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RESEARCH ARTICLE

Prevalence and potential risk factors for periodontal disease among adults aged 35-54 years in Banten

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ABSTRACT

Periodontal disease is a chronic inflammatory disease that affects the gingival tissue and the underlying structures. Risk factors play a role in both the initiation and development of periodontal disease. It is important to know the risk factors for periodontal disease to prevent the occurrence of more widespread periodontal disease. Based on the 2018 Riskesdas, the prevalence of dental and oral health problems in Banten was 62.8%. This study aims to determine the prevalence and potential risk factors for periodontal disease among adults aged 35-54 years in Banten**.** This research was an observational descriptive study with a cross-sectional design using secondary data from the 2018 Riskesdas (National Basic Health Research) in Banten. We used total sampling method in this study. Information was processed using SPSS software, and data was presented in tables containing frequencies and percentages. The total number of respondents aged 35-54 years in Banten was 6,755. One thousand eight hundred and sixty-six respondents met the inclusion criteria, while 595 respondents were excluded due to missing data. Thus, 1,271 respondents were obtained and became the research subjects. The majority of respondents were female (64.4%), had low educational level (61.2%), employed (62.6%), brushed their teeth at the wrong time (99.2%), did not smoke (65.9%), did not chew tobacco (96.5%), were obese (51.4%), and did not suffer from diabetes mellitus (95.6%) and hypertension (82.2%). The prevalence of periodontal disease in these respondents was 27.6%. Potential risk factors for periodontal disease among adults aged 35-54 years in Banten include a high degree of education, employment status, smoking behavior, inappropriate toothbrushing time, and obesity.

Keywords: Indonesia; periodontal disease; prevalence; risk factors

INTRODUCTION

Oral health being an integral component of general health has a major impact on health and quality of life. Periodontal disease is a chronic inflammatory disease that affects the gingival tissue and the underlying structures.[1] Gingivitis and periodontitis are the most commonly found periodontal diseases. Gingivitis is inflammation that affects the gingival tissue and is usually accompanied by complaints of gum bleeding during teeth brushing. Periodontitis is inflammation of the periodontal tissue involving the gingiva, cementum, periodontal ligament, and alveolar bone with one of the signs being loss of epithelial attachment and alveolar bone destruction.[2,3]

The etiology of periodontal disease is the colonization of microorganisms in dental plaque. Dental plaque is a soft deposit that adheres to the tooth surface forming a complex biofilm, composed of various types of microorganisms and encased in a matrix of extracellular polymeric substance. The uncontrolled development of plaque biofilm will interact with the host immune response, which causes inflammatory damage to the supporting tissues of the teeth and alveolar bone.[4]

Besides plaque as the main cause, there are several risk factors that play a role in periodontal disease. Risk factors play a role in both the initiation and development of periodontal disease. It is important to know the risk factors for periodontal disease to prevent the occurrence of more widespread periodontal disease. Risk factors for periodontal disease are divided into 2, namely unmodifiable risk factors and modifiable

risk factors. Genetics, age, and gender are risk factors for periodontal disease that cannot be modified. Modifiable risk factors for periodontal disease are educational level, employment level, socioeconomic status, tooth brushing behavior, smoking, chewing tobacco, stress, nutritional status, diabetes mellitus, and hypertension.[5,6]

Based on the 2018 Riskesdas, periodontal disease was the second largest prevalence of dental and oral health problems after dental caries in Indonesia, with a prevalence reaching 74.1%. Population in the age group 35-44 years and 45-54 years were the 2 age groups with the largest prevalence of periodontal disease, each with 77% and 77.8%. Banten Province is one of the provinces in Indonesia whose prevalence of dental and oral problems is higher than the national prevalence. Prevalence of dental and oral problems in Banten Province is 62.8%, while the national prevalence is 57.6%. However, there is a lack of information about risk factors for periodontitis in Banten Province. The 2018 Riskesdas had data on age, gender, educational level, employment level, tooth brushing behavior, smoking, chewing tobacco, nutritional status, diabetes mellitus, and hypertension.[7] Therefore, this study aims to determine the prevalence and potential risk factors for periodontal disease among adults aged 35-54 years in Banten using these data.

