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The association between hypertension, physical activity, and brushing technique with periodontal disease



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ABSTRAK

Background: Periodontal tooth disease is the second most common dental disease after dental caries. Hypertension is increasing in the world especially in Indonesia. Several studies showed that hypertension could cause periodontal tooth disease. Physical activity can reduce hypertension, which can further reduce the incidence of periodontal disease. Brushing technique also plays a role in preventing periodontal disease. This study aimed to determine the relationship between hypertension, physical activity, and brushing technique with periodontal disease in Indonesia.

Methods: This was an analytical cross-sectional study. A total of 722.329 samples were included, who were all household members aged ≥ 15 years. The data were secondary data from the National Health Survey 2013 study in 33 provinces and 497 districts/cities in Indonesia. Bivariate analysis using the chi-square analysis was used

to know the relationship between the independent and dependent variable. Multivariate analysis using the logistic regression analysis was used to determine the simultaneous influence of the independent variable to the dependent variable.

Results: There was a relationship between hypertension and periodontal tissue status ($p < 0.001$; OR = 1.15). There was a relationship between physical activity and periodontal tissue status ($p < 0.001$; OR = 0.84). There was a relationship between brushing technique and periodontal tissue status ($p < 0.001$, OR = 1.36). Logistic regression analysis showed a significant relationship between hypertension, physical activity, and correct brushing technique with periodontal tissue status ($p < 0.001$).

Conclusion: There was a relationship between hypertension, physical activity, and brushing technique with periodontal disease.

Kata Kunci: Brushing technique, hypertension, physical activity, periodontal disease

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INTRODUCTION

Hypertension is a worldwide problem causing heart and vascular disease with a high mortality rate. Many studies have shown that hypertension is related to lifestyle, meaning that it should be preventable.¹ Hypertension is a systemic or continuous increase in blood pressure over a long period. A rise in blood pressure can occur through a stronger pumping heart mechanism resulting in more fluid flow every second. Besides that, there is increased arterial stiffness, so the arteries cannot expand optimally when the heart pumps blood through the arteries. In addition, there are abnormalities of kidney function that causes an increase in the amount of fluid that circulates in the blood. The blood volume increases because the kidneys cannot get rid of excess fluid and salt, which eventually leads to increased blood pressure.

Hypertension is diagnosed through the measurement of blood pressure for at least three times at different times, in which the readings consistently show high blood pressure.² Hypertension is experienced by men and women in adulthood but is more commonly experienced by

the elderly. The risk of hypertension increases with age.² Hypertension and diabetes are two diseases that have a linear relationship. Studies by the American Heart Association (AHA) reported that the risk of developing cardiovascular diseases in people with diabetes is 3.6 times higher than those without diabetes.^{2,3}

Periodontal disease is an inflammation that occurs in the dental supporting tissues due to the accumulation of plaque bacteria which may cause endothelial dysfunction, plaque formation in the carotid artery, or decreased anti thermogenic properties of high-density lipoprotein (HDL).^{4,5} Periodontal disease is the second most common tooth and mouth disease after dental caries disease. The prevalence of periodontal disease approaches 14% over a wide range of age, including children and parents. Periodontal diseases include gingivitis and periodontitis.⁴ The risk factors for periodontal disease are dental plaques, calculus, age, genetic factors, and diabetes.⁶ Periodontal tissue is a complex system and has a high sensitivity to pressure. Periodontal tissue includes gums (gingiva), cementum, connective tissue and alveolar bone.^{4,7}

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According to Newman et al., periodontitis is an inflammation of the dental supporting tissues caused by certain microorganisms that cause damage to periodontal ligaments and alveolar bone with increasing depth of the periodontal pocket.^{4,5} Periodontitis begins with the loss of the alveolar bone and then the formation of pocket around the tooth, which in turn causes the tooth to shake and become loose. Clinical signs of periodontal pockets are the thickening of the edge gingiva, redness, bleeding, teeth shaking, and pain in the bone. A periodontal pocket can be detected by a periodontal probe and can be estimated by measuring the distance from the edge of the gum to the base of the periodontal pocket.⁸ In healthy periodontal tissue, no loose epithelial attachment or pocket formation is found, and there is an inner gum gap of ± 2 mm.

