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THE EFFECT OF PEATLAND WATER USE ON DENTAL CARIES SYSTEMATIC REVIEW

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Abstract : Peatland water is one of the waters that is mostly used by the people for their daily needs. Peatland water is not feasible to be used because it is acidic and has a pH below seven. The acidity of peatland water can be one of the factors that occur in dental caries. The purpose of this systematic review is to determine the effect of peatland water use on dental caries. Methods: The type of research is a systematic review with qualitative analysis. Result: This study involved nine journals that were selected from the PUBMED journals database and Google Scholar. Cross-sectional and experimental journals within the last 15 years discussing effect of peatland water use on dental caries. Conclusion: There is a relationship between peatland water use on dental caries (n=9)

Keywords: peatland water, demineralization, caries, systematic review

INTRODUCTION

Water is an element that has an important role in the human body. The general human water requirement every day is around 1.5 to 2.5 liters of water per day.[1] When consumed by the body, water can help improve metabolic processes, digestion, and regulate body balance.[1] One of the waters that humans often use to support their needs is peatland water.[2] Peatland water is water that is acidic and has a pH below 7.[2] Continuous use of peatland water will have an impact on dental health, such as the process of tooth demineralization.[2] The low pH value of water and the demineralization process can cause teeth to be susceptible to caries.[3,4]

Peatland water does not meet the requirements for good quality water based on the water quality standardization stages because it has a high organic substance content, pH and has a brown color.[5] The brown color seen in peatland water is caused by the iron content contained in peatland water and dissolved organic substances originating from rotting plant remains such as trees, leaves and wood. The use of peatland water can reduce some of the mineral content of the teeth, this is due to the acidic (pH) value of peatland water so that in the end it can cause the minerals in the teeth to dissolve. The mineral content that dissolves in teeth includes the minerals Fe, Mn, which in this case play a role in the process of mineralization of bones and teeth.[6]

The number of bacterial colonies found in the saliva of the population who gargled using peatland water was found to be higher compared to the number of bacterial colonies found in the saliva of children who gargled using PDAM water.[7] The number of aerobic bacteria in the oral cavity is also known to increase in people who gargle with peat water.[8,9] An increase in bacterial colonies in saliva is known to increase the risk of dental caries.[10,11] The area of peat land in Indonesia is 20.6 million hectares, whereas in 2011 there were around 14.9 million peat land areas in Indonesia, where (43 %) is on Sumatra Island, (32%) is on Kalimantan Island and (25%) is on Papua Island.[12] The area of peatland areas in South Sumatra reaches 1.47 million hectares with the largest distribution in the OKI, Musi Rawas, and Muara Enim.[13] Based on 2013 RISKESDAS data, the prevalence of dental and oral problems in South Sumatra was (19.5%) with an average DMF-T caries index value of 4.6.[14] In the 2018 RISKESDAS data there was an increase in dental and oral problems in South Sumatra by (52.4%).[15] From this description, the author took the initiative to find out about the effect of using peatland water on dental caries.

METHODS

The type of research used in this systematic literature review is experimental and cross sectional research., the bias assessment planning methods used are the CRIS and Axis Tools methods for experimental and AHRQ for cross-sectional research. The research period starts from 17 February to 20 June 2021.

POPULATION

The population in this study is people who are caries-free with all ethnicities, cultures, all age categories, all genders and caries-free teeth, where people who have systemic disease are the exclusion criteria.

EXPOSURE

Exposure in this study was gargling or brushing teeth using peatland water and teeth soaked using peatland water.

OUTCOME

The outcome of this study was a population that experienced caries measured using DMFT, teeth that experienced demineralization and an increase in cariogenic bacteria in the oral cavity.

DATA SEARCH STRATEGY

The journal databases that will be used are PubMed, DOAJ, and Google Scholar. The keywords and controlled-vocabulary used are listed in table 1. The literature used is those published within the last 15 years.