MATERIALS AND METHODS

A descriptive observational study with a cross-sectional research design using secondary data from the 2018 Riskesdas was conducted in 34 provinces in Indonesia from April to May 2018. The data used in this study was data from Banten Province. The dependent variable was periodontal disease, and the independent variables were age, gender, educational level, employment level, frequency and time of tooth brushing, smoking, chewing tobacco, diabetes mellitus, and hypertension, which are the risk factors for periodontal disease. The 2018 Riskesdas data collection method was carried out through interviews and analysis by data collectors who had a minimum educational background of level 3 diploma in health. The questionnaire was designed by the Ministry of Health and was on age, gender, educational level, employment level, frequency and time of tooth brushing, smoking and chewing tobacco, diagnosis of diabetes mellitus and hypertension. The results of the questionnaire were used in this study. To maintain the quality of the results of the questionnaire, an indicator was determined together with the program holders of the Ministry of Health. These indicators were stated in the questions compiled in the instruments with experts in the health sector (professional organizations, universities, and senior researchers at the National Research and Development Agency). Input was also obtained from international organizations (WHO, UNICEF, and the World Bank). Supervision was carried out by the provincial PJT, the operational person in charge (PJO), and the technical team to identify problems during data collection. Independent external validation was carried out by the Association of Indonesian Health Researchers (APKESI). The output of the analysis and the report writing were discussed between the technical team, the expert team, and the person in charge of the provincial report.

This study was conducted at Universitas Trisakti from August to December 2022. Data were obtained and permission was granted from the Health Research and Development Agency (Badan Penelitian dan Pengembangan Kesehatan) of the Ministry of Health of the Republic of Indonesia from June to August 2022. This research was approved by the Ethics Committee of the Faculty of Dentistry at Trisakti University with registration number 553/S1/KEPK/FKG/7/2022. Inclusion criteria in this study were respondents aged 35-54 years, living in Banten Province, and answering “yes” to the variable “Swollen gums and/or abscess” and/or the variable “Gums bleed easily when brushing your teeth”. The exclusion criteria in this study were missing data for each variable.

There are several risk factors that play a role in periodontal disease. Risk factors for periodontal disease are divided into 2: unmodifiable risk factors and modifiable risk factors. Genetics, age,

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and gender are risk factors for periodontal disease that cannot be modified. Modifiable risk factors for periodontal disease are educational level, employment level, socioeconomic status, tooth brushing behavior, smoking, chewing tobacco, stress, nutritional status, diabetes mellitus, and hypertension. In this study, gender was classified into male and female. The level of education was divided into 3 groups: low (uneducated, primary, or junior high school), medium (senior high school), and high (university of higher education). Employment level was divided into 2: employed and unemployed. Information about tooth brushing time was obtained from the question which asked whether the time to brush their teeth was right or wrong. Tooth brushing time was defined as right if the respondents brushed their teeth after breakfast and before going to bed at night. In terms of smoking and chewing tobacco, the respondents selected the categories of yes or no. Nutritional status was obtained from the body mass index which was calculated based on measurements of body weight and height. Body mass index was categorized based on the recommendation of WHO Asia Pacific on BMI for Asian populations: underweight if BMI < 18.5, normal if BMI ≥ 18.5 - < 22.9, overweight if BMI ≥ 23 - < 24.9, and obese if BMI ≥ 25.[8] Information about diabetes mellitus and hypertension was obtained from interviews with the respondents. We asked whether they had ever been diagnosed with these diseases. In this study, we used a total sampling method, in which all respondents who fit the inclusion criteria and exclusion criteria would become participants in this study. Information was processed using SPSS statistical software version 25.0 (IBM). Data were presented in tables containing frequencies and percentages.

RESULTS

This study used the data from the 2018 Riskesdas (Basic Health Research). Based on this data, 6,755 respondents were in the age range 35-54 years in Banten Province. The prevalence of periodontal disease in people aged 35-54 years in Banten Province was 27.6% (1,866 respondents). After adjusting to the exclusion criteria, we found that several data were missing: data on the time variable of brushing their teeth of 44 respondents, data on the variable of nutritional status of 5 respondents, and data on the variable of hypertension of 546 respondents. Therefore, the respondents used in this study according to the inclusion and exclusion criteria were 1,271 people. Flowchart of the respondent selection is shown in Figure 1.

