Portrait of Metabolic Syndrome by Gender in A Rural Area of Gowa Regency

Masalah Potret Sindrom Metabolik Berdasarkan Jenis Kelamin Pada Masyarakat Pedesaan di Kabupaten Gowa

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**Abstract**

Metabolic syndrome is an important indicator in efforts to control non-communicable diseases. The incidence of metabolic syndrome is directly proportional to the incidence of obesity while the prevalence of metabolic syndrome varies based on sociodemographic characteristics and lifestyle. Efforts to identify metabolic syndrome in the community are a crucial step to identify early the potential for hypertension, coronary heart disease, stroke and diabetes mellitus. This study aims to identify components of metabolic syndrome based on gender. Cross sectional study is the research design that underlies data collection on risk factors for metabolic syndrome which is carried out through interviews and measurements of height, weight, waist circumference, blood pressure and cholesterol levels using NCEP-III criteria as the basis for identifying metabolic syndrome. Data analysis used the Chi-Square test. The metabolic syndrome component in the form of obesity is identified in men and women using different indicators. Both men and women have experienced increases in systolic blood pressure and cholesterol levels. A history of smoking was the only risk factor for metabolic syndrome with a statistically significant difference in proportion between men and women. Behavioral modifications such as eating patterns, rest, and others according to the guidance of the Koran and hadith are needed to minimize the incidence of metabolic syndrome.

Abstrak

Sindrom metabolik menjadi indikator penting dalam upaya penanggulangan penyakit tidak menular. Insiden sindrom metabolik berbanding lurus dengan kejadian obesitas sementara prevalensi sindrom metabolik bervariasi berdasarkan karakteristik sosiodemografi dan gaya hidup. Upaya identifikasi sindrom metabolik pada komunitas menjadi langkah krusial untuk mengidentifikasi secara dini potensi kejadian penyakit Hipertensi, Jantung koroner, Stroke dan Diabetes mellitus. Penelitian ini bertujuan untuk mengidentifikasi komponen sindrom metabolik berdasarkan jenis kelamin. Cross sectional study menjadi desain penelitian yang mendasari pengumpulan data faktor risiko sindrom metabolik yang dilakukan melalui wawancara dan pengukuran tinggi badan, berat badan, lingkar pinggang, tekanan darah dan kadar kolesterol dengan kriteria NCEP-III sebagai dasar identifikasi sindrom metabolik. Analisis data menggunakan uji Chi-Square. Komponen sindrom metabolik berupa obesitas teridentifikasi pada laki-laki dan perempuan dengan penggunaan indikator berbeda. Baik laki-laki maupun perempuan telah mengalami peningkatan tekanan darah sistolik dan kadar kolesterol. Riwayat merokok menjadi satu-satunya faktor risiko sindrom metabolik dengan perbedaan proporsi yang signifikan secara statistik antara laki-laki dan perempuan. Modifikasi perilaku seperti pola makan, istirahat, dan lainnya sesuai tuntunan alquran dan hadis diperlukan untuk meminimalisir kejadian sindrom metabolik.

Graphical Abstract
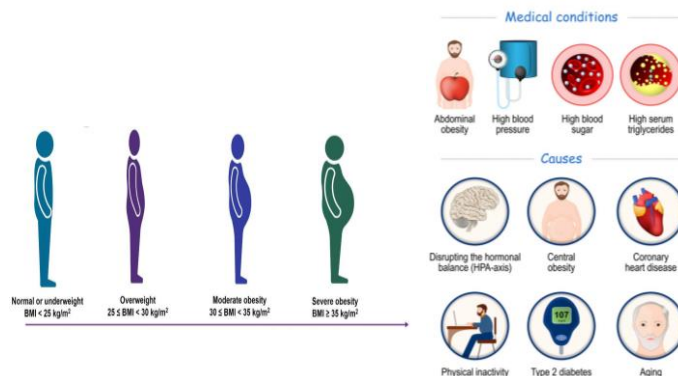
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INTRODUCTION

Non-communicable diseases are a major contributor to the prevalence of disability and premature death globally. One of the non-communicable diseases recorded to have increased prevalence from 2000 to 2019 is metabolic disease, especially in countries with a high sociodemographic index (Chew et al., 2023). Metabolic syndrome characterized by metabolic imbalances, such as high triglyceride levels and low-density lipoprotein (HDL) cholesterol levels, increased blood pressure and belly fat, and insulin resistance is a gateway to non-communicable diseases and is one of the global health challenges today (Rodrigues et al., 2021; Solomon & Mulugeta, 2019). Metabolic syndrome is not a single disease, but rather a series of symptoms and signs that can affect overall health. This condition is of public health concern due to its significantly increased prevalence and negative impact.

