

Periodontal Disease in the Highlands and Lowlands of South Sulawesi

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Abstract

In Indonesia about 86% of people suffer from periodontal disease. Many cases of illness, including periodontal disease not only caused by microorganism to cause disease, yet environmental factors, such as water, also show one of the factors that can lead to the onset of the disease

To analyze the relationship of mineral levels in drinking water and the occurrence of periodontal disorders in Highland and Lowland South Sulawesi.

This research is cross sectional by assigning a sample of using the method of modification of the cluster with the Proportional to Size consists of 419 people.

There is a significant relation exists between the condition of gingivitis and periodontitis in Tempe at the condition of OHI-S on every different age stratum ($P < 0.001$). Similar results were found on the proportion of severe periodontitis in the stratum of high fluorine and worse OHI-S ($P < 0.001$).

There is the influence of the levels of fluorine to periodontal disorders. It is found that the existence of an interaction between the levels of fluorine with OHI-S against the effects of periodontal disorder and found the cut of point for fluorine is at 0.02 ppm.

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Introduction

Periodontal disease is a disease of the teeth and mouth occupied second rank remains a major problem in community.¹ Periodontal disease is the leading cause of tooth loss for adults and cause damage to the gingival, periodontal ligament and alveolar bone.²

Periodontal disease is classified into two types, i.e. gingivitis and periodontitis. In the year of 1960s, clinical research documenting that microbe on dental plaque is important factor to the development of etiology of gingivitis as inflammation of gingiva. However, on periodontal tissue being damaged, appearance of periodontitis is not only due to bacteria or microorganisms in dental plaque, but also due to the response of the body against microbial host

involving genetic factors and the immune system. In many cases, diseases depend on environmental factors which also indicate that one factor such as fluoride-contained drinking water is potential to cause of the periodontal disease.³ It can be summarized that periodontal disease is one of the causes of diseases having multifactor, those are host, agent, and environment.

Host factors that play a role in periodontal disease of the oral cavity health, gender, age, saliva, genetic, socio-economic status, and diseases such as diabetes mellitus, stress, atherosclerosis, stroke, hypertension, osteoporosis, HIV-AIDS, cancer, obesity and unhealthy behaviors such as smoking.⁴⁻⁷ Agent factor is the element of living organisms or germs of infection which causes the onset of a disease. As for factors that can affect the agent of periodontal disease is plaque and bacteria or microorganisms.⁸ However, environmental factors play a role which is important in determining the onset of the process of interaction between the hosts with agents in the process of the occurrence of the disease.

Water is important component of environment for human life. South Sulawesi has

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different source of drinking water, needless to say Tempe District, Regency of Wajo, and Baraka District, Regency of Enrekang, have a diverse source of drinking water. The former is of lowland area, while the latter is of highland area. A source of different kinds of water will contain a different composition of the mineral content. Some of the levels of these minerals are functioning well to oral health, but nevertheless there are minerals that have harmful impacts to health.⁹

The research for various factors hosts and agent had done until now. However, researches related to environmental factors, especially the water containing various minerals are still very little conducted. Some recent researches show the influence of fluoride in mineral water consumed by people against periodontal diseases.^{10,11} Hence, based on researches conducting, fluoridation in the drinking water influences periodontal disease directly or indirectly.⁹ Therefore, the aim of this research was to analyze the relationship of mineral levels in drinking water and the occurrence of periodontal disorders in highland and lowland South Sulawesi.

Materials and methods

This research design is cross sectional, conducted from June to July 2014, in Tempe District, Regency of Wajo; and in the period of August in Baraka District, Regency of Enrekang. These two locations are selected based on purposive sampling technique due to existing natural water resources and information of periodontal diseases. Material of this research is the water sources that are consumed by the community. Employed method is selecting samples (355 respondents for Tempe District, and 264 respondents for Baraka District) using cluster modification by proportional probability to size (PPS) through interviewing respondents based on questioner and conducting periodontal examination. Collected data are analyzed by univariate and bivariate for value of α 5% using software of SPSS 17.0.

Results

The result analysis shows that gender respondents are relatively homogeneous. The age distribution is found that averagely 42.62 years with standard deviation of 13.31 years.

From 136 households, 255 people are taken as samples with majority status as husband or wife. Education of the majority respondents is attended school as of 91.4% (extending from elementary school to university). Generally, the occupations of respondents are farmers, traders, and entrepreneurs linked in the form of group; with monthly earnings is between half to 1 million rupiahs. Five of every 10 respondents have a stage house (50.2%). House owned by respondents is generally their own.

