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RELATIONSHIP OF SEDENTARY LIFESTYLE WITH HYPERTENSION INCIDENCE IN PRODUCTIVE AGES (20-59 YEARS) AMONG EDUCATORS AND EDUCATIONAL STAFF IN JEMBER, INDONESIA

Qaimima Ayuni Indriana[1] , Citra Anggun Kinanthi[2] , Irma Prasetyowati[3*]

[1,2,3] Fakultas Kesehatan Masyarakat, Universitas Jember, Jl. Kalimantan Kampus Tegal boto Jember, 68121

*Correspondence Author: irma_prasetyowati.fkm@unej.ac.id

ABSTRACT

Hypertension remained a major global health issue that had not been fully addressed, causing 10.8 million deaths and serving as the leading risk factor for mortality worldwide. A sedentary lifestyle was a significant contributor to hypertension among the productive age group. It had been shown that a sedentary lifestyle decreased Nitric Oxide (NO) levels, cardiac output, and systemic blood flow, which altered blood vessel diameter, reduced insulin sensitivity, and impaired vascular function. These factors negatively impacted cardiovascular health, including the development of hypertension. The prevalence of hypertension among university educators was higher compared to other educational institutions, primarily due to lower physical activity levels and greater career pressures. Therefore, the objective of this research was to analyze the relationship between a sedentary lifestyle and the incidence of hypertension in productive ages among educators and educational staff in Jember. This research was a quantitative analytic study with a cross-sectional approach. The population of the study consisted of 2,531 educators and educational staff in Jember. A sample of 106 respondents was selected through simple random sampling. Data collection was conducted through interviews and the use of a Global Physical Activity Questionnaire (GPAQ). Both bivariate and multivariate analyses employed binary logistic regression. The results of the bivariate analysis showed significant associations between hypertension and characteristics such as age, family history of hypertension, smoking, Body Mass Index (BMI), and sedentary lifestyle (p-value < 0.05). However, gender was not significantly associated with hypertension (p-value > 0.05). The multivariate analysis confirmed that a sedentary lifestyle was the most dominant determinant of hypertension.

Keywords: educators, hypertension, productive ages, sedentary lifestyle

Introduction

The World Health Organization's projections indicate that NCDs will be responsible for over 80% of the global disease burden by 2020, with hypertension included among NCDs, which is known as a medical condition characterized by arterial blood pressure that exceeds normal limits, with Systolic Blood Pressure (SBP) ≥ 130 mmHg and Diastolic Blood Pressure (DBP) ≥ 80 mmHg.[1,2,43] Hypertension remains a major global health issue that has not been fully addressed, causing 10.8 million deaths and being the leading risk factor for mortality worldwide.[4] Hypertension in Indonesia increased from 25.8% in 2013 to 34.1% in 2018, with an estimated Crude Fatality Rate (CFR) of 0.674%.[5,6] Jember Regency had the highest number of reoccurring in 2021, from 741,735 cases to 762,449 cases in 2022.[7,8] Hypertension is known as "The Silent Killer" because it is generally asymptomatic and, without control efforts, can lead to complications, multi-organ damage, and death. Several complications that can arise from hypertension in various organs include complications in the brain (stroke), complications in the eyes (retinopathy leading to blindness), complications in the heart (capillary leakage in the lungs), and complications in the kidneys (chronic kidney failure).[9,10]