According to NHNES data, during 1988-2010, the average Body Mass Index in the US increased by 0.37% per year in men and women, and waist circumference (LP) increased by 0.37 and 0.27% per year in women, respectively. According to CDC data published in 2017, about 30.2 million adults aged 18 years and older or 12.2% of adults in the US have type 2 diabetes and as many as 23.8% are unaware of having diabetes. The prevalence of prediabetes or metabolic syndrome is about three times more. So, about one-third of adults in America suffer from metabolic syndrome (Saklayen, 2018). In Indonesia, the prevalence of metabolic syndrome is 23% with a percentage distribution of 26.6% in women and 18.3% in men. Consumption of sweet foods more than once per day as much as 43.5% and less than once per day 10.5% with a risk of experiencing metabolic syndrome of 6.567 times. Consumption of salty foods that fall into the category often has a proportion of metabolic syndrome of 100% with a risk of experiencing metabolic syndrome as much as 6,363 times (Suhaema & Masthalina, 2015).

Several factors such as urbanization, excessive energy intake, increased incidence of obesity and sedentary lifestyle, are the reasons metabolic syndrome has become a public health problem and clinical challenge worldwide (Kamso et al., 2011). Sociodemographic and lifestyle characteristics have been studied by various studies and show contributions to differences in the distribution of metabolic syndrome (Herningtyas & Ng, 2019; Naghipour et al., 2021; Sugathan et al., 2021). The prevalence of metabolic syndrome was identified as higher in women than men (Naghipour et al., 2021; Rodrigues et al., 2021). In the last 3 years, metabolic syndrome research in Indonesia has been carried out by several researchers with diverse subjects including adults (Lasimpala et al. 2021), civil servant (Syifa, F. A. 2023), and students (Setiarsih et al. 2023). Even so, research focusing on teachers has not been widely carried out even though this profession is very vulnerable to metabolic syndrome due to lack of physical activity (de Souza., et.al. 2023) and poor rest patterns that impact stress and eating disorders (Amschler & McKenzie, 2010). This study aimed to identify the components of metabolic syndrome based on gender using teachers as research subjects.

METHODS

This research is analytical using a cross sectional design. The study population was all teachers in Kanreapia Village, Gowa Regency, South Sulawesi. The research sample was elementary, junior high and MTs teachers in Kanreapia Village, Gowa Regency, which is a target village of the UIN Alauddin Makassar public health study program. The samples in this study were taken accidentally, totaling 28 people. The study variables were components and risk factors for metabolic syndrome by sex. The Third Report of the National Cholesterol Education Program (NCEP-III) was the criteria used to identify metabolic syndrome in this study. NCEP-III states that a person has metabolic syndrome if he has at least 3 (three) of the following 5 (five) components, namely abdominal obesity (waist circumference >88 cm for women); high blood triglyceride levels (≥ 150 mg / dl); low levels of HDL cholesterol (<50 mg/dl in women); high blood pressure ($\geq 140/\geq 90$ mmHg); and high fasting blood glucose levels (≥ 126 mg/dl). However, given the difference in "normal" waist circumference values between ethnicities, in this study a waist circumference of ≥ 80 cm was used as a limit of central obesity of Asian women (National Cholesterol Education Program et al., 2002).

Data collection took place in October 2023 and was conducted through interviews using a standard metabolic syndrome risk factor history questionnaire (https://www.nhlbi.nih.gov/files/docs/guidelines/atglance.pdf) and through measurements of height, weight, waist circumference, blood pressure and cholesterol levels. Data analysis was carried out univariately and bivariately using the Chi-Square test with a reference significance value of <0.05 to identify differences in the proportion of metabolic syndrome risk factors.