The prevalence of periodontal disease among adults aged 35-54 years in Banten was 27.6%. Table 1 shows the demographic characteristics of the respondents. Respondents were in the

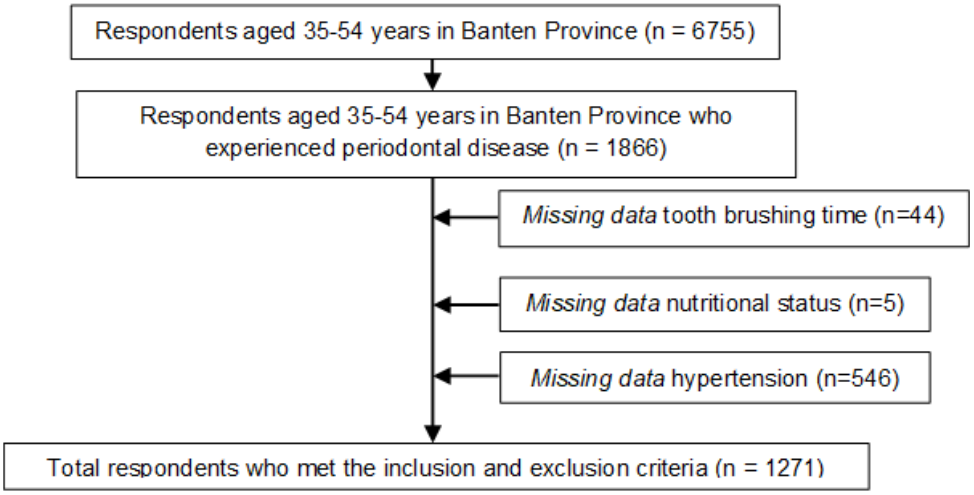

Figure 1. Flowchart of the respondent's selection

age range 35-54 years, and the average age was 43.48 ± 5.59 years. Among the 1,271 respondents, 452 respondents (35.6%) were male, and 819 respondents (64.4%) were female.

Based on their educational level, 778 respondents had low level of education, 349 had middle level of education, and 114 had a high level of education. Based on employment, 475 respondents worked, while 796 respondents were unemployed.

The frequency distribution of respondents based on the time they brushed their teeth is listed in Table 2. In this study, 1,261 respondents (99.2%) or almost all respondents brushed their teeth at the wrong time, while only a small proportion of respondents brushed their teeth at the right time, with 10 respondents (0.8%). Table 3 shows the frequency distribution of respondents according to smoking status. Based on these data, 838 respondents (65.9%) were non-smokers, while 433 respondents (34.1%) were smokers. Table 4 shows the frequency distribution of respondents according to tobacco chewing habit. Almost all of the respondents or 1,247 respondents (98.1%) were not tobacco chewers.

Table 1. Demographics characteristics of respondents

Variable	Frequency (%)	Mean	Standar deviation	Min, Max
Age		43.48	5.591	35-54
Gender				
Male	452 (35.6%)			
Female	819 (64.4%)			
Educational level				
Low	778 (61.2%)			
Middle	349 (27.5%)			
High	114 (11.3%)			
Occupational level				
Unemployed	475 (37.4%)			
Employed	796 (62.6%)			

Table 2. Distribution of the frequency of respondents based on the time of brushing their teeth

Tooth brushing time	Frequency (%)
Correct	10 (0.8%)
Incorrect	1261 (99.2%)

Table 3. Distribution of the frequency of respondents based on smoking behavior

Smoking	Frequency (%)
Yes	433 (34.1%)
No	838 (65.9%)

Table 4. Distribution of the frequency of respondents based on tobacco chewing behavior

Tobacco chewing	Frequency (%)
Yes	45 (3.5%)
No	1226 (96.5%)

Data on respondents based on nutritional status are summarized in Table 5. The nutritional status was seen from the body mass index calculated by dividing the respondent's weight in kilograms by the respondent's height in meters squared. The number of respondents who were obese and experienced periodontal disease was 642 respondents (50.5%).

