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Metabolic Syndrome and Framingham Cardiovascular Risk among Workers at Yayasan Suka Hati Kusuma Bangsa

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ABSTRACT

Metabolic syndrome is a cluster of metabolic abnormalities associated with an increased risk of cardiovascular disease and type 2 diabetes mellitus. This study aimed to determine the prevalence of metabolic syndrome using the modified National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) criteria for Asian populations and to describe the 10-year cardiovascular risk based on the Framingham Risk Score (FRS) among workers at Yayasan Suka Hati Kusuma Bangsa, Jakarta. A descriptive observational study was conducted using baseline data from 58 eligible workers employed in the institution's junior high school, vocational high school, and university units. Data were collected on demographic characteristics, waist circumference, blood pressure, triglycerides, high-density lipoprotein (HDL) cholesterol, blood glucose, and lifestyle factors. Metabolic syndrome classification was based on four available components: waist circumference, triglycerides, HDL cholesterol, and blood pressure, because fasting plasma glucose was unavailable. Cardiovascular risk was assessed using the FRS and categorized as low (<10%), moderate (10–20%), or high (>20%). Data were analyzed descriptively and presented as frequencies, percentages, medians, and interquartile ranges. Of the 58 respondents, 54 (93.1%) were classified as having metabolic syndrome, while four (6.9%) were not. Most participants had a low predicted 10-year cardiovascular risk (89.1%), whereas 10.9% had moderate risk and none had high risk. The median waist circumference was 90 cm, and the median HDL cholesterol level was 34.5 mg/dL. These findings indicate a substantial burden of metabolic abnormalities despite predominantly low predicted short-term cardiovascular risk. Routine workplace health screening and early lifestyle-based interventions are therefore important. However, the prevalence estimate should be interpreted cautiously because fasting plasma glucose was unavailable and the assessment relied on four metabolic components. Further studies involving larger, multisite populations and complete diagnostic measurements are recommended.

Keywords: *Metabolic syndrome; NCEP-ATP III, Framingham Risk Score, Cardiovascular risk*

Introduction

Metabolic syndrome is a constellation of metabolic abnormalities characterized by central obesity, dyslipidemia, elevated blood pressure, and impaired glucose metabolism. These abnormalities frequently occur simultaneously and substantially increase the risk of type 2 diabetes mellitus and cardiovascular disease (Budreviciute et al., 2020; Gami et al., 2007; Rus et al., 2023). The prevalence of metabolic syndrome has increased over recent decades, partly due to urbanization, unhealthy dietary patterns, physical inactivity, sedentary behavior, and obesity. Occupational factors, including prolonged working hours and shift

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work, may further contribute through disruption of circadian rhythms and unhealthy lifestyle behaviors (Sooriyaarachchi et al., 2022).

Several diagnostic criteria have been proposed; however, the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) criteria remain widely used because of their practicality and broad acceptance. According to the modified NCEP-ATP III criteria for Asian populations, metabolic syndrome is diagnosed when at least three abnormalities are present, including abdominal obesity, elevated triglycerides, reduced high-density lipoprotein (HDL) cholesterol, elevated blood pressure, and impaired fasting glucose (Anggraini, 2024; Sulistiowati & Sihombing, 2016).

Metabolic syndrome is closely associated with cardiovascular disease through insulin resistance, chronic low-grade inflammation, endothelial dysfunction, oxidative stress, and accelerated atherosclerosis (Guembe et al., 2020). The Framingham Risk Score (FRS) estimates cardiovascular risk using age, sex, blood pressure, smoking status, diabetes status, and lipid profile to predict the probability of cardiovascular events within the next 10 years (Dwivani et al., 2018; Jahangiry et al., 2017).

Evidence describing metabolic syndrome and cardiovascular risk among Indonesian workers remains limited. Occupational populations are important targets for preventive health programs because metabolic disorders may affect productivity and increase future healthcare burden. Therefore, this study aimed to determine the prevalence of metabolic syndrome using the modified NCEP-ATP III criteria for Asian populations and to describe the distribution of cardiovascular risk according to the FRS among workers at Yayasan Suka Hati Kusuma Bangsa. The findings are expected to support early metabolic screening and preventive strategies in workplace settings.

In addition to individual health outcomes, metabolic syndrome represents an important public health concern in occupational settings because its components may develop gradually without producing noticeable symptoms. Workers who appear healthy and remain physically active in their professional roles may nevertheless have underlying metabolic abnormalities that increase their long-term risk of noncommunicable diseases. Early identification of these abnormalities is therefore essential to facilitate timely intervention before more serious clinical complications develop. Workplace-based health assessments can provide opportunities to identify individuals who require further medical evaluation and to promote healthier behavioral patterns among employees.

