A Clinical Profile of Metabolic Syndrome and Its Determinants among Police Officers in Bali

Febyan, Krisnhaliani Wetarini, Rendy, Chintia Septiani Thintarso, and Ketut Suastika

ABSTRACT

Introduction: Metabolic syndrome is defined as a cluster of cardiovascular risk factors which includes hyperglycemia, central obesity, hypertension and dyslipidemia [1]. It affects more than 1 in 4 United States (US) adults and increases the risk of diabetes mellitus (DM) by 5-fold and the risk of atherosclerotic cardiovascular disease (ASCVD) by 1.5 to 3-fold in over 5-10 years [2]. In US, study showed that this occupational group has a high risk for development of MetS and causing mortality at an earlier age compared to other groups [3]. The increase in risk is related to the lifestyle and working environment of the police that frequently under constant stress with a high rate of smoking and alcohol addiction [3]. Some policemen are often lead a physically inactive life, have irregular diet and limited choice of foods while on duty, take overtime and shift work, suffer from disrupted sleep patterns, stress and have high rates of tobacco and alcohol consumption than the general population, they have been found to have an increased prevalence of MetS risk factors and DM than any other occupational group and among the general population in many countries [3].

Material and Methods: A cross-sectional study was conducted among the police officers who performed the screening program at Bhayangkara Hospital Denpasar. The data was obtained by anamnesis, physical examination from anthropometric measurements and blood pressure, and laboratory findings. All data was computerized and analyzed using SPSS v.24. Criteria of metabolic syndrome was established using modified 3rd Adult Treatment Panel, International Diabetes Federation.

Results: The prevalence of metabolic syndrome among the police officers who performed the screening program in the period of January-June 2019 was 68.7%. Males (87.3%) were found to be more frequent than females (12.7%), and the most prevalent age were ranging from 36-45 years old (62.7%). A significant association was found between the metabolic syndrome event and gender (OR=0.169, 95% CI=0.078-0.366, p-value <0.001).

Conclusions: The prevalence of metabolic syndrome among the police officers was high, especially in male. The most frequent component of metabolic syndrome found in both male and female was central obesity. Association was found between metabolic syndrome and gender.

Keywords: Metabolic Syndrome, Obesity, Police, Indonesia.

I. INTRODUCTION

Metabolic syndrome (MetS) is defined as a cluster of cardiovascular risk factors that includes hyperglycemia, central obesity, hypertension and dyslipidemia [1]. It affects more than 1 in 4 United States (US) adults and increases the risk of diabetes mellitus (DM) by 5-fold and the risk of atherosclerotic cardiovascular disease (ASCVD) by 1.5 to 3-fold in over 5-10 years [2]. In US, study showed that this occupational group has a high risk for development of MetS and causing mortality at an earlier age compared to other groups [3]. The increase in risk is related to the lifestyle and working environment of the police that frequently under constant stress with a high rate of smoking and alcohol addiction [3]. Some policemen are often lead a physically inactive life, have irregular diet and limited choice of foods while on duty, take overtime and shift work, suffer from disrupted sleep patterns, stress and have high rates of tobacco and alcohol consumption than the general population, they have been found to have an increased prevalence of MetS risk factors and DM than any other occupational group and among the general population in many countries [3].

A report from Franke states that the police officers have an increased prevalence of MetS compared to civilians in Indian population. They also reported that it is strongly suggest that MetS likely resulted from inappropriate lifestyle choices and modifiable behaviors. Poor eating habits and physical inactivity are major contributors to both MetS and the component risk factors that make up the MetS [4]. Unfortunately, there is no epidemiological data on the prevalence of DM and MetS among police officers from Indonesia, especially in Bali. Therefore, this study was conducted among the Denpasar police officers to describe the clinical profile of MetS and its determinants in Bhayangkara Hospital, Denpasar, Bali.

