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RESEARCH ARTICLES

Relationship between peatland water use and periodontal disease in Daha Selatan Subdistrict

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ABSTRACT

Periodontal disease is one of the dental and oral health problems in Hulu Sungai Selatan Regency with a prevalence of gingivitis of 24.58% and periodontitis of 10.83%. One of the risk factors for periodontal disease is the use of peatland water. Peatland water has a low pH which can affect the colony of anaerobic bacteria in the oral cavity of the water users. Bacteria that cause periodontal disease are able to develop and survive in acidic conditions. This study aimed to analyze the relationship between peatland water use and periodontal disease in Daha Selatan Subdistrict. This was analytical research with a cross-sectional approach. The sampling technique used a simple random sampling technique with a total sample of 100 people (n = 100) who were residents aged 35-44 years in Daha Selatan Subdistrict. The results showed that the participants with high use of peatland water showedthe highest percentage (39%). In addition, there were 61% respondents who suffered from periodontal disease. Chi-Square test obtained a significance value of 0.022 ($p < 0.05$), showing that there was a relationship between peatland water use and periodontal disease. The risk of periodontal disease in the respondents who used peatland water in the high category was 4.167 times greater than in the respondents who did not use peatland water. It is essential to educate the general public about the effects that using peatland water can have on dental and oral health because there is a high prevalence of periodontal disease, which is caused by the widespread use of peatland water.

Keywords: peatland water; periodontal disease

INTRODUCTION

The most commonly found periodontal diseases in the community are gingivitis and periodontitis.[1] The World Health Organization (WHO) reported that as many as 10 - 15% of the world population suffered from periodontal disease and the prevalence increases with age.[2] Data from *Riset Kesehatan Dasar* (RISKESDAS) in 2018 showed that 13.9% of the Indonesian population suffered from gingivitis and 10.4% suffered from periodontitis.[3] South Kalimantan Province has a prevalence of gingivitis of 14.17% and periodontitis of 8.67%. South Kalimantan Province spreads across 13 regencies/cities, one of them is Hulu Sungai Selatan Regency which has a prevalence of gingivitis of 24.58% and periodontitis of 10.83%.[4]

Some studies showed that a low pH can affect bacterial colonies. Febriyanti et al mentioned that people tend to use peatland water for daily needs such as bathing, brushing teeth, or washing clothes. The characteristics of peatland water is high turbidity and high color intensity (brownish red), and low pH (under 7) which support the growth of acidogenic and aciduric bacteria such as *Porphiromonas gingivalis, Prevotella intermedia,* dan *Fusobacterium nucleatum*.[5,6] Peatland water has a low pH which can affect the colony of anaerobic bacteria in the oral cavity of people who use the water. Peatland water causes the degree of acidity in the oral cavity to reach a critical pH of 5.5, so the saliva in the oral cavity is imbalanced and changes the host bacteria and biofilm, resulting in destruction of the periodontium.[5,7]

Majalah Kedokteran Gigi Indonesia. December 2022; 8(3): 169-175
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Daha Selatan Subdistrict is one of the subdistricts in Hulu Sungai Selatan Regency which is located on the outskirts of the Negara River whose residents use the peatland water for daily needs. A study by Utami et al. reported that the pH of water in the subdistrict was acidic.[8] Based on the above-mentioned problems, the authors conducted a study on the relationship between peatland water use and periodontal disease. This study aimed to analyze the relationship between peatland water use and periodontal disease in Daha Selatan Subdistrict.