Table 1
Frequency Distribution of Metabolic Syndrome

Variable	Man (n=14)		Woman (n=14)	
	Mean/median	SD/Range	Mean/median	SD/Range
Age (years)	43.8	11.6	38.5	10.5
BMI	25.6	16.7 – 28.4	23.8	0.2 – 37.2
Waist circumference (cm)	86.7	64 – 102	87	67 – 105
Systolic blood pressure (mmHg)	135.5	100 – 169	129.5	107 – 192
Diastolic blood pressure (mmHg)	79.5	53,0– 108	81	70 – 127
Cholesterol values (mg/dl)	203.5	123 – 263	241.5	123 – 371

Note: The size of the centering and the size of the spread used are adjusted to the results of the data normality test

RESULTS

The study respondents were 41.2 years old with the highest distribution (46.4%) being elementary school teachers. The ratio of respondents by gender was 1:1. Based on the characteristics of metabolic syndrome, it was identified that female respondents had an average excess abdominal fat content, while male respondents, based on BMI values, were obese on average. Both male and female respondents had diastolic blood pressure that was in the pre-hypertensive category, 120-139 mmHg, and total cholesterol levels above the threshold value recommended by the Indonesian Ministry of Health, which is <200 mg / dl (See Table 1). The results of the analysis of 10 items of metabolic syndrome risk factors identified no respondents who had a history of drinking alcohol and participated in the prolanis program. Smoking history was the only metabolic syndrome risk factor that showed a statistically significant difference in proportion between male and female respondents (See Table 2).

DISCUSSIONS

Body Mass Index (BMI) is an indicator to assess obesity in general, while waist circumference is an indicator to assess central obesity. Both BMI indicators and waist circumference will generally show the same obesity status. However, in this study, the average BMI value in male respondents was in the overweight category, not in line with central obesity status which refers to the value of waist circumference. Conversely, the average waist circumference of female respondents who showed central obesity status was not in line with the average BMI value which was in the normal category. The findings in this study reinforce the results of the study Csongová et al. (2018) which showed waist circumference indicators tended to show central obesity status below the estimated value in men and above the estimated value in women.

The use of BMI and waist circumference indicators to identify obesity needs to consider the results of studies that show the BMI category has a negative predictive value (NPV) that tends to be high to rule out metabolic syndrome, both in men and women in all age groups. However, BMI has a relatively low positive predictive value (PPV) when compared to waist circumference. The value of 27 on BMI can be used as an ideal reference to identify metabolic syndrome with sensitivity and specificity values in men 77.2% and 55.0% and in women 84.7% and 70.1% (Ofer et al., 2019).

Normal Weight Obesity is a condition characterized by BMI values that are in the normal category, but the percentage of body fat has increased. This condition is significantly associated with cardiometabolic dysregulation that contributes to the prevalence of metabolic syndrome. Research conducted by Romero-Corral et al. (2010) shows every 1 percent increase in belly fat can increase the chances of metabolic syndrome by up to 1.11 times. The prevalence of NWO was identified as higher in females than males (Lahav et al., 2023; Romero-Corral et al., 2010). In women, NWO conditions are associated with an increased risk of mortality associated with cardiovascular disease. This is based on the increase in several inflammatory biomarkers in women with NWO, such as plasma concentrations of interleukins that are lower than women with the non-obese category and higher than women with the preobesity category (De Lorenzo et al., 2007).

Differences in the distribution of metabolic syndrome components can be seen by gender. In males, the most common component of metabolic syndrome is hypertension, while in females it is an increase in waist circumference (Marcus et al., 2023).

Table 2
Risk Factor Analysis of Metabolic Syndrome

Factor Risk	Man		Woman		p-value
	n	%	n	%	
Age					
< 25 tahun	3	21.4	6	42.9	0.213
25 – 44 tahun	5	35.7	6	42.9	
45 – 59 tahun	6	42.9	2	14.3	
BMI					
<21	2	14.3	5	35.7	
21 – 22.9	1	7.1	1	7.1	0.596
23 – 23.9	2	14.3	2	14.3	
24 – 24.9	9	64.3	6	42.9	
Drinking alcohol					
No	14	100	14	100	-
Smoking history					
Yes	10	71.4	0	0	0.000*
No	4	28.6	14	100	
Economic difficulties					
Yes	4	28.6	3	21.4	1.000
No	10	71.4	11	78.6	
Physical activity					
Yes	11	78.6	10	71.4	1.000
No	3	21.4	4	28.6	
Limiting salt consumption					
Yes	10	71.4	6	42.9	0.127
No	4	28.6	8	57.1	
Limiting sugar consumption					
Yes	7	50	5	35.7	0.703
No	7	50	9	64.3	
Consumption of dairy products					
Yes	4	28.6	2	14.3	0.645
No	10	71.4	12	85.7	
Program participation in "prolanis"					
No	14	100	14	100	-
Program participation in "posbindu"					
Yes	1	7.1	2	14.3	1.000
No	13	92.9	12	85.7	

Note: * = Significance value based on Chi Square test

Increased blood pressure and hypertension in males may precede the appearance of other components of metabolic syndrome, such as central obesity due to the accumulation of visceral fat lower below the threshold value of the category of increased waist circumference at risk. The pathophysiology of hypertension is multifactorial and it is necessary to pay attention to sympathetic activity, arterial stiffness and sex hormones in explaining the different distribution of hypertension incidence by sex (Cohen et al., 2023).

