Poltekita: Jurnal Ilmu Kesehatan
http://jurnal.poltekkespalu.ac.id/index.php/JIK

Vol.17 No.2 August 2023: Hal. 379-384
p-ISSN: 1907-459X e-ISSN: 2527-7170

Original Article

Drinking Water Fluor Levels and The Event of Dental Carries in The Community of Tondo Village Mantikulore District Central Sulawesi

Sapriana Sapriana [1], Hanum Sasmita[1*], Dedi Mahyudin Syam[1]

[1] Poltekkes Kemenkes Palu, Palu, Central Sulawesi, Indonesia

(Correspondence author's: hanumsasmita.drg@gmail.com, +62 813-1629-9915)

ABSTRACT

According to WHO, the level of fluorine in water that is safe for consumption is 0.7-1.5 ppm. The Indonesian population's prevalence of problems with teeth and mouth is 25.9%. The average Indonesian population has experienced tooth decay as much as 5 teeth per person. Central Sulawesi is a province with the largest dental health problems, namely 75.3% and only 8.2% has received services from dental medical personnel. This study aimed to know the fluorine level of drinking water and the proportion of dental caries in Tondo Village, Mantikulore District, Palu City, Central Sulawesi. This research is descriptive research. The population in this study were people in Tondo Village, Mantikulore District, Palu City, Central Sulawesi. The sample used in this study were part of the community who consumed groundwater (wells) used for drinking and lived in Tondo Village for about 2 years. There were 20 samples of drinking water, and the respondents who had their drinking water samples were also tested for their teeth. Sampling was done by means of non-random sampling, namely by purposive sampling. The results showed that of the 20 respondents, most of the respondents had very low water fluorine levels (95%). The smallest fluorine level was 0.00 mg / l, the highest was 0.40 mg / l, with a median of 0.20 mg / l. or if categorized most (94.7%) had very low fluorine levels, and all respondents experienced dental caries (100%). It is suggested to the public to brush their teeth regularly at least twice a day, that is, after each meal and go to bed at night with fluorine toothpaste.

.

Keywords: Dental Caries, Fluoride, Drinking Water

https://doi.org/10.33860/jik.v17i2.2080

INTRODUCTION

Fluoride is a micromineral that the body needs in smaller amounts but is still needed. These microminerals help metabolize calcium (Ca) and phosphorus (P), components of the matrix of bones and teeth, and inhibit the formation of tartar. According to WHO, the level of fluorine in water that is safe for consumption is 0.7-1.5 ppm [1]. Fluorine is a mandatory parameter related to health.

Consumption of fluorine in drinking water can affect the state of tooth enamel, namely to inhibit demineralization (formation of dental caries). Fluoride deficiency can cause tooth decay. the incidence of dental caries is related to the consumption of drinking water except for the type of drinking water from refill water [2].

The prevalence of dental caries by age is 81.5% for 3-4 years, 92.6% for 5-9 years, 73.4% for 10-14 years, 75.3% for 15-24 years, 25-34 years 87.0%, aged 35-44 years 92.2%, aged 45-54 years 94.5%, aged 55-64 years 96.8% and aged 65+ years 95.0%. Central Sulawesi is the province with the most dental health problems, namely 75.3% and only 8.2% receive services from dental medical personnel[3].

The DMF-T index (Decayed, Missing, Filled Teeth) can measure dental caries status for permanent teeth in individuals or communities. This index is used to see the condition of a person's teeth that have

experienced damage or untreated caries (Decayed), have been removed or absent due to caries (Missing), teeth that have been filled or filled due to caries (Filled) on permanent teeth. Puspa Dewi's research found that DMF-T for children aged 12 years who used river water as drinking water was high, and the average fluoride content of the river water used was very low [4].

The drinking water used by the community can differ in fluorine levels, depending on the type of water source. The close proximity of the sea can cause high fluoride and well water which in turn causes seawater intrusion which causes well water to taste salty [5]. The results of examination of fluoride levels in coastal areas obtained an average of 0.11870 ppm, this value is very low criteria [6], river water fluorine levels <0.05 ppm, including very low criteria (4). Refill bottled water 0.43 mg/l and <0.06 mg/l, below the quality standards [7] and river water that is precipitated 0.18 mg/l, including very low criteria [8].