The assessment of metabolic syndrome and cardiovascular risk provides complementary information for evaluating cardiometabolic health. While metabolic syndrome identifies the clustering of specific metabolic abnormalities, the Framingham Risk Score estimates the probability of developing cardiovascular

events over a 10-year period. These assessments may produce different risk profiles because cardiovascular risk prediction also considers factors such as age, smoking status, and other clinical characteristics. Consequently, individuals with metabolic abnormalities may still have a low estimated short-term cardiovascular risk, particularly when they belong to a relatively young population. Examining both indicators can provide a broader understanding of workers' health status and help identify potential priorities for preventive interventions.

Despite the importance of occupational health screening, evidence concerning the coexistence of metabolic syndrome and predicted cardiovascular risk among workers in Indonesian educational institutions remains limited. Institutional workforces represent a relevant population for investigation because their demographic characteristics, daily routines, and lifestyle behaviors may influence their cardiometabolic profiles. Accordingly, this study examines workers at Yayasan Suka Hati Kusuma Bangsa to characterize the prevalence of metabolic syndrome and the distribution of cardiovascular risk based on the Framingham Risk Score. By describing these two health indicators within the same population, the study seeks to provide preliminary evidence to support workplace health promotion, encourage periodic metabolic assessment, and inform preventive strategies tailored to employees' health needs. The findings may also contribute to further research involving larger populations and more comprehensive diagnostic measurements.

Methods

Study Design and Participants

This study employed a descriptive observational design using baseline data collected from workers at Yayasan Suka Hati Kusuma Bangsa, Jakarta, between June and December 2024. The study population comprised workers from the junior high school, vocational high school, and university units. Initially, 75 workers were recruited; 17 participants were excluded because two declined participation, one relocated outside the study area, and fourteen did not complete scheduled follow-up assessments. Consequently, 58 respondents who fulfilled the inclusion criteria and had complete baseline data were included.

Participants were eligible if they were aged 18 years or older, actively employed at the institution, and provided written informed consent. Respondents with incomplete demographic or clinical data required for metabolic syndrome and cardiovascular risk assessment were excluded.

Data Collection

Baseline demographic characteristics included sex, age, and educational level. Clinical and anthropometric measurements consisted of waist circumference, systolic and diastolic blood pressure, triglycerides, HDL cholesterol, and blood

glucose. Lifestyle characteristics, including smoking status, alcohol consumption, physical activity, and dietary habits, were collected using structured questionnaires. Physical activity was assessed using the Global Physical Activity Questionnaire (GPAQ), whereas dietary behavior was evaluated according to the American Heart Association Diet and Lifestyle Recommendations (World Health Organization; American Heart Association, 2024).

Assessment of Metabolic Syndrome

Metabolic syndrome was assessed using the modified NCEP-ATP III criteria for Asian populations (Hirigo et al., 2021; Sulistiowati & Sihombing, 2016). Fasting plasma glucose was not measured because participants were unable to undergo fasting before blood collection. Therefore, classification in the present study was based on the four available components recorded in the study database: waist circumference, triglycerides, HDL cholesterol, and blood pressure. This constitutes an important methodological limitation because the absence of fasting plasma glucose may affect metabolic syndrome classification and the resulting prevalence estimate. Accordingly, the prevalence reported in this study should be interpreted as a result of a modified assessment approach rather than a complete application of all original NCEP-ATP III components.

Cardiovascular Risk Assessment and Statistical Analysis

The 10-year risk of cardiovascular disease was estimated using the Framingham Risk Score (FRS), incorporating age, sex, systolic blood pressure, smoking status, diabetes status, total cholesterol, and HDL cholesterol (Dwivani et al., 2018; Iso et al., 2021; Jahangiry et al., 2017). Respondents were categorized as low risk (<10%), moderate risk (10–20%), or high risk (>20%). Data were analyzed using IBM SPSS Statistics. Categorical variables are presented as frequencies and percentages, whereas continuous variables are presented as medians and interquartile ranges (IQR) because several variables were not normally distributed.

Results and Discussion

A total of 58 workers fulfilled the eligibility criteria and were included in the final analysis. The demographic characteristics are presented in Table 1.

Variable	n	%
Sex		
Male	33	56.9
Female	25	43.1
Age		
25–35 years	26	44.8
36–45 years	24	41.4
≥46 years	8	13.8
Educational level		
High School	4	6.9
Bachelor's degree	43	74.1
Master's degree	11	19.0

Table 1. Characteristics of Respondents (n = 58)

The study population was predominantly male (56.9%), and most participants (86.2%) were aged 25–45 years. Most respondents had completed a bachelor's degree (74.1%). These characteristics indicate that the study primarily represented economically active adults. Metabolic disorders may develop gradually during productive adulthood because of cumulative exposure to modifiable factors such as physical inactivity, unhealthy dietary patterns, obesity, and occupational stress (Budreviciute et al., 2020; Kementrian Kesehatan RI, 2018).

