and significantly higher in male office workers (37,2%) than in women (20,6%) using NCEP ATP III guidelines (Alavi, et al., 2015). However, the result is higher than Kamso, et al's (2011) study that reported the prevalence of metabolic syndrome in the male employees which is 24,7% in the age range of 25 – 60 years old (Kamso, et al., 2011). Another study also reported higher results compared to the research of Zahtamal, et al (2014) in metabolic syndrome prevalence on employees which is 21,58% with male as the most frequent gender in 124 employees.

The characteristic of office workers with metabolic syndrome in this study was mostly in the 30 – 40 years old age range. The finding is also similar to Alavi, et al's (2015) study which reported that the mean age of workers who suffered from metabolic syndrome is 38,2 years old. In Kamso, et al's (2011) study, the most frequent age range of office workers who suffered from metabolic syndrome is 25 – 49 years old (Kamso, et al., 2011). On the other hand, this statement is different from Zahtamal, et al's (2014) and Konradi, et al's (2011) studies which reported that metabolic syndrome prevalence in office workers is directly proportional to the increase of age in > 50 years old age range. (Zahtamal, et al., 2014; Konradi, et al., 2011). In this study, the office workers mostly had 3 criteria of metabolic syndrome and no one had 5 criteria of metabolic syndrome. The same result had appeared in Zahtamal, et al's (2014) and Konradi, et al's (2011) studies which reported that the frequent numbers of criteria which fulfilled in the sample with metabolic syndrome were 3 criteria and the more criteria fulfilled, the lesser the prevalence was (Zahtamal, et al., 2014; Konradi, et al., 2011). The most common metabolic syndrome components found in the office workers are abnormal abdominal circumference, high TG level, and low HDL level. This statement is similar to Kamso, et al's (2011) study which reported abnormal abdominal circumference, high TG levels, and low HDL levels (Kamso, et al., 2011). Zahtamal, et al's (2014) study also reported the similar statement. However, the high blood pressure component was more common than low HDL level (Zahtamal, et al., 2014).

The main cause of high prevalence in metabolic syndrome among the office workers is spending a lot of time in a sedentary lifestyle with longer sedentary time, followed with having less time to rest. It proves that office workers have higher chance to suffer from metabolic syndrome than ordinary people (Bankoski, et al., 2011). Moreover, the occurrence of metabolic syndrome increases in the productive age in Indonesia related to the habit of frequently consuming salty foods which is more than once a day

(Suhaema & Masthalina, 2015). The lack of physical activities and unhealthy eating habits facilitate the displacement of TG from high TG lipoprotein (VLDL and chylomicron) to excessive HDL particles which resulted in the increase of TG level and the decrease of HDL level (Sargowo & Andarini, 2011). However, this study had not been completed with the office workers' daily eating habits and physical activities list which can support this experiment. The most common metabolic syndrome prevalence in male office workers was in the age range of 30 – 49 years old since the testosterone hormones dropped after reaching 25 years old. The drop of testosterone hormones will trigger high leptin level along with increasing the accumulation of fat tissues which lead to obesity. The accumulation of fat tissue causes an increase in pro-inflammatory agents (adipokines) that can mediate insulin resistance and cardiovascular disease thereby increasing the risk of metabolic syndrome (Bianchi, 2018).

The correlation between metabolic syndrome and uric acid levels

There is no significant correlation between metabolic syndrome and uric acid level ($p=0.414$) in the final result. This statement is also similar to Adnan, et al's (2019) study in Makassar, Indonesia that explained the nonexistent correlation between metabolic syndrome and uric acid level in the sample which does not have resistance towards insulin (Adnan, et al., 2019). The insignificant correlation between metabolic syndrome and uric acid level in this study is suspected by the absence of insulin resistance condition. However, the data concerning insulin resistance indicator is not found. In the office workers' metabolic syndrome component distribution, high TG level and abdominal circumference are the most common components. Meanwhile, high fasting blood glucose level is the least common component. These components lack of showing insulin resistance condition. On the contrary, several other studies discovered significant correlation between metabolic syndrome and the rise of uric acid level (Wei, et al., 2015; Gonçalves, et al., 2012; You et al., 2014).

There are several theories about the mechanism which underlie the correlation between metabolic syndrome and uric acid level. One of the most common is hyperinsulinemia caused by glucose tolerance disruption. Uric acid has an impact on insulin resistance since uric acid can decrease nitric oxide (NO) bioavailability which gradually causes oxidative stress in mitochondria and leads to pancreas β cell dysfunctional. (Zhu, et al., 2014). According to Adnan, et al., (2019), high uric acid induced oxidative stress and generates excessive ROS (Reactive Oxygen Species) in the adipose tissues which result in gradual inflammatory mediator secretion, one of them is TNF-α. TNF-α can disrupt insulin mechanisms by preventing in giving signals to the insulin receptor (Adnan, et al., 2019; Lestari, 2011). Moreover, the increased ROS production and decreased NO bioavailability can disrupt endothelial vasodilation that can lead to hypertension as one of the metabolic syndrome components (You, et al., 2014). In high uric acid, there is an increase in apoE (apolipoprotein E) which has an important role in the modulation of lipoprotein metabolism that can in a decrease clearance rate of the very low-density lipoprotein (VLDL) and consequent higher mean levels of VLDL cholesterol and VLDL triglycerides (Gonçalves, et al., 2012).

CONCLUSION

There is no significant correlation between metabolic syndrome and uric acid level in the male office workers of PT. Wijaya Karya Division IV in the age range of 20 – 60 years old. The insulin resistance indicator, oxidative stress, assessment concerning eating habits and daily physical activities, and addition of the number of samples are needed for further research in order to obtain a better result.

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