The Relationship of Mineral Fluor Exposure in Water with The Presence of Gingivitis (Study Case in Subdistrict of Tempe, Sengkang City, Wajo District)

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Abstract

Periodontal disease is a major disease of the oral cavity with a high prevalence, especially in a number of developing countries**.** Analyze the relationship of fluorine concentration in drinking water with gingivitis periodontal disorder (Case study in Subdistrict of Tempe, Sengkang City, Wajo District). The type and design of the research is explorative / cross-sectional research. Selection of research subjects was conducted by cluster sampling method first to determine the sample population of the sample to be sampled in Tempe Subdistrict. Data analysis was done by univariate, bivariate and advance analysis (ROC to determine cut off risk of fluorine concentration and Layer analysis to determine the magnitude of interaction variable) using the value of α 5%. The fluorine concentration was set at 0.020 through ROC calculations. Different fluorine concentration results shown in the analyzes performed on cooking water consumption showed a p value of 0.067, which means consumption of high fluorine concentrations evenly distributed across all sources of cooked water. The condition of gingivitis is relatively different based on age classification with most patients in stratum age> 40 years. However, a total significant relationship was found between fluorine concentration and gingivitis incidence (p = 0.04). Statistical analysis also showed a positive relationship between the OHIS condition of respondents and the incidence of gingivitis indicated by index gingivitis data. Interaction of severe OHI-S condition variables with high fluorine concentrations resulted in severe gingivitis of 43.1%. In high and medium fluorine stratum concentrations, the effect of OHIS is significant on gingivitis. Comparison of the interaction of two risk factors versus one risk factor shows comparison. There was a correlation between fluorine concentration and gingivitis, found an interaction between fluorine concentration with OHI-S to gingivitis effect and also found Cut off Point for fluor of 0.02 ppm.

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Introduction

Periodontal disease is a major disease of the oral cavity with a high prevalence, especially in a number of developing countries.[1] Attacking up to 90% of people worldwide.[2] Periodontal disease is a major cause of dental dates in adults and causes gingival damage, periodontal ligament and alveolar bone.[3] Periodontal disease is grouped into two gingivitis and periodontitis. Gingivitis is one of the most common abnormalities in the oral cavity. The agent factors that can affect gingivitis are plaque and bacteria or microorganisms. Gram-negative bacteria have an important role in the pathogenesis of periodontal disease in humans.[4] In the 1960s, clinical research documenting the theory that microbes in dental plaque are important etiologic factors for the development of gingivitis as an inflammatory disease of the gingiva.[5] However, technological developments suggest that this multifactorial disease involves host (including genetic) factors, agents and the environment.[6] Environmental factors play an important role in determining the process of interaction between host and agent in the process of disease. Water is an important environmental component for

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human life. Water has a chemical content in which it can be toxic to the body if its use is not in accordance with the proper concentration.

Wajo is one of the districts in South Sulawesi with diverse drinking water sources. Some of these minerals exist that work against oral health and there are also some minerals with harmful effects on health. Fawell et al., (2006)[7] reported the influence of fluorine on water consumed by the public against gingivitis periodontal disease. In the American Journal of Public Health reported a strong correlation between fluorine concentrations in people in a region at the time of their birth with tooth loss as they mature. These results are reinforced by research conducted by Anuradha (2002)[8] who found the presence of a hydroxyapatite change into fluorapatite in the cementum of roots in areas with high fluorine concentrations thus periodontal tissues are resistant to damage. Based on the research reported fluoridation of drinking water can affect gingivitis periodontal disease directly or indirectly.[9]

Fluoridation of drinking water has been introduced in 139 countries and >170 million people have been getting fluorine in drinking water sources. Fluorine in drinking water based on epidemiological studies in some countries has a preventive effect.[10] However, water that is an essential component of human life that contains many chemicals (minerals) can be toxic to the body if the use is not appropriate. Based on these data it is concluded that the concentration of minerals, especially fluorine found in drinking water sources can affect dental and oral health including to periodontal tissues. Whether this conclusion is the answer to the high prevalence of periodontal disease in the Wajo region is a major question of this study.

Based on data from the local government, Wajo District has several types of raw water sources used for daily needs (rivers, springs, wells, groundwater and rain). Different types of water sources will have different expected fluorine concentrations. This will certainly have a different influence on the dental and mouth health of the community in Wajo District. The data of periodontal disease patients in Wajo District in the range of 2010 to 2012 with a total of 5603 people (in 2010 of 1787, 2011 as many as 2038 and 2012 amounting to 1778), shows the number of periodontal disease patients is still very high and require greater attention. In addition, based on observations, the researcher found many dental populations condition faltering. This shakiness is caused by many things, one of which is the tooth attachment is fragile due to a pile of tartar around the cervical tooth. The fluorine-rich water content is thought to be the main link leading to periodontal disease through interaction with tartar around the cervix.

