Artikel Penelitian

Prevalence Of Metabolic Syndrome And Its Components Among Male Workers In Indonesia

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Abstract

Introduction: *Metabolic syndrome (MetS) has emerged as one of the world's major public health issues and the prevalence of this syndrome varies among population. There is a little of information on the epidemiology of MetS in male workers in Indonesia. Therefore, this study aims to determine the prevalence, its component and risk factors of MetS in Indonesian's male working population.*
Methods: *This was a cross sectional study of 1298 workers (median age,IQR 41,37-48 years) who underwent a routine Medical Check Up (MCU). The metabolic syndrome is diagnosed using the criteria established by the revised National Cholesterol Education Program-Adult Treatment Panel-III definition (2005 ATP III).*
Results: *Metabolic syndrome prevalence was 13.9% in male workers. The most common abnormalities among all participants were hypertriglyceridemia (94.5%) and abdominal obesity (80.6%) [p<0.001]. Multivariable logistic regression analysis revealed that obesity (OR: 9.29; 95% CI: 5.56-15.54), overweight (OR: 2.15; 95% CI: 1.11-4.18), increasing age (OR: 2.39; 95% CI: 1.36-4.21), white blood cells/WBC or leukocyte (OR: 1.13; 95% CI: 1.04-1.24) and exercise (OR: 1.51; 95% CI: 1.06-2.15), were associated with a higher risk of developing MetS in the working population.*
Conclusion: *The most common component of MetS in workers is hypertriglyceridemia followed by abdominal obesity. As a result, it is possible that these are the first detectable component of MetS in the working population. Early detection of MetS components, especially in obese workers, could be effective way to prevent the development of the syndrome.*

Keywords: *Metabolic syndrome, Hypertriglyceridemia, Abdominal obesity, Male worker, Indonesia*

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Prevalensi dan Komponen Sindrom Metabolik pada Pekerja Pria di Indonesia

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Abstrak

Pendahuluan: *Sindrom metabolik (MetS) telah muncul sebagai salah satu masalah kesehatan masyarakat utama di dunia dan prevalensi sindrom ini bervariasi antar populasi. Hanya sedikit informasi mengenai epidemiologi MetS pada pekerja pria di Indonesia. Oleh karena itu, penelitian ini bertujuan untuk mengetahui prevalensi, komponen dan faktor risiko MetS pada populasi pekerja pria di Indonesia.*
Metode: *Penelitian ini merupakan studi cross sectional terhadap 1298 pekerja (median usia, IQR 41,37-48 tahun) yang menjalani Medical Check Up (MCU) rutin. Sindrom metabolik didiagnosis dengan menggunakan kriteria yang ditetapkan oleh definisi National Cholesterol Education Program-Adult Treatment Panel-III yang telah direvisi (ATP III 2005).*
Hasil: *Prevalensi sindrom metabolik adalah 13,9% pada pekerja laki-laki. Kelainan yang paling umum di antara semua peserta adalah hipertrigliseridemia (94,5%) dan obesitas perut (80,6%) [p<0,001]. Analisis regresi logistik multivariabel mengungkapkan bahwa obesitas (OR: 9,29; 95% CI: 5,56-15,54), kelebihan berat badan (OR: 2,15; 95% CI: 1,11-4,18), bertambahnya usia (OR: 2,39; 95% CI: 1,36-4. 21), sel darah putih/WBC atau leukosit (OR: 1,13; 95% CI: 1,04-1,24) dan olahraga (OR: 1,51; 95% CI: 1,06-2,15), berhubungan dengan risiko lebih tinggi terkena MetS pada populasi pekerja.*
Kesimpulan: *Komponen MetS yang paling umum pada pekerja adalah hipertrigliserida diikuti oleh obesitas abdominal. Akibatnya, ada kemungkinan bahwa ini adalah komponen MetS pertama yang dapat dideteksi pada populasi pekerja. Deteksi dini komponen MetS, terutama pada pekerja yang mengalami obesitas, bisa menjadi cara yang efektif untuk mencegah perkembangan sindrom ini.*

Kata Kunci*: Sindrom Metabolik, hipertrigliserida, obesitas abdominal, perkerja laki-laki, Indonesia*