II. MATERIAL AND METHODS

A. Study Design and Patients

This study was a cross sectional study with purposive sampling method. The subjects were 268 police officers who performed the screening program at Bhayangkara Hospital Denpasar in the period of January to June 2019. The data were...
obtained by anamnesis, physical examination including anthropometric measurements of weight, height, and waist circumference, done by using standardized techniques. The blood pressure was recorded in the sitting position, from the right upper arm with the cuff at the level of right atrium and antecubital fossa facing upward. Measurement was carried out using the mercury sphygmomanometer. The overnight fasting blood samples were taken after at least eight hours of overnight fasting to estimate the fasting blood glucose, lipid profiles, and liver enzymes.

B. Definition of Metabolic Syndrome

Metabolic syndrome (MetS): The MetS was diagnosed using modified 3rd Adult Treatment Panel (ATP III), International Diabetes Federation (IDF) criteria based on presence of any of the following three out of five criteria [5]-[7]:

a. Fasting blood glucose ≥ 100 mg/dL and/or on diabetic sugar-lowering drugs;

b. Blood pressure ≥ 130/85 mmHg and/or hypertensive patients on drugs;

c. Triglyceride level ≥ 150 mg/dL or on lipid-lowering drugs;

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d. High density lipoprotein cholesterol ≤ 40 mg/dL in male and ≤ 50 mg/dL in female;

e. Waist circumference ≥ 90 cm in male and ≥ 80 cm in female.

C. Statistical Analysis

A computerized database was created for all the records. A statistical package for the International Business Machines Statistical Package for the Social Sciences (IBM SPSS® version 24.0) was used for statistical analysis. All data were expressed in categorical parameters to divide them closely for the clinical study. The statistical significance was assumed at p-value <0.05. Chi-square test was performed to find an association between two categorical variables.

III. Result

Among the police officers who performed the screening program in the period of January to June 2019, the male group (87.3%) were found to be more frequent than female group (12.7%). The prevalence of MetS among the police officers who performed the screening program in the period of January to June 2019 was 68.7% (Table 1).

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In both male and female police officers who were having MetS, we found that the most subjects were within the age less than 40 years old. Among that group, most of them consisted of 100 (57.8%) males rather than females (Table 2).

As shown in Table 3, there was significant association between gender and MetS. Male police officers were found to be 5.93% higher at risk of developing MetS compared to female police officers (OR=5.930, 95% CI=2.731-12.878). However, we also found that there was no significant association between MetS and the years of service or age.

The most frequent component of MetS found in both male and female police officers was central obesity, which is defined based on waist circumference of male ≥ 90 cm and female ≥ 80 cm (Table 4). In fact, we found that all police officers with MetS were having central obesity.

### Table 1: Characteristic of Subjects

| Characteristic Variable | Frequency | Percentage (%) |
|-------------------------|-----------|----------------|
| Gender                  |           |                |
| Male                    | 234       | 87.3           |
| Female                  | 34        | 12.7           |
| Age (y)                 |           |                |
| < 40                    | 166       | 61.9           |
| ≥ 40                    | 102       | 38.1           |
| Years of Service (y)    |           |                |
| ≤ 10                    | 27        | 10.1           |
| > 10                    | 241       | 89.9           |
| Body Mass Index (kg/m²) |           |                |
| Normal                  | 34        | 12.7           |
| Overweight              | 0         | 0.0            |
| Obese 1                 | 35        | 13.1           |
| Obese 2                 | 199       | 74.3           |
| Waist Circumference (cm)|           |                |
| Male (234)               |           |                |
| ≥ 90                    | 217       | 92.7           |
| < 90                    | 17        | 7.3            |
| Female (34)              |           |                |
| ≥ 80                    | 16        | 47.1           |
| < 80                    | 18        | 52.9           |
| Blood Pressure (mmHg)   |           |                |
| Normal                  | 127       | 47.4           |
| Hypertension             | 141       | 52.6           |
| Fasting Blood Glucose (mg/dL)| | |
| < 100                   | 99        | 36.9           |
| ≥ 100                   | 169       | 63.1           |
| Triglyceride (mg/dL)    |           |                |
| < 150                   | 93        | 34.7           |
| ≥ 150                   | 175       | 65.3           |
| High Density Lipoprotein (mg/dL)| | |
| Male (234)               |           |                |
| ≤ 40                    | 8         | 3.0            |
| > 40                    | 226       | 84.3           |
| Female (34)              |           |                |
| ≤ 50                    | 1         | 0.4            |
| > 50                    | 33        | 12.3           |
| Metabolic Syndrome      |           |                |
| Absent                  | 84        | 31.3           |
| Present                 | 184       | 68.7           |