Data on respondents based on the presence or absence of systemic disease are listed in

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Table 5. Distribution of the frequency of respondents based on nutritional status

Nutritional status	Frequency (%)
Underweight (< 18.5 kg/m^2)	67 (5.3%)
Normal (≥ 18.5-22.9 kg/m^2)	341 (26.8%)
Overweight (≥ 23-24.9 kg/m^2)	221 (17.4%)
Obese (≥ 25 kg/m^2)	642 (51.4%)

Table 6. Frequency distribution of respondents based on the absence of systemic disease

Systemic diseases		Frequency (%)
Diabetes melitus	Yes	56 (4.4%)
	No	1215 (95.6%)
Hypertension	Yes	226 (17.8%)
	No	1045 (82.2%)

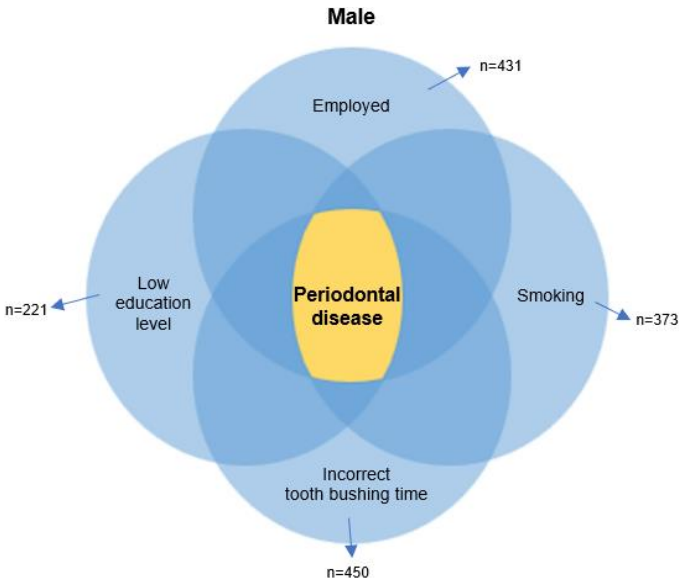

Figure 2. Overview of the dominant risk factors for periodontal disease in male respondents aged 35-54 years in Banten Province

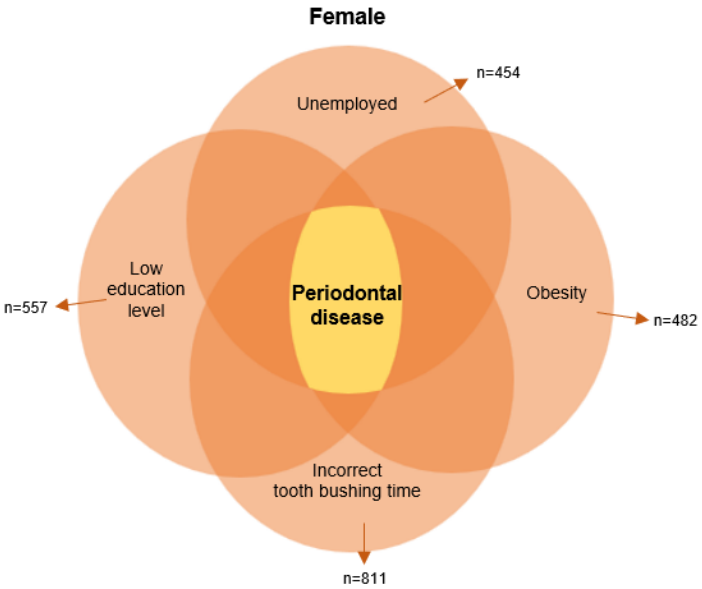

Figure 3. Overview of the dominant risk factors for periodontal disease in female respondents aged 35-54 years in Banten Province

Table 6. The majority of the respondents who had periodontal disease did not suffer from diabetes mellitus with 1,215 people (95.6%). In addition, the majority of respondents who were not hypertensive had periodontal disease, with a total of 1,045 people (82.2%). Based on Figure 2, risk factors for periodontal disease with a high frequency in male respondents were low educational level, being employed, brushing teeth at the wrong time, and smoking. Risk factors for periodontal disease with a high frequency in female were low level of education, being unemployed, brushing teeth at the wrong time, and obesity (Figure 3).

DISCUSSION

This research was a descriptive observational study with a cross-sectional research design. This research was approved by the Ethics Committee of the Faculty of Dentistry, Trisakti University. The number of people who met the inclusion and exclusion criteria of the research was 1,271.