Pendahuluan

Metabolic syndrome (MetS) has developed into a major public health concern on a global scale. This syndrome is estimated to affect between 12% and 37% of the Asian population and between 12% and 26% of the European population.[1] The prevalence of MetS in Indonesia is 21.66% ranging from 0 to 50% at the provincial level, and 0 to 45.45 percent at the ethnic level.[2]

Metabolic syndrome according to various criteria, is a condition that affects a wide range of people, including in working population. The lifestyles and work patterns of workers predispose them to metabolic syndrome. Sedentary behaviour, in which workers do not engage in physical activity during work hours, is one of the risk factors for metabolic syndrome.[3,4] According to the August 2020 National Labor Force Survey, the working age population in Indonesia total 203.97 million people, or approximately 75.49 percent of the total population.[5]

Obesity and metabolic syndrome have been linked to an increased risk of developing diabetes,[6] cardiovascular disease (CVD),[7] and several common cancers.[8,9] Individuals with MetS are three times more likely to die from cardiovascular disease than those who do not have the disorder.[7] Individuals and society bear a significant economic burden as a result of mortality and morbidity. The three leading causes of DALYs (disability-adjusted life years) in Indonesia, according to Mboi et al 2016, are ischemic heart disease, cerebrovascular disease, and diabetes.[10]

Every nation, including Indonesia, relies heavily on its workforce. Male workforce (82.41%) participation in Indonesia is higher than female (53.13%).[5] Metabolic syndrome was associated to lower perceived health, more sick days, and an increase in STD (short-term disability) incidence trend.[11] As a result, individuals diagnosed with MetS who are of working age, particularly male workers who serve as the family's backbone, has consequences not only for the patient, but also for their dependents, their work environment, and the country's human resources .

Since the WHO recommended creating a healthy environment as an effective strategy for reducing the incidence of MetS.[12] As a result, our study sought to determine the prevalence of MetS and associated risk factors among male workers in Indonesia, thereby assisting in the development of workplace health promotion strategies.

Method

Research Subjects

The present study is a retrospective cross-sectional study in which data were extracted from the MCU's result database for a one-year period. This study enrolled 1298 workers who participated in the periodic MCU. Our study included workers over the age of 18, who could read and write, and who were registered for MCUs. Meanwhile, those who were unable to attend the MCUs due to certain medical conditions or who had incomplete MCU results were excluded.

Variables/Data

The data of participants included age, blood pressure, body weight, height, waist circumference, history of lifestyles (smoking, exercise, coffee, alcohol consumption) were collected, respectively. We also collected the laboratories result (WBC, fasting blood glucose, lipid profile such as total cholestoral, LDL, HDL-C, TG, Uric Acid/UA and SGOT/SGPT). The body mass index (BMI) was calculated by diving weight (in kg) by height (in m2) and using criteria for Asia Pasific.

METS was defines as the presence of three or more of the following criteria proposed by 2005 NCEP-ATP III criteria as proposed by the AHA/NLB13 which are : (1) abdominal obesity (waist cirfumference $\geq$ 90 cm for Asian men and $\geq$ 80 cm for Asian women); (2) blood pressure $\geq$130/85 mmHg or self reported hypertension; (3) fasting blood glucose $\geq$100 mg/dl; (4) HDL-C cholesterol$\leq$40 mg/dl in male and $\leq$50 mg/dl in female; (5) triglycerides $\geq$ 150 mg/dl.

Ethical Considerations

The Ethics Committee for Research, Faculty of Medicine, University of Muhammadiyah Prof.Dr.HAMKA, Jakarta, Indonesia, has approved this study (KEPKK/FK/012/09/2021).

Statistical Analysis

Categorical variables were expressed in percentages and continuous variables in median (IQR) or geometric mean (95% confidence interval). The Chi-square test was used to determine between-group differences in categorical variables, and the Mann–Whitney U test was used to determine between-group differences in continuous variables with a non-normal distribution. For all statistical analysis, p value of <0.05 was considered significant. The statistical analysed were performed using Stata version 17 software.

Results

The results indicated that up to 13.9% of respondents had metabolic syndrome. The characteristic of study participants are shown in Table 1. The workers whom with MetS were more likely to be older (median, IQR : 41 years; 37-48) than the participants without MetS (median : 37 years;31-43). Of the participants, BMI> 25 was the predominant group having this syndrome. On average, workers with MetS had higher abnormal blood samples, as compared to to those without MetS. The proportion of smoker and alcohol consumption was lower in MetS group. Table 2 also showed that in group with MetS had higher level of all of the metabolic syndrome's component.

