Jurnal eduHealt
Volume 15 , Number 02, 2024, DOI 10.54209/eduhealth.v15i02
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

Differences in the Dental Caries Index Based on the pH Of Well Water and PDAM Water Used by Communities in Kelay District, Berau Regency

Sheviola Wahyu Okta Angelia[1], Cristiani Nadya Pramasari[2], Krispinus Duma[3]
[1]Dentistry Study Program, Faculty of Medicine, Universitas Mulawarman, Samarinda, Indonesia, [2]Department of Oral and Maxillofacial Surgery, Faculty of Medicine, Universitas Mulawarman, Samarinda, Indonesia, [3]Public Health Science Laboratory, Faculty of Medicine, Universitas Mulawarman, Samarinda, Indonesia

Article Info
Keywords:
Caries,
Water pH,
DMF-T index

ABSTRACT
Dental and oral diseases affect 90% of Indonesia's population, one of which is caries. Based on Basic Health Research (Riskesdas) data for the East Kalimantan region, Berau Regency has the second highest prevalence of caries or cavities after West Kutai, namely 56.08%. The environment is one of the factors that influences the occurrence of caries, one of which is water. A pH value below 6.5-8 indicates that the water is acidic, which can increase the risk factor for caries. The aim of this research is to analyse the differences in the dental caries index based on the pH of well water and PDAM water used by the community in Sido Bangen Village. This research uses observational research with a cross-sectional approach. The sample was taken using a purposive sampling technique. The population of this study was the people of Kelay District. The total sample was 78 people, who were divided into 2 groups, namely 39 research subjects who used well water and 39 research subjects who used PDAM water. The results of the independent sample T test showed that there was a difference in the DMF-T index between users of well water and PDAM water with $p = 0.000$ ($p < 0.05$). The results of the Mann-Whitney test show that there is a difference in pH values between the pH of well water and PDAM water, with $p = 0.000$ ($p < 0.05$).

Corresponding Author:
Sheviola Wahyu Okta Angelia
Universitas Mulawarman
Jl. Kuaro, Gn. Kelua, Kec. Samarinda Ulu, Samarinda, East Kalimantan 75119
sheviola10@gmail.com

INTRODUCTION

Dental and oral health are parts of bodily health that can directly influence bodily health. Apart from untreated tooth decay, dental and oral health issues continue to escalate annually. Dental and oral diseases affect 90% of Indonesia's population, one of which is caries (Nadia, Widodo, et al., 2018). Based on 2018 Riskesdas data, the prevalence of dental caries in Indonesia is 88.8% (Kemenkes RI, 2018). Caries is a progressive dental disorder initiated by the process of demineralisation by acid produced by bacteria. Bacterial activity in plaque produces an acidic atmosphere ($pH < 5.5$) in the oral cavity and causes demineralisation of the tooth structure by acids produced by microorganisms. It is

Jurnal eduHealt
Volume 15 , Number 02, 2024, DOI 10.54209/eduhealth.v15i02
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

characterised by the formation of cavities on the surface of the enamel, dentin, or cementum. Caries is a chronic condition that cannot heal on its own and, if left untreated, can eventually lead to tooth loss (Sibarani, 2014).

Nadia *et al*., 2018 concluded that students who brushed their teeth with river water had a higher caries index than those who used PDAM water. In this research, the pH value of the Kuin River water was obtained, namely 6.06 (<7). The lower the pH of the water used for brushing teeth, the higher the reaction rate of releasing calcium minerals from tooth enamel, or what is called demineralization (Nadia et al., 2018).

The above situation is also experienced by the community in Sido Bangen Village, Kelay District, Berau Regency, East Kalimantan, due to unequal access to incoming PDAM. Based on Basic Health Research (Riskesdas) data for the East Kalimantan region, Berau Regency has the second highest prevalence of caries or cavities after West Kutai, namely 56.08% (Riskesdas, 2018). Based on the explanation above, researchers are interested in conducting research on the differences in caries index based on the pH of well water and tap water used by the community in Sido Bangen Village, Kelay District, Berau Regency.

METHODS

This research uses observational research with a cross-sectional approach. The sample was taken using a purposive sampling technique. The population of this study was the people of Kelay District. The number of research subjects was 78, who were divided into 2 groups, namely 39 research subjects who used well water and 39 research subjects who used PDAM water.