MATERIALS AND METHODS

The research entitled "Relationship between Peatland Water Use and Periodontal Disease in Daha Selatan Subdistrict" has been ethically approved according to Ethical Clearance Certificate No. 047/KEPKG-FKGULM/EC/IV/2022. This was analytical research with a cross-sectional approach. This study was conducted in May 2022 with direct observations in 14 villages of Daha Selatan Subdistrict, Hulu Sungai Selatan Regency. The sampling technique was a probability sampling technique, namely simple random sampling. As the samples, the study involved 100 residents aged 35 - 44 years in Daha Selatan Subdistrict, Hulu Sungai Selatan Regency. The calculation was based on cross-sectional formula using desired accuracy of 10% which resulted in 90 respondents and using dropout of 10% which resulted in a total sample of 100 respondents. A list of the residents of Daha Selatan Subdistrict were inputed into Microsoft Excel programme and divided evently by the programme using randbetween formula.

The inclusion criteria in this study were residents of Daha Selatan Subistrict, Hulu Sungai Selatan Regency except residents of Muning Dalam Village and Muning Baru Village, Daha Selatan Subdistrict; residents aged 35-44 years; cooperative; willing to sign an informed consent to be the research subject. The exclusion criteria in the study were residents with unfavorable health conditions (ill), residents with unfavorable habits (smoking, chewing betel), and pregnant women.

The materials used in this study were medical masks, handscoons, hand sanitizer, informed consent sheets, periodontal index sheets, questionnaire sheets, and sterilizing solution (chlorine). The tools used in this study were disposable diagnostic set (half-moon sonde, dental mirror, tweezer), periodontal probe (WHO), goggle, level 3 hazmat suit, and stationaries.

The data collection in this study used primary data. The primary data in this study were the results of the periodontal index examination and questionnaire of peatland water use of which the validity and reliability had been tested. This questionnaire was a new self-constructed questionnaire. The questionnaire was divided into 2 sections with section B for questions for people who used peatland water and section C for people who did not use peatland water. All the questions in the questionnaire were valid with the r-table in section B of 0.2759 and the r-table in section C of 0.602. The questions were valid if r-table < r-count. The level of reliability of this questionnaire was tested using coefficient alpha. The realibility of section B was 0.894 and that of section C was 0.703. All the questions were reliable if cronchbach alpha > 0.60.

Peatland water usage was measured using a 17-question questionnaire. The total scores of the peatland water usage questionnaire were then categorized with the following categorization: high usage (total score ≥75, using peatland water for drinking and tooth brushing); low usage (total score <75, using peatland water for drinking or tooth brushing); no usage (not using peatland water). The categorization was made using 3 categorization formula because this questionnaire was a new self-constructed questionnaire. Periodontal disease was measured using the Periodontal Disease Index (PDI) which was divided into two categories, namely suffering from periodontal disease (characterized by inflammation or loss of attachment) and not suffering from periodontal disease. The data analysis in this study used a non-parametric analysis, namely Chi-square test with SPSS (Statistical Package for the Social Science) program to analyze the relationship

between peatland water use and periodontal disease in Daha Selatan Subdistrict.

RESULTS

The results of the study of the relationship between peatland water use and periodontal disease in Daha Selatan Subdistrict are as follows:

Respondent Characteristics

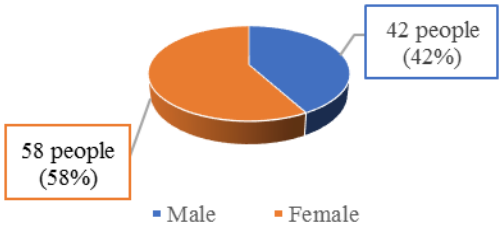

Figure 1. Frequency Distribution of Respondent Characteristics Based on Gender

Table 1. Age Distribution of study respondents based on frequency, mean and standard deviation

Variable	Mean	Standard deviation
Age	39.5	2.568

Table 2. Frequency distribution of peatland water usage based on questionnaire of residents aged 35-44 years-old in Daha Selatan District

Peatland Water Usage Category	Frequency (n)	Percentage (%)
High Usage	39	39
Low Usage	34	34
No Usage	27	27
Total	100	100

Table 3. Frequency distribution of periodontal disease based on periodontal disease index in residents aged 35-44 years old in Daha Selatan District

Periodontal disease	Frequency (n)	Percentage (%)
Suffering from Periodontal Disease	61	61
Not Suffering from Periodontal Disease	39	39
Total	100	100

Figure 1 presents the characteristics of the study respondents based on gender distribution with a total of 100 respondents. There were 58 female respondents (58%) and 42 male respondents (42%).

