

Majalah Kedokteran Sriwijaya,  
Th. 51 Nomor 3, Juli 2019

## Association Between Physical Activity and Metabolic Syndrome among Patients in Primary Public Health Center

Muhammad Ma'ruf Agung, Ririn Puspita, Dwi Lisa Nur'aini, Iche Andriyani Liberty

Public Health and Community Medicine Department, Faculty of Medicine,  
Sriwijaya University

Email: muhammadmarufagung@gmail.com

---

### ABSTRACT

Metabolic syndrome is a major challenge to public health throughout the world, about a quarter of the world's adults suffer from metabolic syndrome. Many studies have concluded that differences in the level of physical activity is associated with the prevalence of the metabolic syndrome. The main objective of this study was to evaluate the associated between physical activity and metabolic syndrome in 2 (two) Primary Public Health Center in Palembang City. This study was an observational analytic study with a cross-sectional design conducted on 91 subjects that met the criteria. Data on respondents' characteristics were taken from personal data interviews, physical activity was obtained by IPAQ questionnaire, lipid profile and fasting blood glucose obtained by medical records, while anthropometric and blood pressure measurement data were obtained directly through measurements. The results showed the prevalence of metabolic syndrome was 59.3% in the subject. The majority of the physical activities of the subjects were low (54.9%) followed by moderate (35.2%), and high (9.9%). Inferential analysis shows that there was a significant associated between physical activity and metabolic syndrome ( $p = 0.003$  and  $POR = 1.785$ ;  $CI95\% = 1.19-2.66$ ).

**Keywords:** Metabolic syndrome, physical activity, public health center

### ABSTRAK

Sindrom metabolik adalah tantangan utama kesehatan masyarakat di seluruh dunia, sekitar seperempat dari orang dewasa di dunia menderita sindrom metabolik. Banyak penelitian telah menyimpulkan bahwa perbedaan tingkat aktivitas fisik mempengaruhi prevalensi sindrom metabolik. Tujuan utama dari penelitian ini adalah untuk mengevaluasi hubungan antara aktivitas fisik dengan kejadian sindrom metabolik pada pasien di dua Puskesmas di Kota Palembang. Penelitian ini merupakan studi analitik observasional dengan desain *cross-sectional* yang dilakukan pada 91 subjek yang memenuhi kriteria. Data karakteristik responden diambil dari wawancara data pribadi, aktivitas fisik diperoleh dengan kuesioner IPAQ, profil lipid dan glukosa darah puasa diperoleh dengan wawancara catatan medis, sedangkan data pengukuran antropometri dan tekanan darah diperoleh langsung melalui pengukuran. Hasil penelitian menunjukkan prevalensi sindrom metabolik adalah 59,3% pada subjek. Mayoritas aktivitas fisik subjek adalah rendah (54,9%) diikuti sedang (35,2%), dan tinggi (9,9%). Analisis inferensial menunjukkan bahwa ada hubungan yang signifikan antara aktivitas fisik dengan sindrom metabolik ( $p = 0,003$  dan  $POR = 1.785$ ;  $CI95\% = 1.19-2.66$ ).

Kata kunci: sindrom metabolik, aktivitas fisik, pusat kesehatan masyarakat

---

## 1. Introduction

The metabolic syndrome is a major and escalating public-health and clinical challenge worldwide in the wake of urbanization, surplus energy intake, increasing obesity, and sedentary life habits.<sup>1</sup> *International Diabetes Federation* estimates about a quarter of the world's adults have metabolic syndrome.<sup>2</sup> Metabolic syndrome and its components are related to the risk of developing cardiovascular disease (CVD), diabetes, and several cancers.<sup>1</sup>

Physical activity is assumed to increase the activity of lipase lipoprotein and lecithin cholesterol acyltransferase and to reduce the activity of hepatic lipase and cholesterol esterified transfer protein, components of reverse cholesterol transport so it induces desirable changes in plasma lipid levels, especially HDL increase and TG decrease, in addition to triggering beneficial effects on total cholesterol and its low-density and very-low-density fractions (LDL and VLDL, respectively).<sup>3</sup>