Prevention so that the oral cavity is not too acidic, either produced by bacteria or food or drink, so as to prevent the release of calcium ions from tooth enamel. Reducing the demineralization process can be done by stopping the diffusion of acids, namely reducing acid contact with teeth, for example reducing acid intake or drinking soft drinks by using a straw, Another way is by stopping the formation of calcium phosphate complex compounds by increasing enamel resistance through fluoridation of drinking water or topical applications with fluoride or the addition of fluoride ions in drinks, as well as using fluoride toothpaste [9].

Based on this description, a study was conducted which aimed to determine the level of fluorine in drinking water and the incidence of dental caries in the community in Tondo Village, Mantikulore District, Central Sulawesi.

METHOD

This research is a descriptive research. The population in this study is the people in the Tondo Village, Mantikulore District, Palu City, Central Sulawesi. The sample is part of the community that consumes ground water (wells) that is used for drinking and has lived in the Tondo Village for approximately 2 years. The number of samples was 20 samples of water for drinking, and the respondents whose water samples were taken were also subjected to dental examinations. Sampling was carried out by means of non-random sampling, namely by purposive sampling.

Research data was collected after obtaining Ethical Approval from the Health Research Ethics Commission of the Health Polytechnic of the Ministry of Health Palu No: LB.01.01/KE/0011/IV/2020.

Data on fluorine content were obtained by examining water samples at the Tadulako University Chemistry Laboratory using spectrophotometry, while data on the incidence of dental caries used the DMF-T index. The DMF-T index is obtained in the following way: DMF-T value = D + M + F then the sum of the DMF components is divided by the number of respondents to get the average DMF-T index. The method used for measuring dental caries is by drying the tooth surface and then examining the caries by a dentist using a probe and a mouth mirror to see if there is caries on the teeth. The research instrument is in the form of a checklist. Furthermore, the data were analyzed descriptively.

RESULTS

The results showed that of the 20 respondents, the youngest was 13 years old and the oldest was 63 years old, the average age was 33.25 years.

Most of the respondents are over 33 years old (55%). Respondents who were female (70%) were more than male. The distribution of respondents based on age and gender can be seen in table 1. below:

Table 1. Distribution of Respondents by Age and Gender

Characteristics of respondents	Amount	%
Age		
≤33 years old	9	45
>33 years	11	55
gender		
Man	6	30
Woman	14	70

Source: Primary Data, 2020

The results showed that of the 20 respondents, most of the respondents had very low water fluoride levels (95%). The lowest fluorine content was 0.00 mg/l, the highest was 0.40 mg/l, with a median of 0.20 mg/l. or if the

majority (95%) are categorized as having very low levels of fluorine, it can be seen in table 2. below:

Table 2. Category of Fluorine Content in Water in Tondo Village, Mantikulore District, Palu City, Central Sulawesi

No.	Fluorine Level	Amount	(%)
1	Very low	19	95,0
2	Low	1	5,0
	Total	20	100

Source: Primary Data, 2020

Table 3. Caries Examination Results with the DMF-T Index in Tondo Village, Mantikulore District, Palu City, Central Sulawesi

Statistic	*Decay*	*Missing*	*Filling*
Maks.	3	0	0
Min.	8	8	1
Median	3	1	0

Source: Primary Data, 2020

Furthermore, the value of the DMF-T Index is searched in the following way: DMF-T value = D + M + F then the sum of the DMF components is divided by the number of respondents to obtain the average DMF-T index. The total value of D = 74, M = 22, F = 1, and divided by the number of respondents is 20 and the results obtained are 4.85 or are included in the high category based on the DMFT Index categorization according to WHO.

DISCUSSION

The results showed that all respondents experienced dental caries, and all water samples did not meet the requirements (low and very low categories) based on Permenkes No. 492 of 2010 concerning Drinking Water Quality Requirements. This shows that there is a relationship between the incidence of dental caries and fluorine levels in the drinking water of the Tondo Village, Mantikulore District.