Prevalence of individual metabolic syndrome criteria is presented in Table 3. Hypertriglyceridemia was the most common

Table 1. Characteristics of Study Participants

Variables	Non MetS cases (n=1117)	MetS cases (n=181)	p Value
Age,year (median,IQR)	37 (31-43)	41(37-48)	
<30 years (n, %)	219(19.6)	19(10.5)	0.000
31-40 years (n,%)	455(40.7)	49(27.1)	
>40 years (n,%)	443(39.7)	113(62.4)	
BMI kg/m2(median,IQR)	23.05(20.93-25,65)	27.89(25.4-30.48)	
<22.9	536 (47.9)	19 (10.5)	0.000
23-24.9	232 (20.8)	20 (11.0)	
>25	349 (31.3)	142 (78.5)	
Cholesterol (median,IQR)			
Total	194(164-227)	207(172-236)	0.002
LDL	105(84-135)	117(89-139)	0.025
Liver enzymes (median,IQR)			
SGOT	19(16-23)	21 (18-25)	0.000
SGPT	18(15-20)	18(16-24)	0.003
Uric Acid (median,IQR)	5.9(5.2-6.5)	6.1(5.3-6.7)	0.006
White Blood Cell (median,IQR)	6.8(5.7-7.9)	7.2 (6.2-8.7)	0.000
Hemoglobin(median,IQR)	15.4(14.4-16.1)	15.4(14.6-16.2)	0.482
Smoking (n,%)			
Smoker	632 (56.5)	85(46.9)	0.016
Non smoker	485(43.5)	96(53.1)	
Exercise (n,%)			
Yes	370 (33.1)	83 (45.8)	0.001
No	747(66.9)	98(54.2)	
Drink Coffee (n,%)			
Yes	337(30.1)	52(28.7)	0.695
No	780 (69.9)	129 (71.3)	
Alcohol consumption (n,%)			
Yes	7 (0.6)	1 (0.5)	0.906
No	1110(99.4)	180(99.5)	

Keterangan: METS, metabolic syndrome, IQR;interquartile range, BMI, bodymass index; BP, blood pressure; HDL indicates high-density lipoprotein; LDL, low-density lipoprotein.

component of the syndrome (94.5%) followed by increasing of waist circumference or abdominal obesity (80.6). Low HDL was present in only 18.2% respondents. This is quite similar with the respondents without MetS. Hypertriglyceridemia was the highest (38.1%) and low HDL was the lowest (1.6%) component among the participants.

According to Table 4, the majority of respondents (35.5%) had at least one of the metabolic syndrome's five components. This was followed by the proportion of respondents who reported having two of five components with a value of up to 24.5% and only 0.3% in the subjects had five components.

The relationship between metabolic syndrome and risk factors revealed in Table 5. As BMI increased, the prevalence of the syndrome increased as well. Additionally, as seen in this table, older age, increased white blood cell count, and physical activity were all associated with an increased risk of MetS.

Discussion

This study provides new information about MetS in male workers in Indonesia in several significant ways. To begin, a pooled analysis of a 1298-person sample reveals that 13.9% of them have metabolic syndrome (MetS). This finding is slightly lower with the study by SKR van Zon in Ducth with 17.5% of Mets found in males worker and 10.6% for females.[14] The prevalence of metabolic syndrome varies according to gender and labor occupational classification in past studies.[14,15]

Table 2. Measurement values of Metabolic Syndrome Component*

Variables	Non MetS cases (n=1117)	MetS cases (n=181)	p Value
Waist cirfumference,cm (median,IQR)	79(73-87)	94(90-101)	<0.001
Blood pressure, mmHg (median,IQR)			<0.001
Systolic BP	110 (110-120)	120 (110-130)	
Diastolic BP	80(80)	80(80-90)	
Fasting glucose,mg/dL (median,IQR)	93(85-101)	107(100-118)	<0.001
Triglyserides (median,IQR)	133(101-172)	190(164-232)	<0.001
HDL cholesterol (median,IQR)	58(50-67)	60(47-70)	<0.001

Keterangan: METS, metabolic syndrome, IQR;interquartile range; BP, blood pressure; HDL indicates high-density lipoprotein.