Materials and methods

Drinking Water

Water used and consumed by the people of Tempe sub-district of Sengkang City of Wajo District, South Sulawesi is placed on a sterile bottle as a place to store water samples to be studied.

Questionnaire

Consisting of questions of respondents' behavior and drinking water service and form of assessment of dental and mouth health status of respondents.

Statistical Analysis

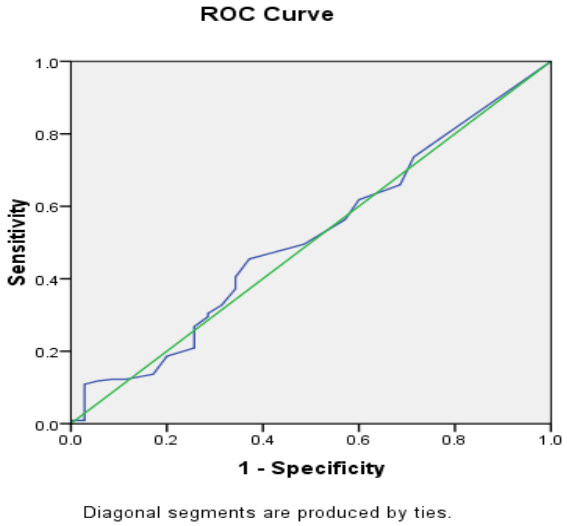
Data analysis was done by univariate, bivariate and advance analysis (ROC to determine cut off risk of fluorine concentration and Layer analysis to determine the magnitude of interaction variable) using α 5%.

Results

Fluorine analysis performed ROC calculations to attract concentrations of noisy cause of disease. Selected sensitivity and 1-specificity 0.659 and 0.686, at that point found fluorine concentration of 0.020 (Figure 1). This shows the average value of 0.02 ppm for all drinking water sources consumed by the people of Tempe sub-district, Wajo. Table 1 shows seven to eight out of every ten population sample using drinking water with fluorine concentration> 0.02 ppm. The results of different fluorine concentrations shown in the analyzes performed on cooking water consumption show the p value of 0.067 which means consumption of high fluorine concentrations evenly distributed across all sources of cooked water (Table 2). Nevertheless, the results did not show significant

fluorides similarly (high fluorine concentration status) in all sources of drinking water.

Figure 1. Graph of ROC fluorine concentrations.



Drinking Water Resources	Fluorine Concentrations High n	%	Low n	%	Total n	%	*p*
Draw well	11	91.7	1	8.3	12	100.0	
Rainwater	4	100.0	0	0.0	4	100.0	
River	19	70.4	8	29.6	27	100.0	
RWC	96	75.0	32	25.0	128	100.0	0.276
MW	57	67.9	27	32.1	84	100.0	
Total	187	73.3	68	26.7	255	100.0	

Table 1. Fluorine concentrations based on drinking water consumed in the community of Tempe Sub-district, Sengkang.

Cooking Water Source	Fluorine Concentrations High N	%	Low n	%	Total n	%	*p*
Draw well	24	88.9	3	11.1	27	100.0	
Rainwater	2	100.0	0	0.0	2	100.0	
River	22	64.7	12	35.3	34	100.0	
RWC	120	75.0	40	25.0	160	100.0	0.067
MW	19	59.4	13	40.6	32	100.0	
Total	187	73.3	68	26.7	255	100.0	

Table 2. Periodontal disease based on source of cooking water consumed community in districts of Tempe, Sengkang.

Based on community water consumption, it shows that four to five out of ten inhabitants in Wajo sub-district suffer severe gingivitis based on different sources of drinking water (Table 3). The condition of gingivitis is relatively different based on age classification. The condition of severe gingivitis is more suffered by respondents with stratum age> 40 years. Found six out of every ten respondents using water ≥ 0.02 ppm suffering from mild gingivitis. However, a total significant relationship was found between fluorine concentration and gingivitis incidence (p = 0.04). In addition to this, statistical analysis showed a positive relationship between OHIS condition of respondents and gingivitis incidence as indicated by index gingivitis data (Table 4).

Interaction of severe OHI-S condition variable with high fluorine concentration resulted in severe gingivitis of 43.1%. If only one working risk factor (severe OHIS conditions with moderate fluorine concentrations) will result in severe gingivitis of 62.5%.

In high fluorine stratum the influence of OHIS is significant to gingivitis and remains significant in stratum of moderate fluorine concentration. The same can be seen from the comparison of the interaction of two risk factors versus one risk factor (69/255 versus 35/255 or 30.6%: 15.5% = 2: 1) (Table 5).