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Eight to nine in every ten samples have status worse OHI-S (84.7%). Figure 3 also provides information that six in every ten respondents have light gingivitis (based on gingival index). Nine of every 10 samples suffered heavy periodontitis and only one in every ten samples suffer mild periodontitis.

The result of this research emphasizes the similarity between condition in Tempe District and that of in Ireland found that some 56% of younger men at the age of 15 have the periodontal disease with type of gingivitis (inflammation and bleeding of the gingiva) and 48% found in younger women.¹³ In contrast to the study by Vandana (2007)¹⁴ which shown that gingivitis and periodontitis occurs more frequently in women than in men.¹⁴ But in a cross-sectional health study based on population conducted in Pomerania, the northeast of Germany, reported the study of periodontal condition found that women have better periodontal condition compared to men by assessing loss of attachment, depth of probing, bleeding and plaque indices.¹⁴

This study provides that the condition of gingivitis is relatively no different classifications

based on age, while the condition of periodontitis shows different classification of the aged ≤ 40 and > 40 years old. Nine out of ten conditions of severe periodontitis found in those aged > 40 years old. Eight out of ten samples of ≤ 40 years old experienced severe periodontitis which shows the condition of possibility of the effect of the accumulation of exposure based on age. Although the prevalence of periodontitis improved with the increase that the increase in prevalence is more influenced by bad oral hygiene and age has a significant effect on rates of regression of the disease.

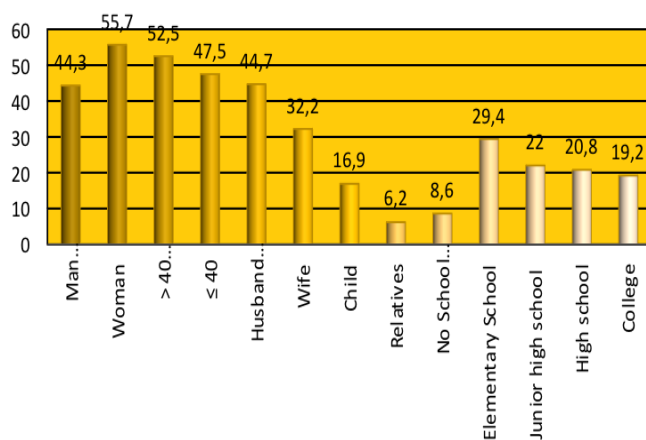


Figure 1. Respondents Distribution Based on Gender, Age, Status in Households, and Education.

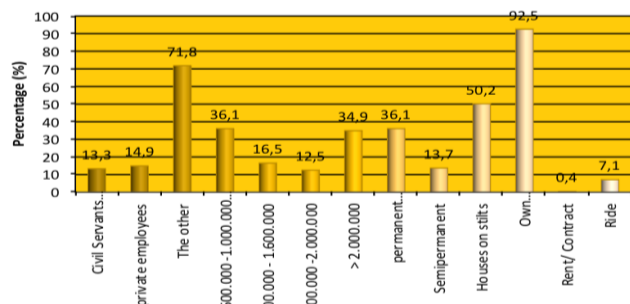


Figure 2. Respondent Distribution Based on Occupation, Income, House Condition and Ownership.

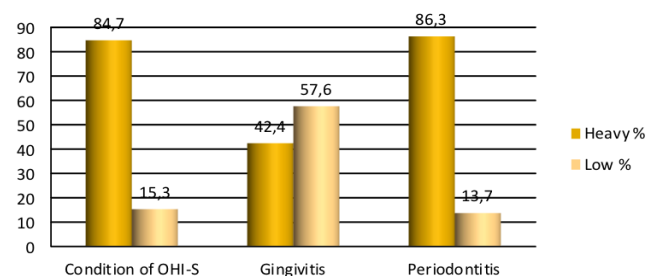


Figure 3. Respondents Distribution of OHI-S, Gingivitis dan Periodontitis.

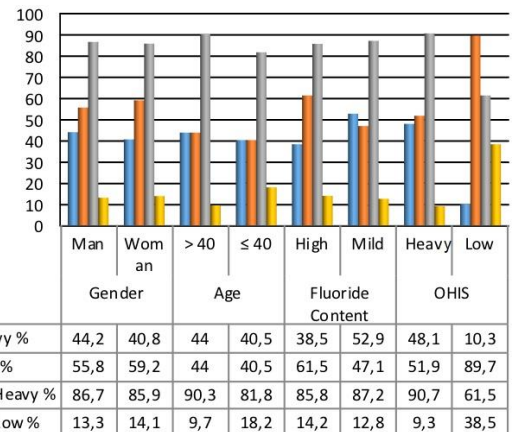


Figure 4. Variables of Gender, Age, Fluoride Content, OHI-S Condition, And Periodontal Condition.