In this study, the average age of the respondents was 43 years, with a minimum age of 35 years and a maximum age of 54 years. Bokhari's study using the community periodontal index (CPI) method shows that subjects aged 40 years and over are four times more likely to experience periodontitis.[9] In this case, age may be related to the length of time in which the periodontal tissue has been exposed to bacterial plaque and may reflect the cumulative dental history of the individual.[10]

In contrast to Sekino's study where male had a higher prevalence of periodontal disease,[11] in this study the majority of individuals with periodontal disease were female. The results of this study are in line with Boneta's study,[12] where 54.67% of female respondents experienced gingival inflammation, while the percentage of males who experienced gingival inflammation was 45.33%. This may have an association with the menopausal phase experienced by individuals with the age of around 45 years. In postmenopausal women, there will be a decrease in estrogen levels, causing changes in the periodontium such as xerostomia, a burning sensation in the oral mucosa, bleeding when probing and brushing teeth, malaise, and loss of alveolar bone.[13] The association of osteoporosis in postmenopausal women with periodontitis, attachment loss and gingival recession has also been reported. Reduced bone mineral density is associated with increased clinical attachment loss.[14]

The results showed that periodontal disease was more common in individuals with lower educational level than those with middle and higher educational level. This is consistent with a study conducted by Al-Hajri where the prevalence of periodontal disease was the highest in individuals with low level of education, followed by middle level of education, while the lowest prevalence was in individuals with high educational level.[15] Individuals with higher level of education are more aware of the importance of maintaining oral health, and generally comply with the instructions given by dentists to maintain good oral hygiene. Low educational level could affect a person's ability and knowledge of the use of health service facilities. People in this level of education tend to ignore complaints in the oral cavity or seek treatment on their own. Previous study reported that an increased level of education corresponded to a higher percentage of periodontally healthy subjects.[16]

In terms of occupation, the results showed that the majority of individuals with periodontal disease had an occupation. The results of this study are in line with research by Nayak, which found that long working hours or an abnormal or busy schedule are associated with deteriorating health conditions. Long working hours can activate the hypothalamic-pituitary-adrenal stress response system, stimulate the adrenal cortex to release glucocorticoids, and affect immune function. The stress response system can also weaken immunity, causing destruction of the periodontal tissues.[17] In addition, the combination of work stress, time constraints, and fatigue caused by the work environment can lead to poor oral health behavior.[18]

The prevalence of periodontal disease in this study was greater in individuals who did not brush their teeth properly. The correct time to brush teeth

is 2 times a day after breakfast and before going to bed. The results of this study are in line with Tefera's study, where the majority of participants with periodontal disease do not brush their teeth regularly and only brush their teeth in the morning.[19] According to Carranza, brushing teeth properly twice a day, in the morning after breakfast and evening before going to bed can reduce the occurrence of germs and dental plaque.[20] In addition to the frequency or time of tooth brushing, the correct method of brushing is also of utmost importance. Brushing teeth after eating is useful for removing food debris that sticks to the surface or between the teeth, so the mouth becomes clean. Brushing teeth before bed is important because of reduced saliva production during sleep, and as a result, the function of saliva in cleaning teeth and mouth is reduced.[21]

The results showed that periodontal disease was more common in non-smokers compared to smokers. This finding was also reported by Jafer.[22] This could be due to the fact that the majority of respondents were female, resulting in a lower number of smokers in this study. However, the results of this study contradict those of Silla's research, which found that there were more periodontal pockets in smoking individuals than non-smokers.[23] The heat from cigarette smoke causes changes in vascularity and salivary secretion. These vascular changes will cause capillary dilatation and infiltration of inflammatory agents, thus resulting in gingival enlargement. In addition, the tar content in cigarettes which settles on the surface of the teeth causes stains on the teeth. This makes the surface of the teeth to become rough, and consequently plaque and bacteria attach easily.[24]

In this study, individuals who did not chew tobacco have a greater prevalence of periodontal disease. The results of this study are in line with a study conducted by Nagarjuna, where bleeding on probing and calculus were more common in patients with periodontal disease who did not chew tobacco. A contributing factor to this result is due to the method of data collection which uses interviews, and therefore the accuracy and reliability of the respondents' answers depend on the honesty of the respondents.[17] However, in Agrawal's study, the prevalence of gingival recession in areas where tobacco was chewed was 65.7%.[25] Chewing tobacco has been associated with severe attachment loss and periodontal breakdown. Gingival recession often occurs at the site of placement of smokeless tobacco.[26]