Drinking Water Resources	Gingivitis Condition Weight n	%	Mild n	%	Total n	%
Draw well	15	55.6	12	44.4	27	100.0
Rain water	1	50.0	1	50.0	2	100.0
River	16	47.1	18	52.9	34	100.0
RWC	60	37.5	100	62.5	160	100.0
MW	16	50.0	16	50.0	32	100.0
Total	108	42.4	147	57.6	255	100.0

Table 3. Periodontal disease based on source of cooking water consumed community in districts of Tempe, Sengkang.

Discussion

The study findings are aimed at analyzing the relationship between the strongly suspected factors as the cause and the consequences. This factor is considered strong as a cause if it satisfies the conditions of cause must precede the result (temporal postulate), postulate dose response to the postulate analog.[11,12]

Variable	Category	Gingivitis Condition				Total		*p*
		Weight		Mild				
		n	%	n	%	n	%	
Sex	Male	50	44.2	63	55.8	113	100.0	0.58
	Female	58	40.8	84	59.2	142	100.0	
	Total	108	42.4	147	57.6	255	100.0	
Age	> 40	59	44.0	75	56.0	134	100.0	0.57
	≤ 40	49	40.5	72	59.5	121	100.0	
	Total	108	42.4	147	57.6	255	100.0	
Fluor Concentration	High	72	38.5	115	61.5	169	100.0	0.04
	Low	36	52.9	32	47.1	86	100.0	
	Total	108	42.4	147	57.6	255	100.0	
KondisiOHI-S	Weight	104	48.1	112	51.9	216	100.0	0.00
	Mild	4	10.3	35	89.7	39	100.0	
	Total	108	42.4	147	57.6	255	100.0	

Table 4. Sex, age, fluorine and OHI-S conditions to periodontal.

Flour Condition	OHI-S Condition	Gingivitis Condition				Total		*p*
		Weight		Mild				
		n	%	n	%	n	%	
High	Weight	69	43.1	91	56.9	160	100.0	0.00
	Mild	3	11.1	24	88.9	27	100.0	
	Total	72	38.5	115	61.5	187	100.0	
Low	Weight	35	62.5	21	37.5	56	100.0	0.00
	Mild	1	8.3	11	91.7	12	100.0	
	Total	36	52.9	32	47.1	68	100.0	

Table 5. The test results between the condition of Gingivitis Index with the interaction of OHI-S versus fluorine concentration.

Age	Fluor Concentration	Gingivitis Condition						*p*
		Weight		Mild		Total		
		n	%	n	%	n	%	
> 40	High	44	48.9	46	51.1	90	100.0	0.55
	Low	12	48	13	52	25	100.0	
	Total	56	48.7	59	51.3	115	100.0	
≤ 40	High	25	35.7	45	64.3	70	100.0	0.00
	Mild	23	74.2	8	25.8	31	100.0	
	Total	48	47.5	53	52.5	101	100.0	

Table 6. Analysis details of time and dose response with ohis weight.

Age	Fluor Concentration	Gingivitis Condition						*p*
		Weight		Mild		Total		
		n	%	n	%	n	%	
> 40	High	2	16.7	10	83.3	12	100.0	0.70
	Low	1	14.3	6	85.7	7	100.0	
	Total	3	15.8	16	84.2	19	100.0	
≤ 40	High	1	6.7	14	93.3	15	100.0	0.75
	Low	0	0.0	5	100	5	100.0	
	Total	1	5.0	19	95.0	20	100.0	

Table 7. Analysis of time and dose response explanations with lightweight OHIS conditions**.**

1. Temporal postulate. Indicates the cause must be earlier than the result. In this study it can not be fully proposed because of the cross-sectional study design, but the analysis with the structure of the sample samples is >40 years and ≤40 years indicates the time response in which the word is implied due to earlier than the effect, see multiple cross sectional design that actually incorporates the time element because it is ahead of effect
2. Postulate the power of association. Between the causal and bonding effects have a high association
3. Postulate Similarity between loci and other loci. The transparency between regions with high fluorine concentrations yields similar results.
4. Postulate Dose and Time response. If three independent variables are at risk for combined gingivitis weighing 48.9%, when two independent variable (OHIS and independent >40) variables are at risk of 48%, and when an independent variable is at risk of 16.7%. This fact also shows that OHIS and age also have a strong contribution to the occurrence of gingivitis.
5. Coherence Postulates. The fact between high cases in the high age group (>40 years) with the fact that OHIS, fluorineconcentration and other relevant factors were found to be related to one another.