The caries index examination was carried out by instructing the research subjects to open their mouths, and then an examination was carried out with a mouth mirror and sonde, starting from the right side of the posterior teeth of the upper jaw, then to the left anterior and posterior of the upper jaw, the left posterior teeth of the lower jaw, then to the anterior of the lower jaw, and to the posterior of the right lower jaw.

The caries index assessment is assessed using the DMF-T index, namely decayed (D) carious teeth that can still be filled, missing (M) teeth that are extracted due to caries, and filled (F) teeth that are filled due to caries. The results of the DMF-T index examination are recorded on the Caries examination sheet.

Well water samples were taken from one of the wells in Sido Bangen Regency, and PDAM water samples were taken directly from PDAM Tirta Segah Berau. River water samples and PDAM water samples are then checked to determine the pH using a tool, namely a pH meter.

RESULTS AND DISCUSSION

Based on research conducted on the community in Kelay District with a total sample of 78 people to find out whether there is a difference in the caries index based on the pH of well water and PDAM water, the following results were obtained:

Jurnal eduHealt
Volume 15 , Number 02, 2024, DOI 10.54209/eduhealth.v15i02
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

Table 1. DMF-T Frequency Based on Water Use

	Well water		PDAM water	
	Total (n)	Percentage (%)	Jumlah (n)	Percentage (%)
DMF-T				
Low	27	69,2	36	92,3
High	12	30,8	3	7
Total	36	100	39	100

Source: primary data 2024

A total of 78 samples were then classified with a cut-off point value of 8, namely a high caries index if the DMFT index was greater than 8 and a low caries index if it was less than or equal to 8. Based on table 1 dental caries data based on research subjects who used well water, 63 (80.8%) people had a low DMF-T score, and 15 (19.2%) people had a high DMF-T score. Dental caries data is based on research subjects who used PDAM water: 36 (92.3%) people with low DMF-T scores and 3 (7%) people with high DMF-T scores.

Table 2. Average caries index based on water consumed

Water Type	DMF-T Index	Rating result
Well	6,95	Very High
PDAM	3,79	Medium

Source: primary data 2024

Based on table 2, it shows that the average caries index (DMF-T) for people using well water is higher (6.95) than for PDAM water users (3.79).

Table 3. Average Water pH Measurement Results

Water Type	pH Score	Information
Well	5,208	Acid
PDAM	6,692	Neutral

Source: primary data 2024

Based on table 3, it shows that the average pH value of well water has a more acidic concentration with a pH value of 5.206 compared to the average pH value of PDAM water, which has a neutral concentration of 6.692.

Table 4. Independent T Test Results for the Caries Index

Variable	Significance Value	Information
DMF-T	0,000	There's a Difference

Source: primary data 2024

The results of the independent sample T test between DMF-T well water and PDAM water show that there is a difference between DMF-T well water and PDAM water. Judging from the significance value of $p < 0.05$, this shows that H0 is rejected, which means there is a difference between DMF-T well water and PDAM water.

Jurnal eduHealt
Volume 15 , Number 02, 2024, DOI 10.54209/eduhealth.v15i02
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

Table 5. Mann-Whitney Water pH Test Results

Variable	Significance Value	Information
pH	0,000	Ada Beda

Source: primary data 2024

Based on the results of the Mann-Whitney test between the pH of well water and PDAM water, it shows a significance value of p<0.05, which shows that there is a difference between the pH of well water and the pH of PDAM water.

Discussion

The results of the research carried out showed that the average of the 78 samples examined showed that DMF-T in well water had an average of 6.95 and was in the very high category. This result was obtained by dividing the sum of all DMF by the 39 well water users who were examined. The average DMF-T value for PDAM water users is 3.79 and is included in the medium category. People who use well water have higher DMF-T values compared to people who use PDAM water. From the results of water pH measurements, it was found that the average pH value of well water had a more acidic concentration with a pH value of 5.206 compared to the average pH value of PDAM water, which had a neutral concentration of 6.692. The results of the Mann-Whitney test between the pH of well water and PDAM water show that the significance value of the test is 0.000, which means p < 0.000, which means there is a difference between the pH of well water and the pH of PDAM water.