Elevated cholesterol levels can occur both in men and in women. A study conducted in America showed women tend to have higher cholesterol levels than men and these results are consistent across all races (Tharu & Tsokos, 2017). One of the factors contributing to this distribution is age. In women the increase in total cholesterol can occur to peak at the age of 56-57 years, while in men occurs at the age of 50-51 years. In women, age's contribution to increased total cholesterol levels can be explained through the drastic decrease in estrogen in the body that occurs during menopause (Harlinda et al., 2022; Izumida et al., 2021).

The risk of identified metabolic syndrome increased by 26% in active smokers than nonsmokers (Rodrigues et al., 2021). Research (Bermudez et al., 2018) shows a higher percentage of metabolic syndrome components in former smokers (47.9%) and active smokers (42.1%), than nonsmokers (31.6%), both in men and women. The components of

metabolic syndrome in question are triglycedira, central obesity, and hypertension. The contribution of cigarette smoke to metabolic syndrome is confirmed by research (Kim et al., 2020) which shows the chance of metabolic syndrome events associated with passive smoking status in women is 1.27 times while in men is 1.11, but the association between passive smoking status and metabolic syndrome incidence is statistically significant only in women. This condition can be explained by a higher rate of cotinine metabolism in women than men due to higher estrogen levels.

The difference in the proportion of smoking history in men and women identified in this study may contribute to several factors. The respondent's job as a teacher demands control of words and deeds because it is an example for students. In addition, cultural factors such as society's stereotypical value of smoking behavior by women as women with moral disabilities have the potential to play a role in the difference in smoking proportions between men and women (Sadarang, 2021).

The act of smoking endangers yourself and others exposed to secondhand smoke because cigarettes are addictive substances and contain 4000 chemicals, 69 of which are carcinogenic / trigger cancer. Various studies have shown the dangers of cigarettes for health including the impact of smoking on the pulmonary alveolus (Rohmani et al., 2018); environment (Prasetyo et al., 2018); nasopharyngeal cancer (Aini et al., 2022). This fact of health causes the act of smoking to contain elements of falling into destruction and even constitutes suicide slowly so that it contradicts the prohibition of the Qur'an in surah Al-Baqarah/2:195 and An-Nisa/4: 29, which means:

> "And spend in the way of Allah and do not throw (yourselves) with your (own) hands into destruction (by refraining) …"

> "… And do not kill yourselves (or one another). Indeed, Allah is to you ever Merciful."

The findings in this study suggest that the normal weight obesity category needs further study support related to the contribution to metabolic syndrome with a larger sample size. In addition, identification of the contribution of metabolic system risk factors based on other sociodemographic characteristics needs to be done as a reference for planning effective risk factor control activities. In this study, respondents who were involved did not match the initial target because during the study, many teachers were absent because they did not have a teaching schedule that day. The location where teachers live far from the school causes teachers to only come to school if they have a teaching schedule.

CONCLUSIONS

The metabolic syndrome component in the form of obesity was identified in men using BMI value indicators while in women using waist circumference indicators. Both men and women in the study had elevated systolic blood pressure and cholesterol levels. History of smoking was the only risk factor for metabolic syndrome with a statistically significant difference in proportion between men and women. Further research using larger samples is needed to validate differences in obesity categories in men and women. In addition, teachers need to make behavioral modifications such as improving diet, resting patterns, and not smoking according to the guidance of the Qur'an and hadith to minimize the incidence of metabolic syndrome. In addition, routine health checks on teachers need to be carried out by health center for early detection of metabolic syndrome events.

AUTHORS' CONTRIBUTIONS
Rimawati A. I. Sadarang & Emmi Bujawati designed the study, wrote manuscript, analyzed and acquired the data. Nildawati designed and formulated the consept. Dian R. Wijaya designed the study. Dian I. Ansyar collected and analized the data, Bs Titi Haerana wrote manuscript and analyzed the data. All authors revised the manuscript, and performed the field work.

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COMPETING INTERESTS

The author(s) declare no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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