A sedentary lifestyle is the most significant risk factor compared to other modifiable factors in increasing hypertension among the productive-age group.[11,12] The term "sedentary" originates from the Latin word "sedentarius," which means spending a lot of time sitting.[13] Sedentary behavior refers to activities performed outside of sleep time, characterized by low energy expenditure of less than 1.5 Metabolic Equivalents (METs). Examples include sitting, lying, watching television, playing video games, and driving.[14] Prolonged sedentary behavior or lack of physical activity can result in a higher heart rate frequency. Physical inactivity can overstimulate the sympathetic nervous system, exert pressure on the arteries, and lead to hypertension.[15] Sedentary behavior also increases insulin resistance and inhibits metabolic regulation, contributing to the risk of other non-communicable disease complications. Office workers are one of the occupations with low activity because they require minimal physical activity and tend to involve technological advancements in their operations.[16] Another study stated that 93% of productive-age office workers have high sedentary levels, with an average of 10 hours of inactivity daily.[17] Sedentary behavior is also prevalent among educators and educational staff at the school and university levels.[17,18] Several previous studies have also stated that the prevalence of hypertension among university educators is higher compared to other educational institutions, has lower physical activity levels, and is the career with the most pressure.[18,19,20]

According to PDDikti[21] data in 2020, the educational institution that employs the most educators and educational staff in Jember Regency is Universitas Jember, with a workforce of 2,531 individuals. UNEJ Medical Canter (UMC) is responsible for providing health services and referrals for the academic community at UNEJ. UMC data indicates an annual increase in

hypertension cases among productive-age educators and educational staff (20-59 years), with the largest increase occurring in 2021, rising by 44.9%.[22] Long teaching and learning hours combined with monotonous work, potentially contribute to sedentary behavior among staff.[23]

The sedentary lifestyle and hypertension, typically associated with the elderly, are increasingly prevalent among the productive age group. This reveals a significant research gap, as most studies have predominantly focused on older populations, while research exploring the impact of a sedentary lifestyle and hypertension on working-age adults remains limited. Therefore, there is a critical need for further in-depth studies to understand the relationship between sedentary behavior and hypertension in the productive age group, emphasizing the importance of early prevention strategies for health risks in this demographic. Based on the above data and issues, this study aims to investigate the relationship between a sedentary lifestyle and hypertension incidence among educators and educational staff in Jember.

Methods

This research was observational analytic research with a cross-sectional design. The population in this study consisted of educators and educational staff in Jember District, East Java with a study population of 2.531 staff. Samples were taken using simple random sampling and random sampling data was conducted using Excel tools. Secondary data were obtained that included all educators and educational staff at Universitas Jember based on age, gender, work unit, and length of employment. The inclusion criteria for the study were educators and educational staff in the productive ages (20-59 years), serving at Universitas Jember in Jember Regency, with a minimum employment duration of 3 years, and working using computers. The sample size in this study was calculated using Slovin's theory (1960) and increased by 10% to account for potential errors, resulting in a final sample size of 106. The primary data collection used in this study was obtained through direct measurement and interviews, while secondary data included records of all educators and staff at Universitas Jember. This study utilized the Global Physical Activity Questionnaire (GPAQ) by WHO. Data were taken on respondents' independent variables such as characteristics (age, gender, family history of hypertension, BMI, and smoking status), and sedentary lifestyle, with hypertension as the dependent variable. Hypertension was measured by blood pressure using a digital sphygmomanometer. BMI was measured in kg/m² using a bathroom scale. Measurements were taken twice, and the last measurement result was used. A sedentary lifestyle was assessed with the GPAQ questionnaire. The GPAQ consists of 16 questions divided into three categories: physical activity at work, travel between locations, and leisure time. Previous research indicates that a person is considered to have a sedentary lifestyle if their total weekly calorie expenditure from physical activities outside sleep time is less than 600 METs.[16] Data analysis was carried out in univariate, bivariate, and multivariate ways. A statistical test was

performed analysis in this study using a binary logistic regression test. The data processed and analyzed were presented in tables and interpretations containing explanations of information obtained from the analysis results in descriptive form. This research received a certificate of ethical review from the Health Research Ethics Committee (KEPK) Faculty of Public Health, Universitas Jember, with certificate number No. 477/KEPK/FKM-UNEJ/III/2024. The approval of the ethical protocol in this study adhered to the application of the 7 Universal Standards WHO (2011), the 25 Guidelines CIOMS (2016), and the KEPPKN Guidelines (2018).