Table 1. Search strategy data

Inclusion Criteria	Population	Exposure	Outcome
Keyword	***Childhood,tooth,oralcavity,saliva***	***Peatland water***	***Caries.***
Natural language	*Child,man,woman,*	*Wetland water*	*Cariosity, dental cavity, cavity, caries.*
Controlled vocabularies	*Permanent teeth,mouth cavity,child,preschool child*	*Peatland water Wetland water Acid water*	*Dental caries Dental fissures, Carious dentin , OHI , white spots Deminrelazation, DMF index, decay*

BIAS ASSESSMENT PLAN

In this literature review, the bias assessment planning methods used are the CRIS and Axis Tools methods for experimental and AHRQ for cross-sectional research.

RESULTS

This systematic review research aims to find out whether there is an effect of the use of peatland water on dental caries according to the PRISMA (Preferred Reporting Item for Systematic Review and Meta Analysis) in the Google Scholar and PubMed journal databases which have been previously published within a period of time the year before this research was conducted. The search for journal data in this systematic review research can be seen in the flow chart below. (Figure 1).

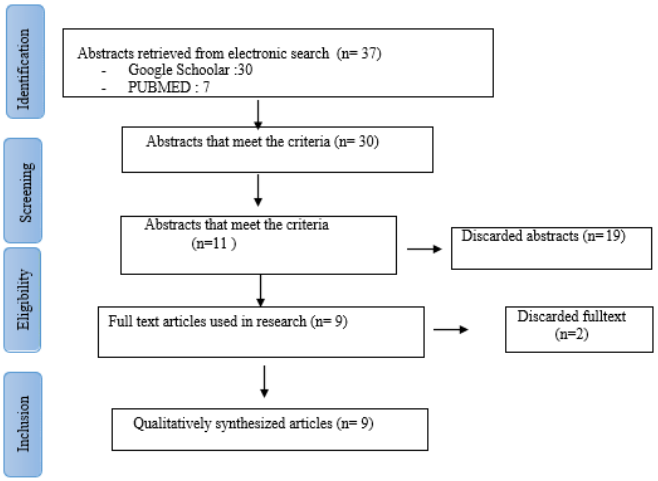

Figure 1. PRISMA flow diagram

Figure 1 shows 37 journal data identified by searching using the keywords: caries, DMF-T, deft, demineralization, peatland water, wetland water, decay,

demineralization, caries, peatland, bog, wetland, peatwater, acid water. A total of 37 abstracts from journals were selected using research type criteria where the research used was experimental and cross-sectional, then a total of 11 journals that met the criteria were collected. The next step was an assessment of the eligibility of the full-texts that would be reviewed and used in this research. 2 full-text journals were discarded because they did not meet the inclusion criteria in this study. From the eligibility assessment carried out, it was obtained that the number of full-texts synthesized qualitatively in the research to be carried out was 9 journals.

Data Extraction Results

Table 2. Data Extraction Results

Number	JOURNAL RESEARCH	JOURNAL YEAR	JOURNAL SUBJECT (number, age and gender ratio)	Results	Research Place	JOURNAL BIAS ANALYSIS RESULTS (low, high, unclear)
1.[16]	Nadia, Widodo*, et all*	2018	A total of 136 grade 1 students at SMPN 15 Banjarmasin	The DMF-T index of the group who used river water on peatlands to brush their teeth was significantly different compared to the group who used PDAM water to brush their teeth.	Banjarmasin	High
2.[3]	Napitupulu, et all	2019	A total of 176 MAN 2 BATOLA students were included in the inclusion criteria	Water acidity is significantly related to the DMF-T index value where the water used comes from acidic peatlands.	Barito Kuala	High
3.[17]	Riyana, M. , et all	2020	A total of 62 people from Bincau Village with an age range of 25-34 years	The result is that Martapura river water has a significant effect on the DMF-T index value compared to drilled well water.	Martapura	High
4.[6]	Amelia, F., *et* all	2016	A total of 25 First premolars extracted were caries free	There was a significant decrease in Mn, Fe, Mg, F levels in the treatment group compared to the control group.	Banjarmasin	High