Researchers assumed the incidence of dental caries experienced by respondents as one of the effects of low fluoride in the water used for drinking. The risk of dental caries is known to be associated with low fluoride intake [10]. This study is in line with research conducted by A. Leondra, et al., in which the degree of caries was calculated using the DMF-T index and a fluorine test using a spectrophotometer with a wavelength of 525 nm. It was concluded that the degree of caries in Wiau Lapi Barat Village was in medium status. and very low fluorine content [11].

In another study, DMF-T for children aged 12 years who used river water as drinking water was classified as high and the average fluoride level in river water in the Pedado River was very low [4]. Research on coastal communities in Watu Ulo Hamlet, Sumberejo Village, Jember Regency showed that the fluorine level of well water used for drinking was classified as very low, and the DMF-T index was classified as medium [6].

Low or very low levels of fluoride in the water used by the community can result in excessive tooth decay, teeth become brittle, in addition to the teeth becoming brittle, a lack of fluorine can cause teeth to be susceptible to caries (caries dentist), discolouration of children's teeth, and bone thinning may occur. On the other hand, high or very high fluoride levels can cause tooth decay. Consumption of 2 ppm fluoride can cause mottled enamel, 5 ppm can cause osteosclerosis, 50 ppm can cause thyroid gland disorders, 120 ppm can cause mental retardation, 125 ppm can cause kidney disease, and 2.5 grams to 5 grams can cause acute doses and death [5].

Caries is an interaction of four major factors: microorganisms, carbohydrate substrates, susceptible tooth surfaces (hosts), and time factors. Low fluorine levels have an impact on the vulnerability of the tooth surface. Vulnerable tooth surfaces supported by an acidic environment in the mouth increase the risk of caries.

Therefore, it prevents the atmosphere in the oral cavity from becoming too acidic, either produced by bacteria or food or drink, so as to prevent the release of calcium ions from tooth enamel. Reducing the demineralization process can be done by stopping the diffusion of acids, namely reducing acid contact with teeth, for example, reducing acid intake or drinking soft drinks by using a straw. Another way is by stopping the formation of calcium phosphate complex compounds by increasing enamel resistance through fluoridation of drinking water or topical applications with fluoride or the addition of fluoride ions in drinks, as well as using fluoride toothpaste [9].

The good fluoride content for consumption (optimum level), according to the American Dental Association (ADA) ranges from 0.7 ppm to 1.2 ppm. The presence of fluoride in bottled water is thought to contribute to the low DMF-T value [12]. Therefore, water fluoridation is the most sustainable community-

level caries prevention method. Water fluoridation should be the intervention of choice in caries prevention [13].

Increase in fluoride levels in drinking water (clear treated water) can be done by passing it through a fluorine-containing stone medium. Preliminary study, By immersion method, Peat-Liang Anggang white stone contains fluorine of 2.12 mg/l. Treated water that is passed through fluoridated rocks has the highest fluoride content increase in rocks with a thickness of 50 cm, where the fluorine content is from 0.08 mg/l (initial) to 0.24 – 0.69 mg/l within 6-72 hours, and the lowest increase in stones with a thickness of 10 cm from 0.08 mg/l (initial) to 0.31 – 0.0.56 mg/l within 6-72 hours [14].

Socioeconomic differences also play a role in the incidence of dental caries. The study of Soffi et al aimed at measuring dental caries based on socioeconomic status in middle-aged adults in Iran and identifying these determinants, showing that there are dissimilarities/differences in dental caries in middle-aged adults based on status. socioeconomic, which means that the prevalence of dental caries is more concentrated in individuals with low socioeconomic status, the prevalence of caries is higher in women, older age groups, individuals with low socioeconomic status, smokers, rural residents and people who use alcohol and drugs - medicine [15].

High caries prevalence was found in underweight and non-obese adolescents (46.7% vs 34.5%) [16]. The relationship between underweight and obesity and caries, respectively (OR [95% CI]), was 1.91 (0.87, 4.18) and 0.34 (0.18, 0.63). The logistic regression model showed that consumption of sugar more than once a day led to a 2.87-fold more significant likelihood of caries (AOR [95% CI] = 2.87 [1.68, 4.88]) [15]. Likewise, after consuming soft drinks, there is a change in the degree of acidity in the mouth [17].