However, the number was lower compare to general population in Indonesia (21.66%) and also a study by FS Sigit et al. revealed that the prevalence of MetS in middle-aged individuals in Indonesia's male population is 28%.[2,16]

Employees may have a lower rate of MetS due to a variety of factors, including their younger age, increased physical activity due to work conditions, and demonstrating a healthy worker effect. To be hired, these individuals must not only be in better-than-average health, but they must also have passed a health examination prior to being admitted to the industry.

Second, approximately one-third of all subjects had at least one MetS component, with hypertriglyceridemia being the most prevalent (96.9%). It was also discovered to be a significant factors in the diagnosis of MetS and the CVD risk index in other studies.[17,18] This finding suggest that hypertriglyceridemia may be a critical marker for detecting early MetS pathology. Another significant finding in this study was that 80.6% of participants had abdominal or central obesity after being diagnosed with hypertriglyceridemia. Hypertriglyceridemia and an elevated WC, referee to as Hypertriglycemic Waist (HTW), may represent a simple clinical phenotype for identifying indivduals with excess visceral adipose tissue.[19] Because abdominal obesity is important in CVD risk stratification, health care workers may discover that measuring WC in addition to BMI is the best alternative assessment. It is inexpensive, simple to use and has relationships with visceral adiposity for a given BMI.[20]

Higher BMI was found to be associated with a greater AOR of developing MetS in this study. A higher BMI is a simple anthropometric assessment of total body fat; however, it should be supplemented with additional

Table 3. Distribution of Metabolic Syndrome Components

Variables	Non MetS Cases (n=1117)		MetsS Cases (n=181)		OR (CI 95%)	p Value
	Yes	N (%)	Yes	N(%)		
Abdomen Obesity						
Yes	214	19.2	146	80.6	17.60 (11.82-26.20)	<0.001
No	903	80.8	35	19.4		
High Triglyserides						
Yes	426	38.1	171	94.5	27.73 (14.49- 53.07)	<0.001
No	691	61.9	10	5.5		
High Fasting Glucose						
Yes	320	28.6	143	79.0	9.37 (6.40-13.71)	<0.001
No	797	71.4	38	21.0		
High Blood Pressure						
Yes	122	10.9	85	46.9	7.22 (5.10-10.21	<0.001
No	995	89.1	96	53.1		
Low HDL						
Yes	18	1.6	33	18.2	13.61 (7.47-24.79)	<0.001
No	1099	98.4	148	81.8		

Table 4 . Prevalence of Risk Factors for Metabolic Syndrome

Component	Prevalence
1	35.5%
2	24.5%
3	11.2%
4	2.2%
5	0.3%

measures of fat distribution, such as the waist-to-height ratio or the waist circumference (WC), in order to identify high-risk individuals. Since visceral adipose tissue is strongly linked to waist circumference, the ATP III added waist circumference as a proxy measure for abdominal/central obesity and outperforms BMI as an anthropometric predictor of metabolic risk factors.[21,22]

It significantly contributes to MetS changes by altering the secretion of biologically active substance derived from adipocytes (adiokines) such as interleukin-6 (IL-6), tumor necrosis factor alpha (TNF-a), C-reactive protein and plasminogen activator inhibitor type-1 (PAI-1),[24] which favors insulin resistance and associated cardiometabolic risk factors. As a result, an atherogenic, prothrombotic, and inflammatory profile is enhaced.[23,24]

White blood cells (WBC) or leukocytes are a common, low-cost, and widely used marker of inflamation. The increased of total leukocytes have all been linked to MetS in numerous studies[25-27] and in our study showed positive association observed between total leukocyte and the METS. Additionally, incident MetS cases had a higher baseline WBC count than subjects without MetS.

Table 5. Crude and Adjusted Odd Ratio of Having MetS

Variables	Crude Odd Ratio (95% CI)	MetS cases (n=181)	p Value
Age			
<30 years	1.24 (0.71-2.15)	1.31 (0.72-2.40)	0.381
31-40	2.94 (1.76-4.90)	2.39 (1.36-4.21)	0.001
>40 years	Ref		
BMI			
<22.9	Ref		
23-24.9	2.43 (1.27-4.64)	2.15(1.11-4.18)	0.023
> 25	11.47 (6.97-18.87)	9.29(5.56-15.54)	0.000
Cholesterol			
Total	1.01 (1.00-1.01)	1.01(0.99-1.01)	0.092
LDL	1.01(1.00-1.01)	0.99 (0.98-1.00)	0.256
Liver enzymes			
SGOT	1.03 (1.01-1.05)	1.02 (0.99-1.05)	0.162
SGPT	1.02 (1.01-1.04)	1.00 (0.98-1.04)	0.585
Uric Acid	1.17 (1.02-1.34)	1.03 (0.88-1.21)	0.648
Leukosit	1.18 (1.09-1.29)	1.13(1.04-1.24)	0.004
Life style			
Smoking	0.67 (0.49-0.93)	1.06 (0.75-1.51)	0.731
Exercise	1.71 (1.24-2.34)	1.51 (1.06-2.15)	0.022