According to Table 4, most of the respondents with peatland water use in the high category suffered from periodontal disease with a total of 30 people (76.9%), most of the respondents with peatland water use in the low category suffered from periodontal disease with a total of 19 people (55.9%), and most of the respondents who did not use peatland water did not suffer from periodontal disease with a total of 15 people (55.6%).

Statistical analysis using the Chi-square test obtained a significance level of 0.022 ($p < 0.05$), meaning that H_0 was rejected or there was a relationship between peatland water use and periodontal disease. Between the group of respondents with high usage of peatland water and no usage of peatland water, the odds ratio (OR) was 4.167. This result showed that the

Table 4. Frequency distribution of peatland water usage and periodontal disease in Daha Selatan District

Variable		Periodontal Disease		Total n (%)	p-value	OR (95% CI)
		Suffer n (%)	Not Suffer n (%)			
Peatland Water Use	High	30 (76.9%)	9 (23.1%)	39 (100%)	0.022*	4.167 (1.44 – 12.07)
	Low	19 (55.9%)	15 (44.1%)	34 (100%)		1.583 (0.57 – 4.38)
	No Usage	12 (44.4%)	15 (55.6%)	27 (100%)		Comparison

Notes: *significance level of 0.022 ($p < 0.05$)

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respondents who used peatland water in the high category had 4.167 times greater possibility of suffering from periodontal disease than the respondents who did not use peatland water.

DISCUSSION

The result of the study on 100 respondents who lived in 14 villages in Daha Selatan Subistrict showed that, in terms of the level of peatland water usage, the highest percentage (39%) was occupied by the participants who had high peatland water usage . The result of this study is in accordance with a study by Utami et al which reported that the people of Daha Selatan Subdistrict used peatland water, namely swamp water and river water located on the banks of the Negara River for daily needs such as drinking water, tooth brushing, and bathing.[8] The results of this study coincide with a study by Napitupulu et al and Harsa which reported that as many as 52% of people who lived in close proximity to rivers used river water for consumption and tooth brushing in their daily activities.[9,10] The result of this study is supported by a previous study which showed that as many as 43.4% of residents of Tapin Regency, South Kalimantan, used river water for daily consumption.[11]

Based on the observation conducted by the researchers, it was found that limited access to clean water such as PDAM (local water company) yet easy access to peatland water from their residence were the reason why respondents chose to use peatland water. The lack of access to clean water was because the PDAM office is located quite far from the densely populated areas. In fact, the residents who have used water from PDAM also said that the quality of the water was not as good as expected. Therefore, many residents decided to use peatland water for their daily needs. In terms of the geographical condition, Daha Selatan Subdistrict is located on the outskirts of the Negara River where the area throughout the year is a lowland area and the land is dominated by swamp or peatland. The Negara River, which is located in Daha Selatan Subdistrict, is the second longest river in South Kalimantan after the Barito River and is the confluence of two rivers, namely the Tabalong River and the Balangan River; both of which flow into the Barito River. This dominant and long water area has made the peatland water more accessible to the residents of the study location.