### Table 2: Age Distribution of Metabolic Syndrome Subjects According to Gender

| Age (y) | Male (N=173) | Gender | Female (N=111) |
|---------|--------------|--------|---------------|
| < 40    | 100 (57.8%)  |        | 8 (72.7%)     |
| ≥ 40    | 73 (42.2%)   | 3      | 3 (27.3%)     |

### Table 3: Association of Years of Service, Age, and Gender with Metabolic Syndrome

| Variable | Present (N=184) | Absent (N=84) | Total (N=268) | Odds Ratio (OR) | Confidence Interval (95% CI) | p-value |
|----------|-----------------|---------------|---------------|-----------------|-----------------------------|---------|
| Gender   |                 |               |               |                 |                             |         |
| Male     | 173 (94.0%)     | 61 (72.6%)    | 234 (87.3%)   | 5.930           | 2.731-12.878                | <0.001  |
| Female   | 11 (6.0%)       | 23 (27.4%)    | 34 (12.7%)    |                 |                             |         |
| Age (y)  |                 |               |               |                 |                             |         |
| < 40     | 108 (58.7%)     | 58 (69.0%)    | 166 (61.9%)   | 0.637           | 0.368-1.102                 | 0.105   |
| ≥ 40     | 76 (41.3%)      | 26 (31.0%)    | 102 (38.1%)   |                 |                             |         |
| Years of Service (y) |       |               |               |                 |                             |         |
| ≤ 10     | 16 (8.7%)       | 11 (13.1%)    | 27 (10.1%)    | 0.632           | 0.280-1.428                 | 0.267   |
| > 10     | 168 (91.3%)     | 73 (86.9%)    | 241 (89.9%)   |                 |                             |         |

*p-value is significant based on α = 0.05.
IV. DISCUSSION

This study was conducted as part of an early detection program made for the police officers in order to prevent the occurrence of non-communicable diseases, especially the metabolic syndrome. Estimation of global MetS prevalence by IDF shows a number of 20-25%, while the prevalence of MetS in Indonesia is known to be at 21.66% [5]. Several studies have shown that the incidence of MetS tends to be higher in police population, allegedly it was related to high work-related stress [6], and high risk of alcohol consumption and smoking in this population [7]-[9].

The prevalence of MetS among police officers in our study was 68.7%. Although our study did not directly compare the prevalence of MetS among police officers and general population, this finding roughly indicated that the MetS prevalence were quite high among police officers in compare to the general population in Bali (15.94%) and Indonesia (21.66%) [5]. Several other studies have found the prevalence of MetS to be in between 16.8-57.3% [7]-[10]. Thus, the finding in our study indicated a higher prevalence compared to the previous studies. A recent longitudinal study confirmed that the incidence of dyslipidemia in police officers can be predicted by psychological distress [11]. Kumar and colleagues also stated that the police officers have been found to be at high risk for MetS and coronary heart diseases. Previous cross-sectional study showed that MetS-related parameters, such as impaired fasting glucose, and impaired glucose tolerance, are more frequent in police officers than in other workers [12].

Many other elements such as dietary factors, lifestyle, atypical work hours, reduced sleep duration, lack of physical activity, or a combination of all these factors can play as a causative role in MetS among police officers. One cohort study had been able to rule out the role of dietary factors, shift and night work, lack of physical activity, and depression or other common mental disorders in their relation with MetS [6]. Instead, the effect of smoking and sleep habits among police officers were found to be related to MetS, so that the latter proved to be a very important factor. A further study about the significant relation between smoking, sleep habits, work stress, and MetS would be useful to clarify their mutual effects.