Results

The distribution of respondents according to their characteristics (age, gender, family history of hypertension, smoking status and Body Mass Index (BMI)), sedentary lifestyle, and hypertension was presented in Table 1.

Table 1. Distribution of Respondents Based on Characteristics, Sedentary Lifestyle, and Hypertension

Variables	n	%
Age		
20-39 Years	25	23.6
40-59 Years	81	76.4
Gender		
Male	57	53.8
Female	49	46.2
Family Hypertension History		
Present	39	36.8
Absent	67	63.2
Smoking		
Yes	22	20.8
No	84	79.2
Body Mass Index (BMI)		
Overweight	48	45.3
Normal	54	50.9
Underweight	4	3.8
Sedentary Lifestyle		
Sedentary	46	43.4
Not Sedentary	60	56.6
Hypertension		
Yes	47	44.3
No	59	55.7

The study results indicated that most educators and educational staff at Universitas Jember were male, aged 40-59 years (76.4%). Additionally, 36.8% have no family history of hypertension, are smokers (20.8%), "overweight" BMI (45.3%). The prevalence of hypertension among educators and staff was 44.3% and 56.6% of respondents were engaged in a sedentary lifestyle. Based on Table 2, bivariate analysis was performed using binary logistic regression to examine the relationship between the independent variables and the dependent variable. Independent variables including age ($p=0.023$), family history of hypertension ($p=0.001$), smoking ($p=0.045$), "overweight" BMI ($p=0.016$), and sedentary lifestyle ($p=0.001$) are variables associated with

hypertension of productive ages. While the variable gender (p=0,570) was not associated with hypertension productive ages.

Table 2. Relationship between Characteristics and Sedentary Lifestyle

Variables	Hypertension						P-Value	PR (95% Cl)
	Hypertensive		Not Hypertensive		Total			
	n	%	n	%	n	%		
Age								
20-39 Years	6	28.6	19	90.5	25	100	0.023	3.246
40-59 Years	41	50.6	40	49.4	81	100		(1.17-8.96)
Gender								
Male	29	50.9	28	49.1	57	100	0.145	1.784
Female	18	36.7	31	63.3	49	100		(0.81-3.88)
Family Hypertension History								
Present	27	69.2	12	30.8	39	100	0.001	5.287
Absent	20	29.9	47	70.1	67	100		(2.24-12.47)
Smoking								
Yes	14	63.6	8	36.4	22	100	0.045	2.705
No	33	39.3	51	60.7	84	100		(1.02-7.15)
Body Mass Index (BMI)								
Overweight	35	55.6	28	44.4	63	100	0.016	2.812 (1.21-6.29)
Underweight	0	0.0	4	100	4	100	0.999	0.000*
Normal	12	30.8	27	69.2	39	100	0.055	Reference
Sedentary Lifestyle								
Sedentary	34	73.9	12	26.1	46	100	0.001	10.244
Not Sedentary	13	21.7	47	78.3	60	100		(4.16-25.2)

* = 'Undefined category' due to the presence of a zero value in one of the cells.

Multivariate analysis was conducted to determine the most dominant and significant variables affecting hypertension. The multivariate candidate variables included those with a bivariate significance level of p < 0.25 including age, gender, family history, smoking status, BMI, and sedentary lifestyle. Subsequently, binary logistic regression analysis was performed using the enter method, with variable removal executed step-by-step, one at a time. Variables were removed starting with those having the largest significance level. For variables with more than two categories, the significance level was based on the smallest p-value.