The result of the study found that the incidence of periodontal disease in 100 respondents aged 35-44 years old was 61%. This result is in accordance with a study by Harapan et al which showed that the incidence of periodontal disease in people aged between 35-44 years old was 40-75%. Periodontal disease conditions in an individual usually begin in adulthood and the severity increases with age, as a result of long-term plaque accumulation in the periodontal tissue.[7,12] The result of this study is in line with a study by Hamdani et al which reported that periodontal disease in people who live in peatlands is a soft tissue disease with the highest prevalence annually. The percentage of periodontal disease was 81.22% in 2017, 73.89% in 2018, 81.33% in 2019, and 71.54% in 2020.[13] The result of this study is also supported by the data from the Central Bureau of Statistics (BPS) of Hulu Sungai Selatan Regency which showed that periodontal disease was one of the 10 most common diseases in one of the community health center (Puskesmas) in Daha Selatan Subdistrict, namely Puskesmas Bayanan, with a total of 739 cases in 2020.[14]

Periodontal disease is affected by various factors, one of them is a predisposing factor, namely behavior. According to Panghiyangani, the interaction between an individual and the surrounding environment affects the individual's behavior. The behavior of people who live in peatland areas such as swamps and river banks can lead to behaviors that may predispose the development of diseases. Behavior is affected by three crucial components, namely the environment in which the behavior occurs, individual behavior, and the impact of the behavior.[15] The condition of the living environment around the river and the behavior of the people of Daha Selatan Subdistrict who used peatland water for daily activities caused the high incidence of periodontal disease in this subdistrict.

The result showed that most of the respondents with peatland water use in the high category (76.9%) suffered from periodontal disease, most of the respondents with peatland water use in the low category (55.9%) suffered from periodontal disease, and most of the respondents who did not use peatland water (55.6%) did not suffer from periodontal disease. The result of the statistical analysis using the Chi-square test showed that there was a relationship between peatland water usage and periodontal disease with a significance level of 0.022 ($p < 0.05$). The result of this study is in accordance with a study by Zhao et al which reported that the use of different water sources, such as surface water and tap water, affects dental and oral health such as tooth loss due to periodontal disease.[16] Peatland water is categorized as surface water with low pH. This acidic water causes the oral cavity to reach a critical level of acidity, namely pH 5.5, causing an imbalance of acidity in the oral cavity.[17,18] This condition affects the growth of acidogenic and aciduric bacterial colonies in the oral cavity which causes the formation of plaque and results in the destruction of periodontal tissue.[5,19] The bacteria found in peatland water are gram positive bacteria *Streptococcus* which initiate primary colonization of plaque formation.[20–22] Over time, there will be a shift of microorganisms which was initially dominated by gram positive bacteria to gram negative bacteria.[21] Research conducted by Prasad et al and Ranjith et al showed that the oral cavity of people with periodontal disease is more acidic compared to healthy people. This condition is because the bacteria have a higher survival in acidic environment, causing the oral cavity to be more prone to plaque formation. According to Prasad et al, in an acidic environment, bacteria such as *Porphiromonas gingivalis*, *Prevotella intermedia*, *Fusobacterium nucleatum* are able to develop and survive with a pH range of 5-7 which can result in destruction of periodontal tissue.[18,23,24]

The result of the study showed that the respondents who used peatland water in the high category had 4.167 times greater possibility of suffering from periodontal disease than the respondents who did not use peatland water. This is in accordance with the theory proposed by HL Blum which states that the level of health of an individual is mostly affected by the environment by 40% and behavior by 30%. A theory developed by Lawreen Green states that the health of an individual is affected by two main factors, namely behavioral factor and non-behavioral factor. Behavioral factor is composed of three parts, namely predisposing factors, enabling factors, and reinforcing factors.[25,26] The use of peatland water in this study is related to the behavioral aspect. The result of this study is in accordance with a previous study which reported that behavioral factor has a major influence on the periodontal health of an individual. Newmann et al reported that behavior is included as a predisposing factor that, if repeated until it becomes a habit, will play a significant role in initiating and causing the development of periodontal disease.[7,27]

The limitation of this study is that two villages in the subdistrict could not be researched because access to these two villages was quite difficult, i.e., land routes were not available. Thus, it is recommended that further research can be carried out in the two villages.

CONCLUSION

According to the results of this study, it can be concluded that a high use of peatland water causes a high incidence of periodontal disease, so it is necessary to educate the public regarding the impact of peatland water use on dental and oral health.

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