Based on the nutritional status, the results showed that the highest prevalence of periodontal disease was in obese individuals (50.5%). Ana's study also showed that there were higher plaque index, gingival inflammation, bleeding on probing, and periodontal pocket depth values in the obese group compared to the other groups.[27] This insulin resistance condition causes diabetes mellitus to be accompanied by a hyperinflammatory state, which is a factor in periodontal disease. In people with obesity, advanced glycosylation end products (AGEs) cause an increase in TNF-α which plays a substantial role in the occurrence of periodontal disease by triggering proliferation, differentiation, and osteoclast activity which results in bone resorption.[28]

The results of this study showed that individuals who did not suffer from diabetes mellitus had a greater prevalence of periodontal disease. This is in line with Garcia's study which showed that 84% of patients with periodontal disease did not have diabetes mellitus.[29] This could be due to the fact that the study was only conducted by subjective examination by interview, not by examining blood sugar levels. The use of self-reported data for diabetes mellitus remains unclear and subject to bias in individuals who are unwilling to disclose their diabetes mellitus status. However, the results of this study are different from those of Thaper's study. In patients with diabetes mellitus, 15 people were found to have periodontal disease, while from the group without diabetes mellitus, only 4 people had periodontal disease.[30] Glucose levels rise in blood and gingival fluid. As a result, the microflora environment becomes one in which specific bacteria flourish to provide food for bacterial development. Diabetes increases the risk of severe periodontitis by affecting PMN function and by forming advanced

glycosylation end products. AGEs bind to AGE receptors on the surface of target cells and cause excessive secretion of inflammatory mediators, such as IL1, tumor necrosis factor alpha, and prostaglandin E2.[31]

The results of this study also showed that individuals who did not suffer from hypertension had a greater prevalence of periodontal disease. This is in line with Zainoddin's study where 56.9% of those with gingivitis did not suffer from hypertension.[32] Wellapuli's study also stated that chronic periodontitis was found more in individuals who said they did not suffer from hypertension. This could be due to the fact that the study was only carried out by subjective examination by interview, not by checking blood pressure.[33] However, the outcome of Machado's study was contrary to that of this study. Out of 700 respondents who had hypertension, 465 had periodontitis.[34] In this study, individuals with a higher level of probing pocket depth had higher average levels of systolic and diastolic blood pressure. High blood pressure will also induce the development of left ventricular hypertrophy and narrow the diameter of the micro vessel lumen, causing ischemia in the heart and periodontal tissue.[35]

This study has a limitation. The data on the prevalence of periodontal disease, diabetes mellitus, and hypertension relied on respondent's information rather than direct examination by doctors and dentists. Therefore, there is a concern that there may be bias in the data which depends on the honesty and memory of the respondents. Notwithstanding this limitation, swollen gums and/or gums that bleed easily when brushing teeth can be easily recognized and is likely to be a useful indicator of periodontal disease. In addition, this could be an inexpensive and useful alternative to improve and reinforce oral hygiene.

CONCLUSION

This study has identified that the prevalence of periodontal disease in people aged 35-54 years in Banten Province was 27.6%. The average age of the respondents was 43 years. Based on the characteristics of the subjects, periodontal disease was more common in female with low educational level, who worked, brushed their teeth at the wrong time, did not smoke, did not chew tobacco, and who were obese. Based on systemic disease, the majority of respondents did not suffer from diabetes and hypertension.

In male respondents, periodontal risk factors increased in those who worked, had low educational level, smoked, and brushed their teeth at the wrong time. In female respondents, periodontal risk factors increased in women who were unemployed, had low educational level, were obese, and brushed their teeth at the wrong time. Therefore, the potential risk factors in this population were gender, educational level, employment status, time of brushing teeth, smoking, and obesity.

CONFLICT OF INTEREST

The authors declare no conflict of interest with the data contained in the manuscript.