Caries is a disease whose causes are multifactorial. The environment is one of the factors that can influence the occurrence of caries, one of which is water. The quality of water used for brushing teeth must meet physical, chemical, and microbiological requirements. A number of chemical parameters are thought to influence dental health, including acidity (pH), fluoride, and calcium (Nadia, Widodo, et al., 2018). According to Kevin et al., 2023 exposure to water with a low pH that is continuously used for brushing teeth can change the acidity level in the oral cavity to reach a critical enamel acidity level, namely pH 5.5, and cause the enamel crystals to dissolve. The lower the pH of the water used to brush teeth, the higher the reaction rate of releasing calcium minerals from tooth enamel, also called demineralisation (Kevin et al., 2023). Demineralisation, caused by acidic conditions, is known to cause tooth erosion. Tooth erosion is the loss of hard tooth tissue through corrosion and chemical breakdown by non-bacterial acids. Erosion begins with demineralisation of the enamel surface, which can lead to dissolution of the subsurface layer and eventual loss of tooth structure. If this condition is allowed to continue, it will cause dental caries (R et al., 2015).

This research is in line with previous research conducted by T. Utami, 2015. The results obtained show that the average DMF-T value in PDAM water is lower than in PAH water, namely that the amount of DMF-T in PDAM water is an average of 2.4 and in average PAH water is 3.7. PDAM water has a higher average pH compared to PAH water; namely, PDAM water has an average pH of 7.5, while PAH water has an average pH of 6 (Utami, 2015).

Jurnal eduHealt
Volume 15 , Number 02, 2024, DOI 10.54209/eduhealth.v15i02
ESSN 2808-4608 (Online)
https://ejournal.seaninstitute.or.id/index.php/healt

In research conducted by Nadia et al., 2018, students who used river water to brush their teeth had a higher DMF-T value, namely 2.1, compared to students who used PDAM water, namely 1.1. With the condition that the river water pH is 6.06 and the PDAM water pH is 7.0 (Nadia, Widodo, et al., 2018). Based on the data obtained, on average, users of water with a low pH experience a higher caries index than users of water with a neutral pH. So a high level of pH acidity can be a risk factor for dental caries.

CONCLUSION

Based on research conducted in Kelay District, it was concluded that there was a significant difference between the caries index in people who used well water and PDAM water, with $p = 0.000$ ($p<0.05$), and there was a significant difference between the pH of well water and PDAM water, with $p = 0.000$ ($p< 0.05$). The DMF-T calculates a caries index of 6.95 for well water users, which is higher than the average dental caries of 3.79 for PDAM water users. Further research can be carried out regarding other ingredients in well water in Kelay District, such as flour and magnesium. Proper education can be provided to the public regarding the correct way to maintain oral health, such as the correct way to brush your teeth and the correct time to brush your teeth. And local governments can make the sanitation of water sources more even.

REFERENCE

Kemenkes RI. (2018). Laporan Riskesdas 2018 Kementrian Kesehatan Republik Indonesia. In *Laporan Nasional Riskesdas 2018* (Vol. 53, Issue 9, pp. 154–165).

Kevin, A., Adhani, R., & Hamdani, R. (2023). Hubungan Kadar pH, Magnesium, Flour Dan Ferrum Air Sungai Konsumsi Terhadap Indeks Karies. *Dentin*, *7*(3), 169–173. https://doi.org/10.20527/dentin.v7i3.10749

Nadia, G., Intan, E., & Santria, Y. (2018). Pengaruh Penggunaan Air Hujan Terhadap Karies Gigi Pada Masyarakat Di Kecamatan Batang Gasan Kabupaten Padang Pariaman Tahun 2017. *B-Dent: Jurnal Kedokteran Gigi Universitas Baiturrahmah*, *5*(1), 45–48.

Nadia, Widodo, & Hatta, I. (2018). Perbandingan Indeks Karies Berdasarkan Parameter Kimiawi Air Sungai Dan Air Pdam Pada Lahan Basah Banjarmasin. *Dentin Jurnal Kedokteran Gigi*, *2*(1), 13–18.

R, A., Widodo, Sukmana, B. ., & Suhartono, E. (2015). Effect pH on Demineralization Dental Erosion. *International Journal of Chemical Engineering and Applications*, *6*(2), 138–141. https://doi.org/10.7763/ijcea.2015.v6.468

Riskesdas. (2018). Laporan Provinsi Kalimantan Timur Riskesdas 2018. *Kementerian Kesehatan RI*, 472.

Sibarani, M. R. (2014). Karies: Etiologi, Karakteristik Klinis dan Tatalaksana. *Majalah Kedokteran Universitas Kristen Indonesia*, *XXX*(1), 14–22.

Utami, T. (2015). Perbedaan Status Karies Pada Anak Ssekolah Dasar Yang Mengkonsumsi Air Minum Dari Air PAH dan Air PDAM Di Kecamatan Musuk Kabupaten Boyolali. *Universitas Muhammadiyah Surakarta*.