5.[18]	Ridho, M. R, et all	2020	A total of 18 First Premolars and Second Premolars were free of caries and had been extracted	There is a significant difference in the selenium ion content between teeth soaked in peat water compared to other groups. The large amount of selenium ions in teeth soaked in peat water can cause teeth to be susceptible to demineralizatio n.	Banjarmasin	High
6.[19]	Adhani, Rosihan, et all.	2017	A total of 24 first premolars were free of caries and had been extracted	The highest demineralization of teeth, Mg and F minerals occurred in teeth soaked in river water on peatlands.	Banjarmasin	High
7.[8]	Purwandari, P, et all	2016	A total of 20 dental students at Gastric Mangkurat University have gargled using peatland water	The results of this research were that there was a significant difference in the average number of aerobic bacteria before and after gargling using peatland water.	Banjarmasin	Low
8.[7]	Febriyanti, E, et all	2018	A total of 60 children at SDN 5 Melayu Kota aged 8-10 years of which 30 had gargled using peatland water and 30 had gargled using PDAM water	There was a significant difference between the total anaerobic bacteria in the group that gargled using peatland water compared to the group that gargled using PDAM water.	Banjarmasin	Low
9.[9]	Senggara, B. Y., Putri, D. K. T., & Aspriyanto	2018	A total of 30 children at SDN Melayu 5 Banjarmasin, 15 gargled using peatland water and 15 gargled using PDAM water.	The results of this study showed a significant difference between the total bacteria Staphylococcus Aureus and Staphylococus epidermidis in the group that gargled using peatland water	Banjarmasin	Low

	compared to those who gargled using PDAM water.

The table written above describes the types of research in the journal, namely experimental in vitro with the CRIS bias assessment method, quasi experimental with the axis tool, and cross-sectional research with the AHRQ bias assessment method, which has been assessed independently by the author. The categories in the bias analysis assessment are divided into low bias, high bias and unclear bias. Based on the CRIS, AXIS tools, and AHRQ assessments, a total of 3 journals were found to be in the "low" risk of bias category, 6 journals were in the "high" risk of bias category. Journals can be said to have good quality if they are included in the low risk category with a total of 3 journals in this study.

In this systematic review, from the research results of the journals used, it was found that a total of 9 journals supported the research domain of this systematic review, where the journal stated that there was a meaningful or statistically significant relationship between peatland water use and caries.

DISCUSSION

Peatland water is acidic water that has a pH below 7 which is caused by an increase in carboxylic and phenolic compounds due to decomposition carried out by bacteria such as Basillus sp and Closridium sp bacteria, thus making peatland water acidic.[7,9] The acidity level of peatland water increases along with the depth of the water where the pH is lower in deep peatland water.[9] Peat water can cause tooth decay because their acidity.[1] The acidity of peatland water can increase the number of aerobic and anaerobic bacteria in the oral cavity, especially acidogenic and aciduric bacteria such as streptococcus which increases at low pH.[8,9] Continuous use of peatland water can cause dental caries.[3,16] This is because the acidic nature of peat water can cause teeth to demineralize, making them susceptible to caries.[6,18]

In this systematic review research, all researchers support the research domain where the use of peatland water can influence dental caries. Three studies examined the effect of peatland water use on the dental caries index, three studies examined the effect of peatland water on the demineralization process in teeth, and three other studies examined the effect of peatland water on the number of cariogenic bacterial colonies in the oral cavity.