Metabolic syndrome status	n	%
Metabolic syndrome	54	93.1
Non-metabolic syndrome	4	6.9

Table 2. Prevalence of Metabolic Syndrome (n = 58)

More than nine out of ten respondents (93.1%) were classified as having metabolic syndrome based on the modified assessment approach. This proportion suggests a considerable cardiometabolic burden within the study population. However, the estimate should be interpreted cautiously because the study involved a relatively small sample from a single institution and classification was based on four available metabolic components rather than the complete original NCEP-ATP III criteria. The absence of fasting plasma glucose may have influenced classification and limits direct comparison with studies using complete diagnostic criteria.

Despite these limitations, the findings highlight the importance of routine metabolic screening in workplace settings. Occupational lifestyle characteristics, including sedentary behavior, irregular meal schedules, psychosocial stress, and

limited opportunities for physical activity, may contribute to adverse metabolic profiles (Ananthy et al., 2021; Anggraini, 2024; Hirigo et al., 2021).

Parameter	Median	Interquartile Range (IQR)
Waist circumference (cm)	90	85–98
Triglycerides (mg/dL)	117	137–194
HDL cholesterol (mg/dL)	34.5	30–40
Systolic blood pressure (mmHg)	116.5	110–124
Diastolic blood pressure (mmHg)	82	76–89
Blood glucose (mg/dL)	114	105–129

Table 3. Baseline Metabolic Profile of Workers (n = 58)

The baseline metabolic profile showed variability across anthropometric and biochemical parameters. The median waist circumference was 90 cm, while the median HDL cholesterol concentration was 34.5 mg/dL, indicating an unfavorable lipid profile among the study population (Ananthy et al., 2021; Li et al., 2020). Blood glucose values should be interpreted cautiously because measurements were obtained under non-fasting conditions.

Although some population-level median values remained below diagnostic thresholds, individual-level clustering of metabolic abnormalities may still occur. Abdominal adiposity, dyslipidemia, impaired glucose regulation, and elevated blood pressure contribute to insulin resistance, chronic inflammation, endothelial dysfunction, and accelerated atherosclerosis (Gami et al., 2007; Guembe et al., 2020).

Cardiovascular risk category	n	%
Low (<10%)	41	89.13
Moderate (10–20%)	5	10.87
High (>20%)	0	0

Table 4. Distribution of Cardiovascular Risk According to the Framingham Risk Score (n = 58)

Most respondents (89.13%) were classified as having low 10-year cardiovascular risk, while 10.87% had moderate risk and none had high risk. This pattern may appear inconsistent with the high prevalence of metabolic abnormalities; however, the FRS assigns considerable weight to age. Because most respondents were 25-45 years old, their estimated short-term cardiovascular risk remained relatively low despite the presence of metabolic disturbances (Dwivani et al., 2018; Jackson et al., 2023).

The findings emphasize the complementary role of metabolic syndrome assessment and cardiovascular risk prediction. While the FRS is useful for estimating short-term cardiovascular risk, assessment of metabolic abnormalities

may identify early cardiometabolic disturbances that are not yet fully reflected in conventional 10-year risk prediction models.

Conclusion

The present study found a high prevalence of metabolic syndrome (93.1%) among workers at Yayasan Suka Hati Kusuma Bangsa using a modified assessment based on the available NCEP-ATP III components. Most respondents had a low predicted 10-year cardiovascular risk according to the Framingham Risk Score, suggesting that metabolic abnormalities may be present before a substantial increase in predicted short-term cardiovascular risk becomes evident. Routine metabolic screening and early lifestyle-based interventions are therefore important in occupational settings. Nevertheless, the prevalence estimate should be interpreted cautiously because fasting plasma glucose was unavailable and the metabolic syndrome classification was based on four available components rather than the complete original NCEP-ATP III criteria.

Recommendations

Future workplace health programs should include periodic comprehensive metabolic screening using complete diagnostic components, including fasting plasma glucose, to improve the accuracy of metabolic syndrome classification. Larger studies involving multiple institutions are also recommended to improve the generalizability of the findings and further evaluate occupational and lifestyle factors associated with cardiometabolic risk.

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Ethics Approval

This study used secondary data obtained from the audited 2025 annual reports publicly disclosed by the respective companies. As the study did not involve human participants, identifiable personal data, or experimental animals, ethical approval was not required.

Conflict of Interest

The authors declare that they have no conflicts of interest related to the research, authorship, or publication of this article.

Declaration on the Use of Artificial Intelligence

The authors declare that artificial intelligence (AI)-assisted tools may have been used to support language editing, grammar checking, and improvements in manuscript readability. These tools were not used as substitutes for the authors' scholarly judgment, data analysis, or interpretation of the research findings. The authors take full responsibility for the accuracy, originality, integrity, and final content of the manuscript.

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