Physical activity and its effect on insulin resistance are known to be important for development of type 2 diabetes. According to the  $\beta$ -cell stress hypothesis overweight, rapid weight gain and low physical activity may contribute to  $\beta$ -cell stress or overload, leading not only to increased insulin secretion but also to increased presentation of pancreatic autoantigens.<sup>4</sup>

Many researches have concluded that differences in the levels of physical activity influence the prevalence of the metabolic syndrome. The study in young Finnish adults MS found that approximately one every tenth of the young adults at the age of 24 years. Higher total mean intensity and volume rates as well as longer duration spent at moderate and high physical activity level had a beneficial impact on the risk of metabolic syndrome.<sup>5</sup>

Another study in Brazil found that lower level of PA in leisure-time was significantly associated with a higher prevalence of diabetes mellitus and hypercholesterolemia.<sup>6</sup> The Finnish Public Sector study (1997–2013) found that modest long-term increase in physical activity was associated with reduction in cardiometabolic risk whereas decrease in physical activity was related to increased risk.<sup>7</sup> Considering the above elucidation, a research is formulated in order to gain knowledge on the association between physical activity and metabolic syndrome among patients in Public Health Center Palembang.

## 2. Methods

This research was an observational analytic study with cross sectional design conducted in March - April 2019 at 2 (two) Public Health Center Palembang, there were Puskesmas Boom Baru and Puskesmas Padang Selasa. The samples in this study were patients those visiting the Public Health Center Palembang and meet the inclusion criteria. The inclusion criteria of respondents were patients those visiting the public health center at 13 of March 2019-30 of March 2019 and meet the criteria of inclusion and exclusion. Exclusion criteria in this study were not willing to be a subject, age under 18 years old, is pregnant and do not have metabolic profile and glucose profile data. suffering from diseases that could affect blood. The samples were taken using accidental sampling technique and 91 eligible samples manage to be obtained.

The data of respondent's characteristic were taken from personal data interview, physical activity was obtained by IPAQ questionnaire, lipid profile and fasting blood glucose were obtained by medical record, while data of anthropometric measurements and blood pressure were obtained through direct measurement.

The analyzed using STATA ver.15 program in the form of univariate analysis and bivariate analysis (Chi- square).

### 3. Results

Ninety-one participants were interviewed, and Table 1 showed their characteristics. The majority was women (59.3%) and was pre-elderly or 45-59 years of age (46.2%). The prevalent occupational status in the sample was unemployed/retired, comprehending 50.54% of all of the assessed participants (n = 46). The highest level of education attained by Subjects was mostly senior high school (36.3%). 80.2% of the participants reported to be active smokers (n = 73) and 60.4% were passive smokers (n = 55).

**Table 1. Frequency Distribution of Subjects Characteristics (n=91)**

Characteristic	N	%
<b>Age (years)</b>		
Adult (18-44)	13	14.3
Pre-elderly (45-59)	42	46.2
Elderly (≥60)	36	39.6
<b>Gender</b>		
Men	37	40.7
Women	54	59.3
<b>Highest Level of Education Attained</b>		
None	5	5.5
Elementary School ( <i>SD</i> )	10	11.0
Junior High School ( <i>SMP</i> )	23	25.3
Senior High School ( <i>SMA</i> )	33	36.3
Bachelor/ Master/ PhD	20	22.0
<b>Occupation</b>		
Unemployed/Retired	46	7.0
Active Worker	45	47.0
<b>Active Smoker</b>		
Yes	73	80.2
No	18	19.8
<b>Passive Smoker</b>		
Yes	55	60.4
No	36	39.6

In Table 2, subjects' physical activity data were presented. The proportion of low levels physical activity showed a figure of 54.9%

**Table 2. Frequents Distribution of Subjects by Physical Activity Levels (n = 91)**

Physical Activity Levels	n	%
Low	50	54.9
Moderate	32	35.2
High	9	9.9
<b>Total</b>	<b>91</b>	<b>100.0</b>

Table 3 showed the descriptive statistics of the metabolic syndrome profile. Among the study population, there were high rates of hypertension (54.9%), low HDL levels (52.7%), normal triglyceride levels (67.0%), central obesity (61.5%), and impaired glucose metabolism (80.2%). The prevalence of metabolic syndrome itself was 59.3%.