However, it is still uncertain whether the physiological changes of aging process itself contributes to the progression of the disease or whether the relationship between the ages with periodontal disease was simply a manifestation of disease of the past.¹⁵

It is found that six of every ten respondents using water with fluoride content ≥ 0.02 ppm suffer mild gingivitis. However, in total it is found that a significant relation exists between levels of fluorine with gingivitis at significance of 0.04, and it is found also that eight to nine of every ten samples using water of ≥ 0.02 ppm suffered severe periodontitis conditions.

A similar case is found in the samples that use water with levels of fluorine < 0.02 ppm. But in total, the 63.52% of sufferers are found to have severe periodontitis caused by using water with high fluorine content, and only 22.74% sufferers with are found to have severe periodontitis on groups caused by using water with moderate fluorine content. Those results reinforced with positive relationships between the severity of OHI-S with the severity condition of gingivitis and periodontitis.

Condition of gingivitis has no difference for the levels of fluorine content (after controlled over variable of age). This can be described that the differentiation of gingivitis condition similar in all age. Similarly, the condition of periodontitis condition has no difference for the levels of fluorine content (after controlled over variable of age). This fact gives explanation that the differentiation of periodontitis condition is similar

for all age (though in all proportions of periodontitis with heavy condition is heavily found on stratum age of > 40 years old and is still higher than stratum of ≤ 40 years old). This result is shown in Table 1.

Drinking water is the biggest contributor to intake fluoride daily. For a particular individual, exposure to fluor (mg kg⁻¹ per day) through drinking water determined by level of fluoride in daily water consumption (liter per day) and communities living in region closer to the equator consume more drinking water.¹⁶ Fluoride is one of chemicals that have been proven to cause significant effect on a person through drinking water. Having a fluoride gives beneficial effect to the teeth with low concentration in drinking water, but excessive exposure fluoride in water to drink some can generate side effects.

In this study found that 63.52% of sufferers of severe periodontitis using water with high levels of fluorine content (> 0.02 ppm), and only 22.74% of sufferers of severe periodontitis on groups using water with a mild level of fluorine (≤ 0.02 ppm). A lot of research and documents that have been published indicate that the increased exposure to fluoride is directly linked to the growing of periodontal disease. From a public health perspective, various studies show an increase in exposure to fluoride can increase the risk of the development of periodontal disease or any other disease which is very important. Hence proof of relationship between high fluoride intake and prevalence disease is significant.¹² Ions trigger stimulation of prostaglandin bi-phasic in dose response. At concentrations of less than 5 mM (0.01% w/v), fluoride has no significant effect through the stimulation of the secretion of PGE sub 2; more than 50 mM (more than 0.1 w/v), the fluoride ion is hampered for the secretion of PGE sub 2. Concentration of sodium fluoride content on marketed toothpaste is about 0.15 % during in use, when it contacts to saliva will give respond to a solution assumed less than 50 mM on the surface of the alveolar, and then stimulate the production of prostaglandins.¹²

The results in Table 2 show a significant relationship between the condition of gingivitis with condition of OHI-S on each stratum age with different values of *phi* 0.001 and 0.00. Similar results were found to be between OHI-S in each stratum of different age ($P=0.00$). an increase in incidence of periodontitis based on expansion of age.¹⁷

Men and women aged of 16 to 50 years old to determine occurrences of periodontal disease in conjunction with cleanliness mouths, found that 83 % of examinee suffered periodontal disease with increased by expansion of age. on inspection of three random samples of 600, 584, and 597 and in 1973, 1983 and 1993. This subject was 20 to 70 years old. Severity level of this disease is divided into five groups, with the 5th severity group having the highest. Significant occurrence was increase by 1 %, 2 % to 3 % for three times the research that possibly caused by increased subjects in older age group.¹⁷

Discussion

The interaction between variable of heavy conditions of OHI-S with high levels of fluor produce heavy gingivitis at 43.1 %. If there is only one risk factor working (heavy OHI-S with mild level of fluorine) will produce heavy periodontitis at 62.5 %.