In children, based on an oral health survey conducted in Taiwan, it was found that the prevalence of dental caries in children aged 8-9 years was 85.9%. Children who live in rural areas tend to have a lower percentage in the category of receiving fluoride varnish application services. Children with highly educated parents received significantly more fluoride varnish application services than children with lower educated parents ($p<0.0001$). Children who received fluoride varnish application services were associated with caries risk, with a significant 36% reduction in caries risk. Untreated and unrestored caries can negatively impact general health, development, school performance, or even quality of life among school children [13].

Poor oral hygiene has an impact on a poor quality of life as well. School-based interventions can form positive behaviors that can reduce the likelihood of dental caries in the future. Tooth brushing interventions day and night improve oral hygiene in children in Nigeria and reduce the likelihood of cavities, loss or fillings in Indonesian children [18].

Oral hygiene was significantly worse in boys, and levels of bacteria in dental plaque were significantly higher in boys. Analysis of the relationship between risk indicators and dental caries showed that frequency of brushing teeth, how to brush teeth, daily rinse habits, visits to the dentist, consumption of sweet and light foods and dental and oral hygiene status were risk factors for dental caries [19] in [20]. Based on the cariogram the risk factors that influence caries are bacteria (22.90%), susceptibility (19.39%), eating habits (12.09%), and others (7.55%) [21].

Water fluoridation has been widely applied worldwide for decades and research results show that water fluoridation reduces the prevalence of dental caries. Salt or milk fluoridation is another collective fluoride intervention that prevents dental caries in children. Early childhood fluoride supplement intake and fluoride levels of 0.7 ppm in drinking water are associated with a risk of dental fluorosis, ranging from mild to severe esthetic problems. As for research on the effects of various levels of fluoride concentrations in toothpaste is still limited. Topical fluorides (gels and varnishes) effectively prevent dental caries and are especially recommended for children at high risk of dental caries [15].

In addition to fluoride, dentifrices containing 10% hydroxyapatite are effective in remineralizing early caries and preventing demineralization [22].

CONCLUSIONS

The results showed that of the 20 respondents, 95% of the respondents had very low water fluoride levels. The lowest fluorine content was 0.00 mg/l, the highest was 0.40

mg/l, with a median of 0.20 mg/l. All respondents experienced dental caries (100%). It is recommended to the public to brush their teeth regularly at least twice a day, namely every time after eating and going to bed at night with fluoride-containing toothpaste, and conducting water fluoridation at the community level

ACKNOWLEDGMENT

Acknowledgements are extended to Mr. Nasrul, SKM, M.Kes as the Director of the Poltekkes Kemenkes Palu, Mr. Head of the Tondo Village for his approval and good cooperation during the implementation of the research.