Many of cardiometablic risk factors are caused by a combination of insulin resistance and abdominal obesity caused by an increase intra-abdominal fat. Endothelial dysfunction, cytokine imbalance and inflammation obesity are all a result of insulin resistance, which is frequently associated with MetS. Atherogenic dyslipidemia, which is characterized by high TG, low HDL cholesterol and tiny dense LDL, is also exacerbated by insulin resistance.

Although the processes behind the association between WBC numbers and MetS are remain unclear, there are several theories. Inflammation is connected to obesity and insulin resistance, and it may be a central mechanism in MetS. Disorders of lipid metabolism are also observed during inflammation. TNF-a and IL-6, two proinflammatory cytokines that are synthesized in adipose tissue in addition to being produced by activated macrophage, have been shown to impair insulin action on both adipocytes and muscle cells in a paracrine/autocrine manner. Obesity alter these inflammatory mediators, including C-reactive protein (CRP). Hormones (such as adiponectin and leptin) are also thought to contribute to the inflammatory profile seen in obesity, particularly abdominal obesity. The fact that cytokines raise WBC count, which are associated with insulin resistance and hyperinsulinemia, suggest that their combination could lead to the development of a subclinical inflammatory responses as well as insulin resistance.[24,28,29]

Numerous population studies have discovered that the prevalence of MetS increases with age[30-32] and our study also discovered that AOR for developing MetS was higher in the 31-40 years group compared to the age group below 30 years, indicating that age is a strong independent predictor of the development of the MetS. Increasing sedentary behaviour and functional disability in older adults may be contributing factors to the increased prevalence of MetS.

In aging individuals, there are age-related decline in growth hormone and its anabolic mediator, insulin like growth factor 1 is associated with the decreased lean body and bone mass, as well as the increase in body fat percentage. In terms of pancreatic enzymatic function, pancreatic lipase may be mildly reduced in elderly individuals, which may explain the mild impairment of fat absorption observed in this population. Age related change in insulin extraction from the liver and glucose sensitivity during the second phase of insulin secretion are all associated with increased hepatic insulin extraction. Rather than insulin secretion impairment, increased insulin resistance appears to be the primary cause of this age-related decline in glucose tolerance, thereby increasing the risk of developing MetS.[33,34]

The implication of this finding are that efforts to raise awareness of preventive strategies should begin as soon as possible, ideally before any of the constituent components (for example, hypertriglyceridemia) develops into the full three components required for the formal definition of Mets by NCE-ATP III or other criteria.

Our findings indicated a reverse relationship between exercise and the risk of MetS. However, this finding should be interpreted cautiously, as the definition may contain a bias. Additionally, physical exercise may be a response (‘effect’) to the development of MetS in workers rather than the cause. Some participants may have begun exercising as a result of their MetS. The mechanism underlying these associations are unknown and should be investigated further.

The current study several limitations as follows: One of which was its cross-sectional design, which precluded inferring causal relationships between the associations discovered. The absence of clinical outcomes (CVD events) is also significant limitation of this study. Finally, the results of this study can only be generalized to some group of the workers. Despite these limitations, the study has provided useful information about the prevalence of Mets and risk factors of male Indonesian working population.

Conclusion

Hypertriglyceridemia followed by abdominal obesity were the most finding component of Mets and higher BMI was found to be associated with a greater AOR of developing MetS in this study. Therefore measuring waist circumference (WC) in addition to BMI is important for screening of this syndrome in Medical Check Up for workers. Future research should be conducted to determine the efficacy of specific interventions for MetS particularly in the high-risk individuals in the working population such as the workers who are obese and disease management programs that address risk factors for MetS. This is encouraging because health promotion’s programs in the workplace may help employees reduces their health risk.

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