The macro conclusions are also based on the postulat paradigm that it is concluded that risk factor is not only a risk factor but also can be considered causal factor.

Gingivitis is the earliest form of periodontal disease, and the incidence appears to have spread in various regions.[11] In this study the study of periodontal disease was assessed due to consideration for gender, age and oral hygiene status with fluorine mineral relevance to gingivitis.[14]

The results of this dissertation showed 44.2% of the sample suffered severe gingivitis with percentage of gingivitis sufferers suffered by many men. This finding is similar to the study conducted by Declan (2012)[12] who found 56% of 15-year-old boys had periodontal disease ie gingivitis (inflammation and gingival bleeding) and as many as 48% were found in women. The results of Declan's research emphasize the similarity of research results in Tempe Subdistrict and in Ireland. In a population-based cross-sectional health study conducted in northeastern Germany from Pomerania studied the subject's periodontal circumstances and found better periodontal female conditions compared to men by assessing attachment loss, probing depth, bleeding and plaque indices.[14] The reasons for this gender difference have not been explored in detail, but are thought to relate to poor oral hygiene and dental visit behavior as well as genetic factors. This suggests that men usually show poorer oral hygiene than women.[15]

Another uncertainty is the influence of age on the periodontal conditions. Age is considered one of the determinants of periodontal disease. The results of this dissertation study found there were 59 people who had mild gingivitis but had a severe OHI-S condition with age >40 years after the layer analysis was found that the majority had high fluorine concentrations. This subject should have severe gingivitis but a mild gingivitis condition because of the insufficient duration of 'OHIS' is inadequate to severe gingivitis or any

other unknown protection factor. In addition, three people with severe gingivitis were found to have mild OHIS with age >40 years, two of whom had a fluorine exposure of more than 0.02 ppm.[15,16]

There were 48 individuals expected to enter the mild gingivitis group but had severe gingivitis due to age ≤ 40 years (duration of low fluorine exposure) but due to severe OHIS caused this subject to enter severe gingivitis. There were 53 people with mild gingivitis with severe OHIS but not severe gingivitis, one of the answers because of the low duration of exposure to fluoride. One person who had severe gingivitis with mild OHIS with age ≤ 40 years were expected to have mild gingivitis at the analysis layer was found to have a fluorine concentration <0.02 ppm.[17]

Cumulative tissue damage during life can lead to gingivitis. Other evidence of gingivitis events as a result of environmental factors. Declan (2012)[12] revealed the impact of periodontal disease worldwide rising to 15% in the adult population. Drinking Water is the largest contributor to daily fluoride intake. For certain individuals, exposure to fluoride (mg kg-1 per day) through drinking water is determined by the fluoride level in daily water consumption (liters per day).[17,18]

Fluoride is one of the chemicals that has been shown to cause significant effects on people through drinking water. Fluoride has a beneficial effect on teeth with low concentrations in drinking water, but excessive exposure to fluoride in drinking water can lead to a number of side effects. Many published studies and documents show that increased fluoride exposure is directly associated with increased periodontal disease. The results found that the fluoride-triggered stimulation of prostaglandin bi-phasic in dose response. At concentrations less than 5 mM (such as 0. 01 w/v), fluoride has no significant effect through stimulation of PGE sub 2 secretions; more than 50 mM (such as more than 0.1 w/v), fluoride ions become inhibitors for PGE sub-secretions. The sodium fluoride concentration of toothpaste marketed 0.15% when in use, contact with saliva reacts to a solution assumed to be less than 50 nM on the alveolar surface, and then stimulates prostaglandin production.[18]

Areas with relatively high concentrations of fluoride (more than 4 million parts per fluoride) are shown to show a trend of higher gingivitis events.[13] Kumar (2009)[9] found the most likely source of fluoride plaque is drinking water. High concentrations of fluoride can release the pellicle protein and bacteria, and significantly affect the colonization and plaque formation of the oral cavity. In fact, an experiment conducted on dental plaque to see the effect of fluoride in drinking water causes a change in pH when plaque is incubated with sucrose. This study shows that drinking fluoride water has an effect on the teeth, fluoride from water, incorporated in plaque, causing bacteria to produce less acid in sucrose in the mouth.[14,15]

Conclusions

Both published and unpublished observations conclude that ginggiv disease may be induced or aggravated by certain chemicals, including fluoride. The research documentation from the pharmaceutical company Sepracor (renamed Sunovion Pharmaceuticals Inc.), suggests that fluoride toothpaste can cause or contribute to periodontal bone loss.[16,17] These findings support the biochemical explanation for previous reports by many researchers who have found increased gingivitis and gingival inflammation due to fluoridation of water, or other sources of fluoride.[12,18]

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