

Hypertension and Its Association with Oral Health Status in Adults: A Pilot Study in Padusunan Adults Community

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Abstract—The association between general and oral health is clearly important, particularly in adults with medical conditions. Many of the medical systemic conditions are either caused or aggravated by poor oral hygiene and vice versa. Hypertension is one of common medical systemic problem which has been a public health concern worldwide due to its known consequences. Those consequences must be related to oral health status as well, whether it may cause or worsen the oral health conditions. The objective of this study was to find out the association between hypertension and oral health status in adults. This study was an analytical observational study by using cross-sectional method. A total of 42 adults both male and female in Padusunan Village, Pariaman, West Sumatra, Indonesia were selected as subjects by using purposive sampling. Manual sphygmomanometer was used to measure blood pressure and dental examination was performed to calculate the decayed, missing, and filled teeth (DMFT) scores in order to represent oral health status. The data obtained was analyzed statistically using One Way ANOVA to determine the association between hypertensive adults and their oral health status. The result showed that majority age of the subjects was ranging from 51-70 years (40.5%). Based on blood pressure examination, 57.1% of subjects were classified to prehypertension. Overall, the mean of DMFT score calculated in normal, prehypertension and hypertension group was not considered statistically significant. The was no significant association ($p>0.05$) between hypertension and oral health status in adults.

Keywords—Blood pressure, hypertension, DMFT, oral health status.

I. INTRODUCTION

Poor oral health leads to dental decay, periodontal disease, and so on. Those two remain a major oral health problem. These oral health problems are not just limited to the mouth, but importantly are associated to general health condition overall, as a result of common risk factors [1].

The World Oral Health Report stated clearly that the relationship between oral health and general health is proven by evidence and the latest evidence has emerged further strengthening the case. According to the report, oral health and general health are connected in four ways: 1) There is significant association between poor oral health and major chronic diseases, 2) Poor oral health may cause disability, 3) Risk factors of oral health issues and major diseases are commonly the same, and 4) Oral health state may be the

reason of general health problem or worsen the condition [1].

Hypertension, also known as high or raised blood pressure, is a global public health issue. It affects millions of people and becomes a major public health problem throughout the world. In 2008, approximately 40% of adults worldwide in 25 of age and above had been diagnosed with hypertension and the amount of those who has hypertension rose from 600 million in 1980 to 1 billion in 2008 [2]. It also has been firmly established that an association exists between oral health problems and cardiovascular disease (CVD) since one of the key risk factors for CVD is hypertension [2], [3]. Hypertension is one of the major risk factors for cardiovascular mortality, which is reported for 20%-50% of all deaths worldwide [4], [5].

According to the *Eighth Joint National Committee* (JNC-8), when systolic blood pressure examined > 140 mmHg and/or diastolic blood pressure examined > 90 mmHg is categorized as Hypertension. Systolic and diastolic blood pressure in normal state are principally important for the efficient function of vital organs and for overall health and thus oral health is no exception [2].

In epidemiological oral health surveys, an index is used to represent the prevalence and incidence of a specific condition. Dental indices provide quantitative method to measure, evaluate, and analyze dental condition in individuals and groups. One of dental indices which is used in oral health survey is D.M.F.T index. This index was developed by Henry Klein, Carrole E Palmer and Knutson JW in 1938. DMFT describe the amount of decayed, missing, and filled teeth in an individual which represent the oral health status [6].

Since oral health plays an important role, it can no longer be ignored in designing overall national health strategies. Thus, this study is needed and aimed to explore the association between hypertension and oral health status in adults.

II. METHOD

This analytical observational study was carried out in Padusunan Village, Pariaman, West Sumatera, Indonesia by using cross-sectional method. The data were collected from Mass Health Screening examined in Social Responsibility Program on July 17th, 2016 in Padusunan Village, Pariaman, Indonesia. The number of samples used in this study was 42 adults by using purposive sampling. The instruments used in this study were as follows:

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1. Manual Sphygmomanometer

This instrument was used to measure blood pressure of the subjects. *The Eighth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure* (JNC-8) became the guideline to classify blood pressure of adults. Normal blood pressure was defined as a systolic blood pressure < 120 mmHg and a diastolic blood pressure < 80 mmHg. Prehypertension was defined as a systolic blood pressure range between 120-139 mmHg and a diastolic blood pressure range between 80-89. Hypertension was defined as a systolic blood pressure range between > 140 mmHg and a diastolic blood pressure > 90 mmHg [2].