Table 3. Final Model of Multivariate Analysis

Variables	p-value	PR	95%Cl
Sedentary Lifestyle	0.001	16.721	5.066 – 55.191
Gender	0.016	4.349	1.322 – 14.031
Family Hypertension History	0.007	4.122	1.478 – 11.494

Based on Table 3, the results of the multivariate analysis show that the variables significantly associated with hypertension of productive ages were gender, family history, and sedentary lifestyle after being controlled by confounding variables, including main independent variables such as age, smoking status, and BMI. The test results showed that the most dominant variable influencing hypertension was a sedentary lifestyle because it had the highest OR value. The OR value of a sedentary lifestyle was 16.721 with a confidence interval of 5.066 – 55.191 explaining

that engaging in a sedentary lifestyle increases the risk of developing hypertension by a factor of 16.7 times compared to individuals who do not engage in a sedentary lifestyle and a confidence degree of 95% researchers believe sedentary lifestyle availability increases the risk of hypertension from 5.066 to 55.191 times.

Discussion

Based on the univariate analysis results of 106 respondents, the majority of respondents are aged 50-59 years and are male. The 2023 staffing data of Universitas Jember shows that 68% of educators and educational staff are aged 40-60 years, and 64% (1.632 individuals) are male. Based on the characteristics of family history and smoking status, it is known that most respondents do not have a family history of hypertension and non-smokers. Several faculties at Universitas Jember have established smoke-free areas aimed at reducing smoking activity and exposure to cigarette smoke among the academic community. Awareness of health issues among the workforce, such as diet and knowledge, can influence their decisions to maintain overall health. Knowledge about nutrition and healthy eating habits, as well as workplace education and health policy interventions, play a significant role in improving workforce health.[24] Based on the BMI variable, the majority of respondents in the study fall into the overweight category. This finding is consistent with other studies which state that most educators at institutions such as Adeleke University fall into the overweight category due to low physical activity and the monotonous nature of their work, which can lead to the accumulation of unburned calories and a slowed metabolism, thus contributing to weight gain among educators.[20,25]

Based on the sedentary lifestyle variable, it is known that most respondents do not engage in a sedentary lifestyle (≥ 600 METs).[26] This can be linked to the ability of some educators to manage stress well, particularly through adequate physical activity due to daily routines such as hours-long teaching activities. Based on interviews with respondents, some faculties hold weekly exercise sessions to increase the physical activity levels of their educators and educational staff. A pre-experimental study in Yogyakarta states that regular exercise can affect the reduction of systolic and diastolic pressure.[27] Office workers have become a popular group to study in the sedentary behavior field given that this type of work is inherent in prolonged periods of sitting and lower amounts of physical activity.[28]

Research findings indicate a correlation between gender and hypertension among educators and administrative staff in Jember. Increasing age is a risk factor for hypertension in educators, influenced by the decrease in estrogen and HDL levels, which heightens atherosclerosis and the risk of hypertension. Aging can disrupt neurohormonal mechanisms such as the renin-angiotensin-aldosterone system (RAAS), causing vasoconstriction. It also leads to reduced vascular responsiveness, fat and plaque accumulation, and hormonal changes that can result in endothelial

dysfunction, reduced blood flow, and impaired lipid and glucose metabolism, contributing to hypertension.[29–31]

The study revealed no significant relationship between gender and hypertension among educators and educational staff in Jember. There are no significant gender differences in hypertension rates, suggesting equal risk for both males and females. Gender is an immutable factor influencing blood pressure. Males generally have higher hypertension risk due to lower resting heart rates, cardiac index, and protective estrogen levels. However, females become more susceptible to hypertension during menopause due to declining estrogen levels.[32] Analysis indicates a significant relationship between family history and hypertension among educators and educational staff in Jember. Genetics influence cardiovascular function, including blood pressure regulation. This affects salt sensitivity, resulting in sodium and water retention, arterial blood volume regulation, and responses to blood pressure-regulating hormones like renin and angiotensin, leading to vasoconstriction and increased blood pressure in case of dysfunction.[20,25]