**Table 3. Frequency Distribution of Metabolic Syndrome Profile (n=91)**

Characteristic	n	%
<b>Blood Pressure</b>		
Hypertension	48	52.7
Normal	43	47.3
<b>HDL Levels</b>		
Low	46	50.5
Normal	45	49.5
<b>Triglyceride Levels</b>		
High	30	33.0
Normal	61	67.0
<b>Waist Circumferences</b>		
Central Obesity	56	61.5
Normal	35	38.5
<b>Fasting Blood Glucose</b>		
Impaired Glucose Metabolism	73	80.2
Normal	18	19.8
<b>Metabolic Syndrome</b>		
Yes	54	59.3
No	37	40.7

The result of Chi-square analysis of the association of physical activity levels with metabolic syndrome was shown in Table 4. The prevalence of metabolic syndrome according to the level of physical activity was 40.7% for the low physical activity group and 18.7% for the moderate-high physical group; it was significantly lower in the moderate-high physical activity groups ( $p < 0.1$ ). The prevalence ratio for metabolic syndrome according to the level of physical activity was 1.785 (95% CI, 1.19–2.66) in the low physical activity group. This group had a greater risk of developing metabolic syndrome than the group with a moderate-high level of physical activity (Table 4).

**Table 4. The Relationship of Physical Activity Levels with Metabolic Syndrome**

Physical Activity Levels	Metabolic Syndrome				<i>p</i>	POR 95%
	Yes		No			
	n	%	n	%		
Low	37	40.7	13	14.3	0.003	1.785 (1.19)
Moderate - High	17	18.7	24	26.4		2.66)

#### 4. Discussion

Table 1 showed that the majority (46.2%) was pre-elderly or 45-59 years of age. This finding is analogous to the research by Magdalena.<sup>8</sup> This study also revealed most subjects were women. This supports the similar research finding by Magdalena and Salonen showing women was dominant.<sup>8,9</sup> This data also supported by the epidemiologic data of Palembang citizen showing women was higher in number than men. Higher proportion of subjects was unemployed/retired and attaining senior high school as their highest level of education. Magdalena also stated in her research the same finding which showed senior high school graduates are more prevalent.<sup>8</sup>

WHO and *Global Adult Tobacco Survey* (GATS) stated that the proportion of those who actively smokes in Indonesia is steadily increasing and 67.4% of active smokers. Those statements were found out to be in line with the finding of this research which shows that the majority of subjects are active smokers. It is also supported by a research conducted by Chien Huey in 2015.<sup>10</sup> The proportion of low physical activity was 54.9%, while moderate (35.2%) and high (9.9%) found to be lower in number (See Table 2). According to the research conducted by Chase (2009) and Nelson (2018), similar results were found.<sup>11,12</sup>

Metabolic syndrome risk factors consist of blood pressure, HDL levels, triglyceride levels, waist circumference, and fasting blood glucose. Among the study population, there were high rates of hypertension, low HDL levels, normal triglyceride levels, central obesity, and impaired glucose metabolism. We also find high number of subjects with positive metabolic syndrome. These findings were supported by Shao-Hsien Liu (2015) and Caroline da Silva (2016) in their research.<sup>13,14</sup>

The present study examined the relationship between physical activity level and metabolic syndrome by dividing the activity levels into low and moderate-high physical activity groups according to IPAQ classification. The study results showed that the moderate-highly active groups showed significant differences compared with the low activity group in their metabolic syndrome status. Previous studies have already proven that physical activity and exercise play a crucial role in preventing metabolic syndrome, a complex cardiovascular disease,<sup>15,16</sup> and moderate or vigorous physical activity is recommended for health promotion and prevention of chronic disease.<sup>17</sup> A study on the prevalence of metabolic syndrome showed that the risk of metabolic syndrome decreased as the level of physical activity increased.<sup>18</sup> Moreover, decreased physical activity has been shown to be associated with metabolic syndrome factors such as obesity, hypertension, diabetes, and dyslipidemia,<sup>19-21</sup> and a group with high levels of physical activity had a lower incidence of metabolic syndrome compared with those in an inactive group, showing a negative correlation.<sup>22</sup>