Periodontitis is caused by specific sub-gingival bacteria causing gingival inflammatory response, which damage the structure of the tooth supporting tissue (cementum and periodontium ligaments) and the alveolar bone. Damage to the deep alveolar bone, formation of periodontal pockets, migration of pathology could cause tooth shaking and result in tooth loss in the end.^{6,7,9} Loose teeth can affect the quality of food and nutrient intake, which leads to an increased risk of vascular disease.¹⁰ Chronic periodontitis is usually slow and suffered at age ≥ 30 years. Periodontal disease and hypertension share multiple common risk factors, which should be controlled in the assessment of a possible association in patients with signs and symptoms of poor oral health.¹¹ Hypertension can adversely affect the periodontal tissues also.^{6,7}

Based on other study, routine exercise contributes to improvements in periodontal disease.¹² It is suggested that brushing your teeth properly twice a day, that is in the morning after breakfast and at night before going to bed, can reduce the occurrence of germs and dental plaques.^{6,7}

Based on these facts, hypertension, physical activity, and brushing technique appear to play a role in periodontal disease. This study aimed to determine the relationship between hypertension, physical activity, and brushing technique with periodontal disease in Indonesia.

METHODS

This was a cross-sectional study. The data source was the National Basic Health Research in 2013 that was collected by the National Institute of Health Research and Development about non-communicable diseases that include hypertension and oral health. The study population was the Indonesian population from 33 provinces and

497 districts/cities. The inclusion criteria were all members of the household aged ≥ 15 years, as permanent teeth have grown until the second molar teeth in people aged ≥ 15 years.³ Participants had signed inform consent for approval to involve in the study. The selection of the sample was using census block sample frame from the National Institute Central of Statistics. The total sample size was 772,329 respondents.

The dependent variable was the status of the periodontal tissue, while the independent variables were hypertension, physical activity, and brushing technique. The data collection was done by performing dental and oral examinations under the supervision of experienced experts in the field. Healthy periodontal tissue was indicated as packed teeth, pink tissue, supple consistency and not easily bleed.³ Unhealthy periodontal tissue was indicated defined as the presence of periodontal diseases, such as gingivitis (inflammation of the gum) or periodontitis (inflammation of the periodontal tissues). Hypertension was defined as a condition of continuously high blood pressure above 140/90 mmHg in three measurements at different times. Adequate physical activity was defined as performing medium and heavy physical activity routinely. Medium physical activity is performing a moderate physical activity, such as sweeping, mopping, etc. for at least 150 minutes per day for 5 days a week. Heavy physical activity is a continuous activity carried out for 10 minutes.¹³ The correct brushing technique was defined as teeth-brushing twice daily in the morning and evening.

Bivariate analysis using the Chi-square analysis was performed to know the relationship between the independent and dependent variables. Multivariate analysis using logistic regression analysis was performed to determine the simultaneous influence of independent variables to the dependent variable.¹⁴

RESULT

As shown in [Table 1](#), there was a significant relationship between hypertension and periodontal tissue status ($p < 0.001$; OR=1.15). The percentage of non-hypertensive subjects with healthy and unhealthy periodontal tissue was 4.8% and 95.2% respectively. The OR value obtained from the Chi-square analysis was 1.15, meaning that subjects who did not have hypertension have a 1.15 greater chance of having healthy periodontal tissue than those with hypertension.

There was a significant relationship between physical activity and periodontal tissue status ($p < 0.001$; OR= 0.84). The percentage of subjects with healthy and unhealthy periodontal tissues was

Table 1 Relationship of Hypertension and Periodontal Tissue Status

Periodontal Tissue	Hypertension				Total	OR	p
	Yes		No				
Unhealthy	60.399	96.0%	627.426	95.2%	687.825	95.2%	
Healthy	2.544	4.0%	31.961	4.8%	34.505	4.8%	1.15 < 0.001
Total	62.943	100%	659.387	100%	722.330	100%	

OR: Odds ratio

Table 2 Relationship of Physical Activity and Periodontal Tissue Status

Physical Activity	Periodontal Tissue				Total	OR	p
	Healthy		Unhealthy				
Adequate	6.774	3%	222.369	97%	229.143	100%	
Inadequate	27.730	5.6%	465.456	94.4%	483.186	100%	0.84 <0.001
Total	34.505	4.8%	687.825	95.2%	722.330	100%	

Table 3 Relationship of Brushing Technique and Periodontal Tissue Status

Brushing technique	Periodontal Tissue				Total	OR	p
	Healthy		Unhealthy				
Correct	1.162	7.3%	14.857	92.7%	16.019	100%	
Incorrect	33.342	4.7%	672.968	95.3%	706.310	100%	1.36 <0.001
Total	34.504	4.8%	687.825	95.2%	722.329	100%	

Table 4 Logistic Regression Analysis of Periodontal Tissue Status with Hypertension, Physical Activity, and Brushing Technique

Variable	Initial Model		Final Model	
	OR (95% CI)	p	OR (95% CI)	p
Hypertension	1.151 (1.081-1.225)	< 0.001	1.146 (1.077-1.219)	< 0.001
Physical Activity	0.84 (0.808-0.881)	< 0.001	0.843 (0.808-0.880)	< 0.001
Brushing Technique	1.356 (1.244-1.479)	< 0.001	1.358 (1.245-1.481)	< 0.001

OR: odds ratio; CI: confidence interval

3.0% and 97% respectively. The OR value obtained from the chi-square analysis was 0.84, which means that subjects who perform adequate physical activity have a 0.84 greater chance of having healthy periodontal tissue than those who perform inadequate physical activity (Table 2).