The study found a significant relationship between smoking status and hypertension among educators and educational staff in Jember. Nicotine and carbon monoxide in cigarettes damage the endothelium, increasing adrenal gland response and arteriosclerosis through heightened sympathetic nerve activity.[33] This finding aligns with previous studies indicating a positive relationship between smoking and hypertension, with smokers having a 4.7 times higher risk of hypertension compared to non-smokers.[34] Contrarily, research in Gorontalo found no significant relationship between smoking status and hypertension, likely due to the low number of smokers in their sample, making the statistical relationship insufficiently strong.[34a]

The study found a significant relationship between BMI and hypertension among educators and educational staff in Jember. Normal BMI offers protection against hypertension by reducing adiposity, ensuring good insulin sensitivity, better vascular stability, and using appropriate thresholds for BMI assessment.[35] Conversely, high BMI significantly impacts blood pressure elevation. Individuals with high BMI have a higher risk of hypertension. High BMI is associated with increased carbohydrate and fat consumption, systemic endothelial inflammation, lipid metabolism disorders, and triglyceride buildup in blood vessels, affecting vascular elasticity, and causing atherosclerosis and hypertension.[36]

A sedentary lifestyle, characterized by minimal physical activity, is a significant risk factor for non-communicable diseases, especially hypertension.[17] The study found a significant relationship between a sedentary lifestyle and hypertension among educators and educational staff in Jember. A sedentary lifestyle increases sympathetic nerve activity, causing vasoconstriction, increasing heart workload, oxygen demand, and blood pressure.[37] Analysis shows that individuals with a sedentary lifestyle have a high risk of hypertension. The results of this study are consistent with other researchers which state that the majority of educators, including those at Adeleke

University, fall into the overweight category due to low physical activity and monotonous work. [20,25] This can lead to the accumulation of unburned calories and a slowed metabolism, contributing to weight gain among educators. A pre-experimental study conducted in Yogyakarta found that regular exercise can influence the reduction of systolic and diastolic blood pressure. [27] Adequate physical activity ($\geq$ 600 METs) is essential, providing various benefits like controlling blood pressure, cholesterol, and weight, preventing diabetes mellitus, and reducing anxiety and stress. [4,38] Higher physical activity levels lower the likelihood of hypertension, with those engaging in light activity having a 30-50% higher tendency for hypertension compared to those with moderate or heavy activity. [39]

Multivariate analysis using logistic regression revealed that the most dominant variable related to hypertension occurrence among productive-age educators and educational staff in Jember is a sedentary lifestyle, with an OR value of 16.721. This indicates that a sedentary lifestyle is 16.721 times more influential in causing hypertension compared to those not leading a sedentary lifestyle, with higher risk after controlling for age, gender, BMI, family history, and smoking status. A sedentary lifestyle significantly influences hypertension occurrence after controlling for variables like age, gender, education, and medical history. [40,41] A sedentary lifestyle affects health, particularly cardiovascular and metabolic disease risks. Reduced physical activity leads to decreased lipoprotein enzyme levels, insulin resistance, increased inflammatory molecules like C-reactive protein (CRP), higher blood pressure, and reduced muscle mass. Consequently, fat tends to be stored in adipose tissue rather than being used as fuel, chronic inflammation damages tissues, accelerates cardiovascular disease progression, and reduces basal metabolic rate, contributing to higher BMI and stress levels, and increasing the risk of cardiovascular diseases, including hypertension. [17,42,43]

These findings can guide the development of targeted interventions to reduce sedentary behavior and its associated risks, including promoting active transportation, such as walking or cycling, designing more walkable communities, initiatives to encourage physical activity in workplaces, and workplace wellness programs. The study faced several limitations during its implementation. One of the primary challenges was the collection of height data, which was done through recall via questionnaires instead of using a direct measurement tool. This limitation arose due to the absence of a fixed research location and the unfeasibility of using a microtoise for height measurement at multiple sites.

Conclusion

There is a significant relationship between age, family history of hypertension, smoking, "overweight" BMI, and sedentary lifestyle with hypertension among educators and educational staff in Jember. While the variable of gender is not significantly related to hypertension among

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