Similar to previous studies, the present study showed that for physical activity were significantly related to metabolic syndrome. A previous investigation of 7,432 adults using the IPAQ showed that a group that exercised more than 3 times per week (20.3%) had a lower prevalence of metabolic syndrome than a the group without physical activity (36.2%).<sup>23</sup> A prospective cohort study of 874 middle-aged men and women showed a lower prevalence of metabolic syndrome in a group with high physical activity levels,<sup>24</sup> and the odds ratio for metabolic syndrome prevalence tended to decrease as the level of physical activity increased.<sup>25</sup>

In a study by Chung,<sup>26</sup> when a group that engaged in regular exercise more than 5 times per week was given a value of 1, the odds ratio a group without any exercise increased by 1.7 times (95% CI, 1.0–2.8). In the present study, the overall prevalence of metabolic syndrome was 59.3% in subjects; according to the physical activity level, the prevalence of metabolic syndrome was higher in those with low physical activity (40.7%) than in those with moderate-high (19.7%) activity. The prevalence ration for metabolic syndrome was 1.785-fold higher in the group with low physical activity (95% CI, 1.19–2.66) compared with the moderate-high physical activity group. As the physical activity level increased, the risk of metabolic syndrome incidence also tended to decrease. This indicates that the level of physical activity is important for decreasing the risk of metabolic syndrome.

An individual with low physical activity has higher risk in increasing weight more than individuals whose active. It is because low activity makes positive energy balance and excess energy would be transformed into adipose tissue, making them more vulnerable in getting central obesity.

Physical activity can interfere with blood pressure through their action in lowering the peripheral resistance caused by decreasing sympathetic stimulation. Physical activity can also interfere with body glucose and lipid levels by increasing body metabolism and activating several liver enzymes. Hence, the chances of metabolic syndrome on an individual with low level physical activity are higher than those with moderate-high level physical activity.<sup>27</sup>

This study was a cross-sectional study on patients of public health center within a certain region, it is limited in terms of predicting the actual incidence of metabolic syndrome according to physical activity level. It is suggestive, that prospective studies to confirm these findings are needed. Furthermore, the data of laboratory results is collected by medical records and we did not analyze each metabolic factor, which is another limitation of the present study. In addition, the current analysis does not include information about behavioral aspects of physical activity, such as type or mode, which could affect the observed associations. Further analysis of such factors may reveal further indicators of being at risk for metabolic syndrome and other health conditions.

## **5. Conclusion**

In conclusion, the present study showed that low physical activity is associated with a higher prevalence of metabolic syndrome in patients whose attend public health center. The results found should be taken for consideration to encourage people to increasing the level of physical activity is important for preventing metabolic syndrome.

## Acknowledgment

The authors would like to acknowledge the head of Puskesmas Padang Selasa and Boom Baru Palembang who had given permission to conduct a research in her working domain and also the staff and management of Puskesmas for all the support during the study. We are also grateful to the study participants for their contribution. The authors would like to thank all the other parties who have helped this study.