There was a relationship between brushing technique and periodontal tissue ($p < 0.001$; OR = 1.36). As shown in Table 3, the percentage of subjects who did the correct brushing technique with healthy and unhealthy periodontal tissue statuses was 7.3% and 92.7% respectively. The OR value obtained from the chi-square analysis was 1.36, which means that subjects who did the

correct brushing technique had a 1.36 greater chance of having healthy periodontal tissue.

As shown in Table 4, the logistic regression analysis showed a significant relationship between hypertension, physical activity, and correct brushing technique with periodontal tissue status ($p < 0.001$).

DISCUSSION

People who performed inadequate physical activity will be more susceptible to high blood pressure or hypertension. The prevalence of hypertension in Indonesia is high. According to Basic Health Research (Riskesdas) 2007, most

cases of hypertension in the community have not been diagnosed. In America, an estimated 67 million people suffer from hypertension. This disease is often called the “silent killer” because it can be fatal, but it does not show typical symptoms. Consequently, many people do not realize that they suffer from hypertension. From the measurement of blood pressure of subjects aged 18 years and over, the prevalence of hypertension in Indonesia is 31.7%, but only 7.2% of them are aware of their disease, and only 0.4% are controlled cases (taking hypertension medication).

Normal blood pressure is defined as having <120 mmHg of systolic pressure and <80 mmHg of diastolic pressure. Initially, hypertension is suffered by the elderly. However, many cases of hypertension are starting to occur in the productive age group (under 50 years). Hypertension has a high prevalence in the community, but most people do not realize it. Therefore, it is important for health workers, including dentists, to pay more attention to this disease.

Table 1 shows that there is a relationship between hypertension and dental periodontal tissue ($p < 0.001$). This finding is in accordance with other research that found a relationship between periodontal disease and vascular disease, as well as its relation to hypertension. Hypertension can cause microcirculation dysfunction in periodontal tissue, which can lead to periodontal abnormalities and indirectly as well as risk factors for coronary heart disease.¹⁵

People with hypertension usually take anti-hypertensive medication to control blood pressure. Anti-hypertensive drugs can affect the condition of the oral cavity. Some drugs cause dryness in the mouth and lead to changes in taste sensation, while other drugs such as Ca-channel blockers cause enlargement and swelling of the gums. The lack of saliva volume in the dry mouth can make it difficult for patients to talk and chew. Moreover, it can facilitate the growth of bacteria and fungi.¹⁵ All of these issues contribute to increasing risk of periodontal disease. In general, bacteria found in the gums can cause systemic diseases, such as cardiovascular diseases, because bacteria in the teeth can go directly into the body through the bloodstream.

There is a significant relationship between adequate physical activity and periodontal tissue. This is likely due to the effect of exercise, which causes the dilation of the blood vessels, resulting in increased blood circulation. Research has shown that exercising causes the opening of more blood vessels that prevent hypertension and especially periodontal tissue disease.¹⁶

It is advised to perform physical activity or exercise daily to maintain a healthy body. Physical activity is also an important part of everyday lifestyle.¹⁴ Sport is a special form of planned and intentional physical activity, such as aerobics, swimming, or walking. Doing physical activity makes the body produce enzymes that help the recovery of organs.¹⁷⁻¹⁹ According to WHO, physical activity is any body movement produced by skeletal muscles that require energy. Physical activity carried out for 30 minutes for 4-7 days per week is enough to obtain resilience.^{18,19} Another opinion states that exercise for 30-45 minutes as much as 3-5 times per week is good for health. The recommended physical activity is gymnastics because it involves the muscles and increases heart rate.¹⁸

A previous study by Lee et al. in 2007 reported that walking exercise has a good effect in lowering the blood pressure of hypertensive patients in Taiwan.¹⁹ According to So HK. et al. in Hong Kong, speed-walking could reduce the risk of developing cardiovascular diseases.²⁰

CONCLUSION

It can be concluded that there was a relationship between hypertension, physical activity, and brushing technique with periodontal disease.

COMPETING INTEREST

The authors declare no competing interests.

AUTHOR'S CONTRIBUTION

Indirawati Tjahja Notohartoyo and Made Ayu Lely Suratri designed the research and participated in data collection, analysis, and interpretation. Vivi Setiawaty participated in drafting the manuscript. All authors read and approved the final manuscript. All authors are the main contributors.

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