REFERENCE

1. Permenkes RI. Permenkes R.I Nomor 492/Menkes/Per/IV/2010. Permenkes R.I. 2010.
2. Suratri MAL, Jovina TA, Notohartojo IT. Hubungan Kejadian Karies Gigi dengan Konsumsi Air Minum pada Masyarakat di Indonesia (The Relationship of Dental Caries with Drinking Water Consumption on Community in Indonesia). Media Penelit dan Pengemb Kesehat. 2018;28(3):211–8.
3. Riskesdas. Laporan_Nasional_RKD2018_FINAL. pdf. 2018.
4. Puspa Dewi SR, Safitri Y, Lany LE, Dwi RS. Gambaran Kadar Fluorida Dalam Air Minum Dan Skor Dmf-T Anak 12 Tahun Di Sungai Pedado Palembang. J Ris Kesehat. 2019;8(1):68.
5. Dewi NMCK. Kandungan Fluorida Dan Kualitas Bakteriologis Pada Air Sumur Yang Dikonsumsi Secara Langsung Di Desa Adat Bualu, Kecamatan Kuta Selatan Tahun 2016. Universitas Udayana; 2016.
6. Larasati puspitaningrum. Hubungan Kadar Fluor Air Minum Dengan Karies Gigi Pada Masyarakat Pesisir Dusun Watu Ulo Desa Sumberejo Kecamatan Ambulu Kabupaten Jember. Universitas Jember. Jember; 2018.
7. Triwuri Nurlinda Ayu, Hazimah. Kandungan Fluoride Dalam Air Minum Isi Ulang Di Kota Batam. J Rekayasa Sist Ind. 2018;4(1).
8. Utami Naning K. Perbedaan Rata-Rata DMF-T Pada Masyarakat yang Mengkonsumsi Air Minum Kemasan Isi Ulang dan Air Sungai yang Diendapkan. 2020;17(1):43–8.
9. Rahma A, Dewi N, Dentin DP-, 2020 U. Pengaruh Aplikasi Sodium Fluoride 2% Terhadap Ph Plak Dan Ph Saliva Anak Usia 7-9 Tahun. PpjpUlmAcId. 2020;4(3):69–74.
10. Aoun A, Darwiche F, Al Hayek S, Doumit J. The fluoride debate: The pros and cons of fluoridation. Prev Nutr Food Sci. 2018;23(3):171–80.
11. Leondra A, Paulina G, Dinar W. Status Karies Dan Kadar Fluor Yang Dikonsumsi Penduduk Usia 12 – 14 Tahun Di Desa Wiau Lapi Barat. e-GIGI. 2014;2(1).
12. Tanumihardja M, Daniel D, Rehatta F. Gambaran status karies pada anak usia 12-15 tahun yang mengkonsumsi air minum kemasan di SMP Nusantara, Tahun 2016. Makassar Dent J. 2017;6(3):149–56.
13. Ashley P, Duane B, Johnstone M, Lyne A. The environmental impact of community caries prevention - part 2: toothbrushing programmes. Br Dent J. 2022;233(4):295–302.
14. Rahmawati I, Said F, Haris A. Perancangan Alat Peningkatan Kadar Fluor Air Sungai Planning Of River Water Fluoride Improvement Equipment Using Contact Method Of Fluorine-Containing Rocks In Mekar Sari. An-Nadaa J Kesehat Masy [Internet]. 2021;8(2):131–5. Available from: https://ojs.uniska-bjm.ac.id/index.php/ANN/article/view/5663
15. Jullien S. Prophylaxis of caries with fluoride for children under five years. BMC Pediatr [Internet]. 2021;21(Suppl 1):1–11. Available from: http://dx.doi.org/10.1186/s12887-021-02702-3
16. Gudipaneni RK, Albilasi RM, HadiAlrewili O, Alam MK, Patil SR, Saeed F. Association of Body Mass Index and Waist Circumference With Dental Caries and Consequences of Untreated Dental Caries Among 12- to 14-Year-old Boys: A Cross-Sectional

Study. Int Dent J. 2021;71(6):522–9.
17. Santoso TLA, Wicaksono DA, Gunawan PN. Effects of Carbonated Soft Drink on Saliva pH in the Occurrence of Dental Caries. e-GiGi. 2022;10(1):66.
18. Melo P, Fine C, Malone S, Taylor S. Impact of the Brush Day & Night Programme on Well-Being, Plaque, and Dental Caries in Children. Int Dent J. 2021;71:S15–30.
19. Nugraheni H, Sadimin S, Sukini S. Determinan Perilaku Pencegahan Karies Gigi Siswa Sekolah Dasar Di Kota Semarang. J Kesehat Gigi. 2019;6(1):26.
20. Kyaw Myint ZC, Zaitsu T, Oshiro A, Ueno M, Soe KK, Kawaguchi Y. Risk indicators of dental caries and gingivitis among 10−11-year-old students in Yangon, Myanmar. Int Dent J. 2020;70(3):167–75.
21. Widyagdo A, Priyono B, Hanindriyo L. Caries risk factors based on cariogram among male smokers aged 15-24 years in Temanggung, Central Java, Indonesia. Maj Kedokt Gigi Indones. 2022;8(1):24.
22. Amaechi BT, AbdulAzees PA, Alshareif DO, Shehata MA, Lima PP de CS, Abdollahi A, et al. Comparative efficacy of a hydroxyapatite and a fluoride toothpaste for prevention and remineralization of dental caries in children. BDJ Open. 2019;5(1).