## References

1. Kaur J. 2014. A Comprehensive Review on Metabolic Syndrome. *Cardiol Res Pract.* 2014. 11 (3).
2. International Diabetes Federation: The IDF consensus worldwide definition of the metabolic syndrome, <http://www.idf.org/metabolic-syndrome>.
3. Silva, Raquel Caroline da et al. "Physical Activity and Lipid Profile in the ELSA-Brasil Study." *Arquivos brasileiros de cardiologia* vol. 107,1 (2016): 10-9. doi:10.5935/abc.20160091
4. Huus, Karina et al. "Physical Activity, Blood Glucose and C-Peptide in Healthy School- Children, a Longitudinal Study." *PloS one* vol. 11,6 e0156401. 7 Jun. 2016, doi:10.1371/journal
5. Salonen M et al. Physical Activity, Body Composition and Metabolic Syndrome in Young Adults. *PLoS ONE.* 2015. 10(5)e0126737
6. Turi Bruna et al. Low Levels of Physical Activity and Metabolic Syndrome: Cross-sectional Study in the Brazilian Public Health System. *SciELO.* 21(4) 2016. 1043-1050.
7. Leskinen, T., et al. Change in Physical Activity and Accumulation of Cardiometabolic Risk Factors. *Preventive Medicine* [serial online]. 2018;112: 31–7.
8. Magdalena et al. Faktor-Faktor yang Berhubungan dengan Sindrom Metabolik pada Penderita Rahat Jalan di RSUD Ulin Banjarmasin. *Jurnal Skala Kesehatan.* 2014. 5(2):1-6
9. Salonen M et al. Physical Activity, Body Composition and Metabolic Syndrome in Young Adults. *PLoS ONE.* 2015. 10(5)e0126737
10. Teh CH, Chan YY, Lim KH, et al. Association of physical activity with blood pressure and blood glucose among Malaysian adults: a population-based study. *BMC Public Health.* 2015; 15:1205. Published 2015 Dec 3. doi:10.1186/s12889-015-2528-1
11. Chase, N. L., Sui, X., Lee, D., & Blair, S. N. The Association of Cardiorespiratory Fitness and Physical Activity With Incidence of Hypertension in Men, *Am J Hypertens.* 2009 Apr;22(4):417-24. doi: 10.1038/ajh.2009.6.
12. Nelson, V. R., et al. Association Between a Physical Activity Vital Sign and Cardiometabolic Disease in High-Risk Patients. *Clin J Sport Med.* 2018 Mar 26. doi: 10.1097/JSM.0000000000000588.
13. Liu SH, Waring ME, Eaton CB, Lapane KL. Association of Objectively Measured Physical Activity and Metabolic Syndrome Among US Adults with Osteoarthritis. *Arthritis Care Res (Hoboken).* 2015;67(10):1371–1378.
14. Caroline R, Fátima M De, Sander H, Alvim S, Vidigal PG, Maria L, dkk. Physical Activity and Lipid Profile in the ELSA- Brasil Study. *Sociadade Bras Cardiol.* 2016;10–9.
15. Azadbakht L, Mirmiran P, Esmailzadeh A, et al.: Beneficial effects of a Dietary Approaches to Stop Hypertension eating plan on features of the metabolic syndrome. *Diabetes Care,* 2005, 28: 2823–2831.
16. Lakka TA, Laaksonen DE: Physical activity in prevention and treatment of the metabolic syndrome. *Appl Physiol Nutr Metab,* 2007, 32: 76–88.
17. U.S. Department of Health and Human Services: 2008 Physical Activity Guidelines for Americans. Hyattsville: U.S. Department of Health and Human Services, 2008. Lakka TA, Laaksonen DE, Lakka HM, et al.: Sedentary lifestyle, poor cardiorespiratory fitness, and the metabolic syndrome. *Med Sci Sports Exerc,* 2003, 35:1279–1286

18. Carroll S, Cooke CB, Butterly RJ: Metabolic clustering, physical activity and fitness in nonsmoking, middle-aged men. *Med Sci Sports Exerc*, 2000, 32:2079–2086.
19. Wannamethee SG, Shaper AG, Alberti KG: Physical activity, metabolic factors, and the incidence of coronary heart disease and type 2 diabetes. *Arch InternMed*, 2000, 160: 2108– 2116.
20. Whaley MH, Kampert JB, Kohl HW 3rd, et al.: Physical fitness and clustering of risk factors associated with the metabolic syndrome. *Med Sci Sports Exerc*, 1999, 31: 287–293.
21. Ekelund U, Brage S, Franks PW, et al.: Physical activity energy expenditure predicts progression toward the metabolic syndrome independently of aerobic fitness in middle-aged healthy Caucasians: The Medical Research Council Ely Study. *Diabetes Care*, 2005, 28: 1195–1200.
22. Churilla JR, Johnson TM, Magyari PM, et al.: Descriptive analysis of resistance exercise and metabolic syndrome. *Diabetes Metab Syndr*, 2012, 6: 42–47.
23. Franks PW, Ekelund U, Brage S, et al.: Does the association of habitual physical activity with the metabolic syndrome differ by level of cardiorespiratory fitness? *Diabetes Care*, 2004, 27: 1187–1193.