Nadia (2018) stated that the DMF-T Index increased in populations that used river water on peatlands to brush their teeth compared to populations that used

PDAM water to brush their teeth.[16] The high value of the DMF-T index in populations that use river water on peatlands to brush their teeth is caused by the difference in pH values in river water and PDAM water, where river water has a lower acidity compared to PDAM water, which causes caries to occur more easily in population who brush their teeth using river water on peatlands.[16] In this study it was also stated that there are several other factors that influence the DMF-T value apart from the acidity level of the water, such as health services, environment, behavior and level of education.[16]

This research is similar to Napitupulu (2019) who examined the effect of using river water on peatlands, toothbrushing behavior and dental health services on caries at MAN 2 Batola, where the DMF-T Index was obtained for individuals who used river water on peatlands with a low pH, the DMF-T index is found to be higher.[3] Water acidity is the most significant factor influencing the high DMF-T index, followed by other factors such as dental health services and tooth brushing behavior.[3]

Research by Riyana (2020) examined the effect of using river water on peatlands and drilled well water on the DMF-T index where it was found that the DMF-T index score for populations who often use river water on peatlands was 7.74.[17] This is because river water in peatlands has a low pH and is acidic, thereby increasing the risk of caries. Apart from that, low knowledge about dental and oral health is another factor that influences the high level of caries.[17]

Amelia (2016) in their research examined demineralization of teeth caused by peat water, where it was found that teeth soaked in peat water caused a decrease in several dental minerals such as Mg, F, Mn, and Fe, where these minerals had an effect on calcification and mineralization in teeth.[6] The dissolution of these minerals is caused by exposure to acids which can dissolve minerals and damage the chemical bonds in hydroxyapatite.[6] Research by Ridho (2020) examined the effect of peatland water on the demineralization of copper and selenium ions where peatland water did not affects copper ions in teeth, while selenium ions are often found in teeth, where selenium ions in teeth can cause teeth to be susceptible to caries, selenium ions are also known to reduce the absorption of flour in hydroxyapatite.[18]

Adhani (2017) examined demineralization in teeth that were soaked using different water such as river water on peatlands, tap water and well water, where it was found that the highest demineralization occurred in river water on peatlands because the pH was lower than the other groups.[19] This study also assessed the demineralization of Mg and F minerals, where it was found that Mg minerals became soluble because the chemical bonds of hydroxyapatite were broken due to the low pH, while F minerals dissolved due to the pressure of H^+ ions.[19]

Purwandari (2016), Senggara (2018) examined the effect of peatland water on the number of aerobic bacteria in the oral cavity where it was found that the total bacterial colonies in children who gargled using peatland water increased after

being exposed to peatland water.[8,9] The acidity of peatland water results in an increase in colonies of aciduric and acidogenic bacteria which make teeth susceptible to caries.[8,9] In peatland water cultures, Staphylococcus aureus bacteria were found which contribute to the formation of caries, where these bacteria produce acids which can lower the pH by fermenting carbohydrates. mannitol.[9] Meanwhile, research conducted by Febriyanti (2018) found that in the saliva of children who gargled with peatland water, the total number of anaerobic bacteria was greater than those who gargled using PDAM water.[7] The bacteria found in this study were Streptococcus sp and Lactobacillus sp. The bacteria Streptococcus sp and Lactobacillus sp are bacteria that are aciduric and acidogenic and are cariogenic bacteria. [7]

Based on the description above, the use of peat water can cause an increase in cariogenic bacteria and also demineralization of teeth. The DMF-T index in communities that use peatland water was also found to increase significantly. Several other factors that can influence the relationship between peatland water use and caries are health services, environment, behavior and the level of education of the community itself.

CONCLUSION

1. This systematic review research shows that there is an influence between the use of peatland water on the incidence of dental caries (n=9).
2. The use of peatland water can cause tooth demineralization because peatland water is acidic so that many tooth minerals dissolve.
3. The use of peatland water can increase the number of cariogenic anaerobic and aerobic bacterial colonies because peatland water is acidic.
4. Using peatland water can increase the DMF-T Index in the community.