REFERENCES

1. Di Benedetto A, Gigante I, Colucci S, Grano M. Periodontal disease: Linking the primary inflammation to bone loss. Clin Dev Immunol. 2013; 2013.
2. Preshaw P. Periodontal Disease Pathogenesis. In: Newman and Carranza's Clinical Periodontology. 13th Editi. Philadelphia: Elsevier; 2019. 89–111.
3. Chapple IL, Mealey BL, Van Dyke TE, Mark Bartold P, Dommisch H, Eickholz P, et al. Periodontal health and gingival diseases and conditions on an intact and a reduced periodontium: Consensus report of workgroup 1 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. J Clin Periodontol. 2018; 45(20): 68–77. doi: 10.1111/jcpe.12940
4. Hasan A, Palmer RM. A clinical guide to periodontology: Pathology of periodontal disease. Br Dent J. 2014; 216(8): 457–461. doi: 10.1038/sj.bdj.2014.299

5. Genco R, Borgnakke W. Risk factors for periodontal disease. Periodontology 2000. 2013; 62(1): 59–94. doi: 10.1111/j.1600-0757.2012.00457.x
6. Aljehani YA. Risk factors of periodontal disease: Review of the literature. Int J Dent. 2014; 2014: 182513. doi: 10.1155/2014/182513
7. Kementerian Kesehatan RI 2018. Laporan_Nasional_RKD2018_FINAL.pdf [Internet]. Badan Penelitian dan Pengembangan Kesehatan. 2018. p. 198. Available from: http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan_Nasional_RKD2018_FINAL.pdf
8. Lim JU, Lee JH, Kim JS, Hwang Y Il, Kim TH, Lim SY, et al. Comparison of World Health Organization and Asia-Pacific body mass index classifications in COPD patients. Int J Chron Obstruct Pulmon Dis. 2017; 12: 2465–2475. doi: 10.2147/COPD.S141295
9. Bokhari S, Suhail A, Malik A, Imran M. Periodontal disease status and associated risk factors in patients attending a dental teaching hospital in Rawalpindi, Pakistan. J Indian Soc Periodontol. 2015; 19(6): 678–682. doi: 10.4103/0972-124X.156882
10. Hajishengallis G. Aging and its impact on innate immunity and inflammation Implications for periodontitis. J Oral Biosci. 2014; 56(1): 30–37. doi: 10.1016/j.job.2013.09.001
11. Sekino S, Takahashi R, Numabe Y, Okamoto H. Current status of periodontal disease in adults in Takahagi, Japan: A cross-sectional study. BMC Oral Health. 2020; 20(1): 1–9. doi: 10.1186/s12903-020-1046-4
12. Elías-Boneta AR, Toro MJ, Rivas-Tumanyan S, Rajendra-Santoch AB, Brache M, Collins C JR. Prevalence, severity, and risk factors of gingival inflammation in caribbean adults: A multi-city, cross-sectional study. P R Health Sci J. 2018; 37(2): 115–123.
13. Mahmood H, Khan P, Raouf M. Correlation of education level with severity of gingivitis and plaque score. J Pak Dent Assoc. 2022; 31(01): 38-42.
14. Sorina Mihaela S, Gianina I, Liliana P, Georgeta SI, Ioana M, Ionuţ L, et al. Risk predictors in periodontal disease. Rom J Oral Rehabil. 2017; 9(3): 89–96.
15. Al-Hajri MM. Risk factors of periodontal diseases among yemeni young dental patients. Univers J Pharm Res. 2017; 2(5): 64–68. doi: 10.22270/ujpr.v2i5.CS1
16. Vano M, Gennai S, Karapetsa D, Miceli M, Giuca MR, Gabriele M, et al. The influence of educational level and oral hygiene behaviours on DMFT index and CPITN index in an adult Italian population: an epidemiological study. Int J Dent Hyg. 2015; 13(2): 151–157. doi: 10.1111/idh.12098
17. Nayak PA, Nayak UA, Wali O, Marusamy KO, Muhcu NK. Effect of lifestyle on periodontal health status in Jeddah, Saudi Arabia. J Evol Med Dent Sci. 2021; 10(11): 760–767.
18. Carasol M, Llodra JC, Fernández-Meseguer A, Bravo M, García-Margallo MT, Calvo-Bonacho E, et al. Periodontal conditions among employed adults in Spain. J Clin Periodontol. 2016; 43(7): 548–556. doi: 10.1111/jcpe.12558
19. Tefera A, Bekele B. Periodontal disease status and associated risk factors in patients attending a tertiary hospital in Northwest Ethiopia. Clin Cosmet Investig Dent. 2020; 12: 485–492. doi: 10.2147/CCIDE.S282727
20. Fiorellini JP, Kim D, Uzel N, Carranza F. Anatomy, Structure and Function of the Periodontium. In: Newman and Carranza's Clinical Periodontology. 13th Editi. Philadelphia: Elsevier; 2019. 19–32.
21. Maruanaya AM, Mariati NW, Pangemanan DHC. Gambaran status gingiva menurut kebiasaan menyikat gigi sebelum tidur malam hari pada siswa Sekolah Dasar Negeri 70 Manado. e-GIGI. 2015; 3(2). doi: 10.35790/eg.3.2.2015.8762
22. Jafer M. The periodontal status and associated systemic health problems among an elderly population attending the outpatient clinics of a dental school. J Contemp Dent Pract. 2015;