2. Dental Diagnostic Instruments

Dental examination was performed using a sterilized dental mirrors, dental explorers, tweezers, excavators, gloves, and masks. These instruments were used to calculate the DMFT score in order to represent oral health status. Criteria for recording D.M.F.T score are as follows: a) Decayed (D) when dental caries and a restoration are present on the same tooth, when a crown is broken due to caries, and tooth with temporary restoration are recorded as decayed; b) Missing (M) when a tooth has been extracted because of dental caries and when a tooth is carious that cannot be restored and is indicated for extraction; c) Filled (F) permanent restorations are recorded as F. All 28 teeth are examined [7].

The level of caries experience in the primary or permanent dentition may follow the WHO severity criteria. As for adults, the criteria are as follows: 1) Very low <5.0; 2) Low 5.0–8.9; 3) Moderate 9.0–13.9; 4) High >13.9 [6]. Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 16.0. One Way ANOVA test was used to determine the association between hypertensive adults and their oral health status. *P* values lower than 0.05 were considered statistically significant.

III. RESULTS

A total of 42 adults examined in The Mass Health Screening conducted by Social Responsibility Program carried out in Padusunan Village Pariaman, Indonesia were included as subjects in this study by using purposive sampling.

Table I shows the characteristic of the subjects according to the age. The mean value of age of the subjects was 57.67 years (± 14.47) with an age range of 51-70 years (40.5%).

Table II represents the distribution of the subject according to the gender. Results showed that from total of 42 subjects, there were 10 males (23.8%) and 32 females (76.2%) examined in this study.

Table III shows the distribution of blood pressure criteria of each subject according to its frequencies. It represents that among 42 subject examined, 24 subjects (57.1%) were categorized as prehypertension who form the majority of the subjects selected, followed by hypertension (35.7%) and normal blood pressure (7.1%). In addition, the mean value of D.M.F.T index of each criteria was shown in Table IV, results revealed that the mean value was 9.14 and the missing teeth component dominated all the D.M.F.T components. Also,

based on Table IV, each subject had at least nine missing teeth and had no decayed and filled teeth. It means M-component dominated in the D.M.F.T index. Whereas, Table V showed the distribution of DMFT component according to Blood Pressure Criteria. It was revealed that 18 subjects among 24 subjects in prehypertension group and 11 subjects among 15 subjects in hypertension group had missing teeth component (M).

TABLE I
CHARACTERISTIC REGARDING TO AGE OF SUBJECTS

Age	Frequency	%	Mean (S.D)
30-50	15	35.7%	57.67 (14.47)
51-70	17	40.5%	
71-90	10	23.8%	

TABLE II
GENDER

Gender	Frequency	%
Male	10	23.8%
Female	32	76.2%

TABLE III
DISTRIBUTION OF BLOOD PRESSURE CRITERIA OF SUBJECTS

Blood Pressure Criteria	Frequency	%
Normal	3	7.1%
Pre-hypertension	24	57.1%
Hypertension	15	35.7%

TABLE IV
DECAYED, MISSING AND FILLED TEETH INDEX COMPONENTS

Components	No. of Teeth	Mean
D	17	0.40
M	365	8.69
F	2	0.05
Total	384	9.14

TABLE V
DISTRIBUTION OF BLOOD PRESSURE CRITERIA AND D.M.F.T COMPONENTS

Blood Pressure Criteria	Decayed			Missing			Filled		
	N	Y	Total	N	Y	Total	N	Y	Total
Normal	2	1	3	2	1	3	2	1	3
Pre-hypertension	17	7	24	6	18	24	24	0	24
Hypertension	12	3	15	4	11	15	15	0	15
Total	31	11	42	12	30	42	31	1	42

N = No; Y = Yes

TABLE VI
ASSOCIATION OF HYPERTENSION AND D.M.F.T

Blood Pressure Criteria	Frequency	Mean D.M.F.T (S.D)	<i>P</i> value
Normal	3	3.00 (3.60)	<i>P</i> = 0.38
Pre-hypertension	24	9.46 (7.90)	
Hypertension	15	9.87 (8.36)	

Table VI illustrates the association between hypertension and D.M.F.T index, results revealed that the mean of D.M.F.T index in hypertension criteria was the highest (9.87) compared to normal blood pressure (3.00) and prehypertension (9.46). However, based on the result analyzed by using One Way ANOVA test, it was revealed that the *p* value was 0.38 (*p*>0.05). Since the *p* value obtained was higher than 0.05, it was concluded that the association between hypertension and

D.M.F.T representing oral health status was not statistically significant ($p = 0.38$).