REFERENCES

1. Prasetyowati Indah. Tingkat pengetahuan tentang pentingnya mengkonsumsi air mineral pada siswa kelas IV di SD Negeri Keputran A Yogyakarta. Jurnal Pendidikan Jasmani Indonesia. Volume 10, Nomor 2, November 2014
2. Adhani R, Widodo, Sukmana BI. Effect pH on Demineralization Dental Erosion. International Journal of Chemical Engineering and Applications 2015; 6 (2): 138-141.
3. Napitupulu R, Adhani R. Hubungan perilaku menyikat gigi, keasaman air, pelayanan kesehatan gigi terhadap karies di MAN 2 Batola. Dentin (Jur. Ked. Gigi), Vol III. No 1. April 2019 : 17 – 22.
4. Fitriati, Nur, Andri Dwi Hernawan, and Elly Trisnawati. "Perilaku Konsumsi Minuman Ringan (Softdrink) dan pH Saliva Dengan Kejadian Karies Gigi." *Unnes Journal of Public Health* 6.2 (2017): 113-122.

5. Rubinata A,Purnaini R. Perancangan alat pengolahan air gambut sederhana menjadi air minum skala rumah tangga. Jurnal Online Mahasiswa Fakultas Untan. 2014;2.
6. Amelia F,Sahbana A. Demineralization of the Tooth by Peat Swamp Water. International Journal of Pharmaceutical and Clinical Research 2016; 8(4): 216-220.
7. Febriyanti E,Kania D. Perbandingan jumlah koloni bakteri anaerob pada saliva anak yang berkumur dengan air lahan gambut dan air PDAM. Dentin (Jur. Ked. Gigi), Vol II. No 1. April 2018 : 113 – 117.
8. Purwandari P, Dewi N. The influence of peat water to the colony number of aerob bacteria in mouth. Journal of Dentomaxillofacial Science (J Dentomaxillofac Sci) August 2016; 1(2): 88-91.
9. Senggara B,Kania D. Total colony characterucation of aerobic bacteria of oral cavity on peatlands water and PDAM water. Dentino (Jur. Ked. Gigi), Vol III. No 1. Maret 2018 : 67 – 71.
10. Prasetya, Rendra Chriestedy. "Perbandingan jumlah koloni bakteri saliva pada anak-anak karies dan non karies setelah mengkonsumsi minuman berkarbonasi." *Journal of Dentistry Indonesia* 15.1 (2013): 65-70.
11. Endriani, Rita, et al. "Pola bakteri pada karies gigi pasien diabetes melitus Bacteria in dental caries of diabetes mellitus patients." *Jurnal Kedokteran Gigi Universitas Padjadjaran* 32.1 (2020): 34-40.
12. Nugroho K. Luas dan Sebaran Lahan Gambut di Indonesia [internet]. Jakarta: Pantau gambut; [17 Juli 2020]. Terdapat pada: http://www.pantaugambut.id/.
13. Budiningsih, Kushartati. "Implementasi kebijakan pengendalian kebakaran hutan dan lahan di Provinsi Sumatera Selatan." *Jurnal Analisis Kebijakan Kehutanan* 14.2 (2017): 165-186.
14. Badan Penelitian dan Pengembangan Kemenkes RI. Riset Kesehatan Dasar. Jakarta; 2013.
15. Badan Penelitian dan Pengembangan Kemenkes RI. Riset Kesehatan Dasar. Jakarta; 2018.
16. Nadia, Nadia. "Perbandingan Indeks Karies Berdasarkan Parameter Kimiawi Air Sungai dan Air PDAM pada Lahan Basah Banjarmasin." *Dentin* 2.1 (2018).
17. Riyana, Mustika Meisy, Rosihan Adhani, and Muhammad Yanuar Ichrom Nahzi. "Pengaruh Penggunaan Air Sungai Martapura dan Air Sumur Bor terhadap Indeks DMF-T." *Dentin* 4.1 (2020).
18. Ridho, Muhammad Rizki, Dewi Puspitasari, and I. Wayan Arya Khrisnawan Firdaus. " The Effect of Peat Swamp Water on Tooth Demineralization of Cooper And Selenium Ion." *Dentino: Jurnal Kedokteran Gigi* 5.2: 115-120.

19. Rosihan, Adhani. "Experimental investigation of Human Teeth Demineralization by Three Different Water Treatment." IJCPR Vol.8 (2017).