16(10): 950–956.
doi: 10.5005/jp-journals-10024-1787

23. Almerich-Silla JM, Almiñana-Pastor PJ, Boronat-Catalá M, Bellot-Arcís C, Montiel-Company JM. Socioeconomic factors and severity of periodontal disease in adults (35-44 years). A cross sectional study. J Clin Exp Dent. 2017; 9(8): e988-e994. doi: 10.4317/jced.54033
24. Rohmawati N, Santik YDP. Status penyakit periodontal pada pria perokok dewasa. HIGEIA (Journal Public Heal Res Dev). 2019; 3(2): 286–297. doi: 10.15294/higeia.v3i2.25497
25. Agrawal N, Aggarwal A, Gupta ND, Tewari RK, Gupta J, Garg AK. Oral health consequences of use of smokeless tobacco in North India: A cross-sectional survey. Pesqui Bras Odontopediatria Clin Integr. 2021; 21: 1–9. doi: 10.1590/pboci.2021.025
26. Kulkarni V, Uttamani JR, Bhatavadekar NB. Comparison of clinical periodontal status among habitual smokeless-tobacco users and cigarette smokers. Int Dent J. 2016; 66(1): 29–35. doi: 10.1111/idj.12192
27. Ana P, Dimitrije M, Ivan M, Mariola S. The association between periodontal disease and obesity among middle-aged adults periodontitis and obesity. J Metabolic Synd. 2016; 5: 208. doi:10.4172/ 2167-0943.1000208
28. Banihashemrad SA, Fatemi K, Pakdel T, Nasrabadi N. Relationship between BMI ≥25 and periodontal status: A case– control study. J Adv Periodontol Implant Dent. 2018; 10(2): 90–94. doi: 10.15171/japid.2018.014
29. Garcia D, Tarima S, Okunseri C. Periodontitis and Glycemic Control in Diabetes: NHANES 2009 to 2012. J Periodontol. 2015; 86(4): 499–506. doi: 10.1902/jop.2014.140364
30. Thaper S, Thaper T, Vishnu Priya V, Thaper R, Thaper R. Prevalence of periodontitis in diabetic and non-diabetic patients. Asian J Pharm Clin Res. 2016; 9(1): 308–310.
31. Taylor JJ, Preshaw PM, Lalla E. A review of the evidence for pathogenic mechanisms that may link periodontitis and diabetes. J Clin Periodontol. 2013; 40(14): S113-134. doi: 10.1111/jcpe.12059
32. Zainoddin NBMM, Taib H, Awang RAR, Hassan A, Alam MK. Systemic conditions in patients with periodontal disease. Int Med J. 2013; 20(3): 363–366.
33. Wellapuli N, Ekanayake L. Risk factors for chronic periodontitis in Sri Lankan adults: A population based case-control study. BMC Res Notes. 2017; 10(1): 1–7. doi: 10.1186/s13104-017-2778-3
34. Machado V, Aguilera EM, Botelho J, Hussain SB, Leira Y, Proença L, et al. Association between periodontitis and high blood pressure: Results from the study of periodontal health in almada-seixal (sophias). J Clin Med. 2020; 9(5): 1–13. doi: 10.3390/jcm9051585
35. Zeigler CC, Wondimu B, Marcus C, Modéer T. Pathological periodontal pockets are associated with raised diastolic blood pressure in obese adolescents. BMC Oral Health. 2015; 15(1): 1-7. doi: 10.1186/s12903-015-0026-6