IV. DISCUSSION

Oral health is very important for health in general and quality of life. Oral health needs to be assessed by survey to achieve comprehensive understanding of it needs [8]. One of oral health surveys is D.M.F.T index which is used in this study. Based on this study, the score of D.M.F.T index was 9.14 in adults with 30-90 years of age and categorized as moderate in level of caries severity. According to D.M.F.T score compared to Blood Pressure Criteria, normal blood pressure was categorized as low in level of caries experience. Whereas, in prehypertension and hypertension, the D.M.F.T score was categorized as moderate in level of caries experience [6].

Hypertension may play an important role in influencing the oral health status. It may cause general systemic changes, which is often reflected in the oral cavity [9]. Thus, in this study, the D.M.F.T index shows number of dental decay, filled teeth, and missing teeth which represent the oral health status of the subject. It also indicates that oral health status cannot be reflected by dental caries only, but the filled teeth and tooth loss are the main indicator as well.

As for the connection of those indicators and hypertension, the prevalence of caries was higher in hypertensive patients than those in normal ones. The finding of the previous study by Masood in 2011 showed that the salivary flow rate is decreased in hypertensive group compared to the control one, however the difference was statistically not significant. It also revealed that the highest value of dental caries belonged to hypertensive and the newly diagnosed group compared to the control group, but the difference was statistically not significant as well. Saliva through its flow rate and constituents has an important role in maintaining the integrity in both soft and hard tissues in the oral cavity including teeth. That way, it affects caries-experience through its variables since the increase of salivary pH may increase the tooth remineralization [5]. Based on that study, the decrease in blood flow to the salivary glands in hypertensive patients may be related to the reduction in the salivary flow rate. The reduction in the salivary flow rate may lead to decrease in the salivary constituents which include the salivary buffer. This may give an explanation for the high caries-severity among hypertensive patients [5]. The study conducted by Sabino-Silva et al. also showed that the salivary flow in diabetic and hypertensive rat undergo reduction and sympathetic activity might be responsible to this situation. It is stated that the transformation of the SGLT1 protein expression in salivary glands may illustrate the alterations of salivary secretion in diabetic and hypertensive subjects [10]. Since the saliva secretion is decreased, it may contribute to become the risk factor of the caries level in hypertensive patients. It is relevance to the result of this study that level of caries experience was categorized as moderate in hypertensive patients.

The D.M.F.T index was moderate due to missing teeth component. The majority subjects examined had teeth complete crown destructed (only the root left). Teeth complete crown destructed is the consequence of left untreated dental caries [11]. In D.M.F.T recording, Missing (M) was recorded when a tooth has been extracted because of dental caries and when a tooth is carious that cannot be restored and is indicated for extraction. Teeth complete crown destructed due to dental caries left the root of the teeth. It cannot be restored whereas indicated to be extracted and recorded as missing [7].

The other study stated that elevated blood pressure causes alveolar bone loss and is associated with tooth loss as well. Patients with lesser number of teeth and edentulous condition be prone in having higher blood pressure [13], [12]. It goes the same way in previous study conducted by Holmlund et al. A large population in Sweden showed an association between pocket depth, clinical attachment loss and hypertension. Holmlund et al. found that the level of periodontal disease severity and number of remaining teeth related to a history of heart attack and hypertension. It was reported that the prevalence of Chronic Periodontitis with hypertension was 16% [13].

The previous study assessed by M. Leye et al. showed that periodontal state and hypertension in Senegalese patients are associated. It is stated that the patient with periodontal disease is twice more prone in having hypertension [14]. It is related to the result from this study that among 42 subjects examined, there were 71.4% had missing teeth criteria and among 15 hypertensive subjects, there were 73.3% had missing teeth criteria.

In this study, we found that there was no significant association between hypertension and oral health status of adults in Padusunan ($p = 0.38$). Similar result was observed in previous study by Norsuryani et al., in which they found that that there was no significant association between hypertension and the severity of Chronic Periodontitis ($p = 0.229$) [15]. A study by Zainoddin et al. also stated that a significant association exists between chronic periodontitis and hypertension but the association between the level of Chronic Periodontitis (mild, moderate, and severe) and hypertension was not statistically significant ($p = 0.252$) [16].