The research carried out by Garbarino and colleagues shows the characteristics that resemble our study, which found that the male police officers were more frequent than female police officers. Most of the police officers were less than 40 years old in age and had more than 10 years of service [6]. The majority of subjects were found to be categorized as having obesity, based on body mass index (BMI) > 30.0 kg/m². The percentage of obesity found in this study was much higher compared to other studies (87.4% vs. 47.9-72.64%) [6]-[10]. This becomes a problem because generally the police are expected to be in an ideal physical condition to be able to work strong and agile in their daily professional activities. The other MetS components, including hypertension, hyperglycemia, and hypertriglyceridemia were also found to dominate the study population.

Among the police officers who had MetS, it was found that the most subjects consisted of males rather than females, with the age mostly less than 40 years old. Male police officers were also found to be 5.93% higher at risk of developing MetS compared to female police officers (OR=5.930, 95% CI=2.731-12.878; p-value <0.01). The prevalence study by Suastika and colleagues, conducted in Bali, found a 16.6% prevalence of MetS among males and a prevalence of 20.0% among females in general population. Although they found no differences in the prevalence of nutritional state between male and female subjects, but central obesity was more frequently in female subjects than in male (43.4% vs. 27.5%, p-value <0.001) [13]. In other words, compared to the prior study done by Suastika and colleagues, our study found a different result. This may be caused by the difference in gender characteristic among police officers and general population, where in our study the male groups were dominantly included.

Matic and colleagues stated that males are found to be related to MetS because it may be decreased levels of aromatase enzyme, the principal enzyme of estrogen production, develop abdominal obesity, elevated blood lipids and insulin resistance that developing MetS [14]. Yan H and colleagues also found the prevalence of MetS is higher in males than in females. These are influenced by the estrogen which improves insulin sensitivity and suppresses hepatic gluconeogenesis through activation of estrogen receptor (ER) alpha phosphoinositide 3-kinase-Akt-Foxo1 signaling, which can be independent of insulin receptor substrates 1 and 2 (Irs1 and Irs2) that revealing an important of mechanism for estrogen in the regulation of glucose homeostasis. These may help explain why young females have lower incidence of MetS [15].

Meanwhile, the age and years of service variables were found to have a significant relationship. This result showed an accordance with the research conducted by Zhang and colleagues, in which policemen were found to be significantly related to MetS (OR=11.3; 95% CI=7.2-17.8; p-value <0.01). In contrast to the results of our study, Zhang and colleagues found that older age (OR=1.6; 95% CI=1.4-1.7; p-value <0.01) increased the risk of MetS events among police officers [8]. Study by Tharkar and colleagues also showed that older age was associated with the event of DM (OR=10.4; 95% CI=3.5-30.3; p-value <0.01) and MetS (OR=3.9; 95% CI=1.3-11.9; p-value=0.015) [9].

The different findings were probably caused by the differences in characteristics between two studies, with the different age criteria were shown in study done by Zhang and

| Components of Metabolic Syndrome | Gender | Total (N=184) |
|----------------------------------|--------|--------------|
|                                 | Male (N=173) | Female (N=11) |             |
| Central Obesity                  | 173 (100%)   | 11 (100%)     | 184 (100%)  |
| Hypertriglyceridemia             | 151 (87.3%)  | 11 (100%)     | 162 (88.0%) |
| Hyperglycemia                    | 144 (83.2%)  | 9 (81.8%)     | 153 (83.2%) |
| Hypertension                     | 121 (69.9%)  | 9 (81.8%)     | 130 (70.7%) |
| Low HDL-C                        | 7 (4.0%)     | 1 (9.1%)      | 8 (4.3%)    |