This study used 42 subjects as samples by using purposive sampling which then categorized as three Blood Pressure Criteria according to the blood pressure examination. However, this purposive sampling might lead us to the limitation of this study. The small sample size and non equal number of each blood pressure criteria may give an explanation for the non significant association based on the statistical analysis by using One Way ANOVA between Hypertension and D.M.F.T index which represents oral health status ($p > 0.05$) resulted in this study.

V. CONCLUSION

In conclusion, this study revealed that the mean of D.M.F.T score calculated in hypertension group was higher compared to normal group and quite higher compared to prehypertension group but not considered statistically significant ($p > 0.05$) in

Padusunan Adults Community. The possible reason might be due to the small sample size used in this study. Therefore, a study with a larger sample size and equal number of each blood pressure category need to be carried out in order to obtain more accurate result for the benefits of oral health in the future.

REFERENCES

- [1] World Health Organization. *The World Oral Health Report 2003; Continuous improvement of oral health in 21st century - the approach of The WHO Global Oral Health Programme*. Geneva, World Health Organization, 2003.
- [2] World Health Organization. *A global brief on hypertension: silent killer, a global public health crisis*. Geneva, World Health Organization, 2013.
- [3] R. T. Demmer, M. Desvarieux, "Periodontal infections and cardiovascular disease: The heart of the matter," *JADA*, vol. 137, pp. 14S-20S, Oct. 2006.
- [4] K. Bell, J. Twigg, and R. Bernie, "Hypertension: The Silent Killer: Updated JNC-8 Guideline", Harrison School of Pharmacy, Auburn University, Alabama Pharmacy Association, 2015.
- [5] N. H. Masood, S. K. El-Samarrai, "Dental caries in relation to salivary parameters among hypertensive patients in comparison to healthy individuals", *J BaghColl Dentistry*, vol. 23 (1), pp. 136-140, 2011.
- [6] World Health Organization. *Oral Health Survey: Basic Method--5th edition*. Geneva, World Health Organization, 2013.
- [7] C. M. Marya *A Text Book of Public Health Dentistry*. 1st ed. Jaypee Brothers Medical Publishers, New Delhi: India, 2011.
- [8] H. Hessari, "Oral Health among Young Adults and the Middle-aged in Iran", Academic dissertation, Faculty of Medicine, University of Helsinki, Finland, 2009.
- [9] H. Sharanya. "Assessment of Salivary Parameters and Incidence of Dental Caries in Hypertensive Patient", *J. Pharm. Sci. & Res.*, vol. 7(9), pp. 782-787, 2015.
- [10] Sabino-Silva *et al*, "Increased SGLT1 expression in salivary gland ductal cells correlates with hyposalivation in diabetic and hypertensive rats", *Diabetology & Metabolic Syndrome*, vol. 5(64), pp. 1-5, 2013.
- [11] Begzati *et al.*, "Early Childhood Caries (ECC) — Etiology, Clinical Consequences and Prevention", *Creative Commons Attribution License inTech*, chapter 2, pp. 31-63, 2015.
- [12] Haq MH, Tanwir F, Nawaz M, *et al*. "Association of Systemic Diseases on Tooth Loss and Oral Health", *J Biomedical Sci*, vol. 4(1), pp. 1-7, Apr. 2015.
- [13] Holmlund, A., Holm, G. and Lind, L. "Severity of periodontal disease and number of remaining teeth are related to the prevalence of myocardial infarction and hypertension in a study based on 4254 subjects", *Journal of Periodontology*, vol. 77, pp. 1173-1178, 2006.
- [14] M. Leye *et al*. "Hypertension and Periodontal Status in Senegales Patients: A Case Control Study", *Open Journal of Epidemiology*, vol. 4, pp. 25-29, Feb. 2014.
- [15] Siti Norsuryani *et al*. "Hypertension and its association with the severity of chronic periodontitis", *Arch OrofacSci*, vol. 10(1), pp. 5-9, Jan. 2015.
- [16] M. M. Zainuddin N, *et al*. "Systemic conditions in patients with periodontal disease", *Int Med J*, vol. 20(3), pp. 363-366, 2013.