HDC-L: high-density lipoprotein cholesterol.
colleagues [8]. Whereas in the study done by Thankar and colleagues, the mean age of police officers were 44.3±12.1 years, meaning that the majority of study population was dominated by older age [9]. Nestel and colleagues reported that the age group of 40–60 years had a higher prevalence of MetS [16]. The result in our study, contrary showed difference findings from Ogbera and colleagues, with the prevalence of MetS being 43.5% in females and 34.1% in males in general population [17]. Another study also reported an overall MetS prevalence of 51%, consisted of 56% females and 44% males [18]. A retrospective study in Southern Brazil from Marchi and colleagues found that MetS was observed in 18.5% of general population, consisted of 9.4% the young females and 22.2% of the elderly females displayed MetS [19]. Suastika and colleagues, found that the elderly group (> 60 years) had a significantly higher prevalence of MetS than in younger aged group (< 60 years) [22.9% vs. 17.3%, p-value =0.026; prevalence risk 1.423 [CI=1.043-1.944]] in the population of Bali [20]. Moreover, there was a statistically significant relationship between postmenopausal stage and increased age with the presence of MetS. Older females (older than 56 years) were 5.95 (CI=3.03-11.64) times more likely than younger females to be diagnosed with MetS [21].

We found that the most frequent component of MetS found in both male and female police officers was central obesity. In our study it was found that all police officers suffering from MetS had central obesity. The findings by Ogbera and colleagues also showed that the high prevalence of the police group with MetS had abdominal obesity which is one of the components of MetS according to the IDF criteria [17]. Similar to the findings of Kelliny and colleagues, they also found that abdominal obesity was one of the MetS components that occurred frequently [18]. Other MetS components that were also found to be high includes hypertriglyceridemia, hyperglycemia, and hypertension. While low HDL-C was only found in 4.3% of police officers with MetS. Thus, preventing and controlling obesity as a major health problem in the MetS police officer population are essential steps for preventing MetS-related morbidities and mortality.

Cheng and colleagues found that the high triglyceride was significantly associated with a decrease of the mean leukocyte telomere length (LTL) in fully adjusted models (p-value <0.001) that furtherly developing to be MetS. A higher score of waist circumference was also found to be associated with 4.8 times increased risk of developing of the MetS (OR=4.76, 95% CI=3.71-6.10). In both the male and female groups, waist circumference was significantly associated with a decrease of mean LTL (p-value <0.05) [22]. Pathogenesis of MetS and other related diseases involves the excess of reactive oxygen species, which damage mitochondrial components and trigger cellular lysis. Such toxic reactions lead to the aging process [23]. In a longitudinal study reported by Lee and colleagues, telomere length was shorter in an obese population. Their study was conducted of 5,598 participants, and they stated that a shorter LTL was associated with multiple measures of obesity in both males and females with MetS. Shorter telomere length is a sign of cellular marker for biological age, and was associated with a higher metabolic risk profiles, which remains unfavorable even after a period of 6 years. Accumulating evidences demonstrated that shortened leukocyte telomere length had a significant association with MetS [22].

A prospective study from Multi-ethnic Dallas Heart Study by Mani and colleagues found that among 1,120 participants without DM or MetS at baseline (57% females, 45% black, mean age 43), were followed up with the total percentage of 22.8% new incident of MetS. In that study, the low result of high-density lipoprotein particle (HDL-P) and HDL-C levels were modestly correlated with MetS incident (r=0.54, p-value <0.0001). However, adjustment for visceral adiposity did not attenuate the inverse association between HDL-P and MetS incident, suggesting that the pathways by which low HDL-P confers increased metabolic risk is distinct from the pathways reflected by metabolically dysfunctional fat depots [23,24].

V. CONCLUSION

The prevalence of MetS was high among the police officers. Male gender is one of the unmodifiable risk factors that found to be significantly related to MetS. A marked number of central obesity, hypertriglyceridemia, hyperglycemia, and hypertension were found among the police officers who experience MetS. Only a small number of police officers that were found to be having low HDL cholesterol. Community programs in the public health setting are crucial to promote awareness of components MetS. Thus, such programs should focus on encouraging lifestyle changes to prevent health problems among the police officers in Denpasar, Bali.

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