On the stratum of high levels of fluorine, OHIS influences significantly to gingivitis and keep significance on mild stratum of fluorine content. While the interaction between variable of heavy conditions of OHI-S with high levels of fluorine produce severe periodontitis at 91.9%. When there is only one working risk factor that works (heavy condition of OHI-S with mild levels of fluorine content) will result in severe periodontitis at 87.5%. On the stratum of high levels of fluorine, OHIS influences significantly to periodontitis, but not significant in the stratum mild level of fluorine. The proportion of severe periodontitis in the stratum of high fluorine and heavy OHIS is similar, but the proportion of severe periodontitis are considerably higher on the interaction of two risk factors than one risk factor (147/255 comparing to 49/255 or 57.6% comparing to 19.2% similar to 3.00 comparing to 1; Table 3).

That oral hygiene is due to the accumulation of plaque and calculus supragingival that are correlated with the occurrence of chronic periodontitis. and possible source of plaque occurrence is due to fluoride content in drinkable water. High levels of fluorine can deliver protein pellicle and develop bacterium, and significantly affecting colonization and forming plaques in mouth cavities. Even, an experiment which carried on dental plaque to see the influence of fluoride in drinkable water caused the changes in its pH when the plaque

incubated with sucrose. This study indicates that fluoridated drinking water influence the teeth, fluoride from water incorporated in the plaque causes bacteria to produce less acid in sucrose on the oral cavity. Fluoride also can inhibit the binding of proteins to hydroxy apatite acid during formation of pellicle. In addition, fluoride has some effect on the adsorption of pellicle bacteria on the teeth with calcium ions.⁹

This is important in bridging the gap between a group of acids on the surface of the thin skin and the cell walls of bacteria. Fluoride can be seen in two forms which exists in saliva and plaque, both free and bound ions is closely related to bacterial cells, epithelial cells or other inorganic constituents. Therefore, the effect of antimicrobial can reduce the severity of periodontitis. The consumption of high levels of fluorine causes conversion of hydroxyapatite for fluoroapatite (especially in the cementum), so periodontium resistant to damage. It can be speculated that the occurrence of periodontitis because of alveolar bone and

cementum are absorbed and therefore calcium, phosphorus and Fluoride is produced to the dentogingival. The GCF will then be expected to have a high concentration of fluoride. This can interfere with the metabolism of plaque on teeth and resulted in the development of periodontitis.^{9,18}

Conclusions

There is the influence of environmental factors (the levels of fluorine) to periodontal disorder, it is found that the existence of an interaction between the levels of fluorine with OHI-S against the effects of periodontal disorders, it is found also that the Cut off Point for fluorine is of 0.02 ppm.

Declaration of Interest

The authors report no conflict of interest and the article is not funded or supported by any research grant.

Age (years)	Fluorine Content	Periodontal Disorder													
		Condition of Gingivitis						p	Condition of Periodontitis						p
		heavy		low		Total			heavy		low		Total		
n	%	n	%	n	%	n	%	N	%	n	%				
> 40	High	46	45.1	56	54.9	102	100	0.66	93	91.2	9	8.8	102	100	0.38
	Mild	13	40.6	19	59.4	32	100		28	87.5	4	12.5	32	100	
	Total	59	44	75	56	134	100		121	90.3	13	9.7	134	100	
≤ 40	High	26	30.6	59	69.4	85	100	0.00	69	81.2	16	18.8	85	100	0.50
	Mild	23	63.9	13	36.1	36	100		30	83.3	6	16.7	36	100	
	Total	49	40.5	72	59.5	121	100		99	81.8	22	18.2	121	100	

Table 1. Variable of Fluorine Content with Age Stratification versus Periodontal Disorder.

Age (years)	Condition of OHI-S	Periodontal Disorder													
		Condition of Gingivitis						p	Condition of Periodontitis						p
		heavy		Low		Total			heavy		low		Total		
n	%	n	%	n	%	n	%	N	%	n	%				
> 40	High	56	48.7	59	51.3	115	100	0.01	107	93	8	7	115	100	0.009
	Mild	3	15.8	16	84.2	19	100		14	73.7	5	26.3	19	100	
	Total	59	44	75	56	134	100		121	90.3	13	9.7	134	100	
≤ 40	High	48	47.5	53	52.5	101	100	0.00	89	88.1	12	11.9	101	100	0.00
	Mild	1	5	19	95	20	100		10	50	10	50	20	100	
	Total	49	40.5	72	59.5	121	100		99	81.8	22	18.2	121	100	

Table 2. Examination Results between OHI-S Against Periodontal Status with Age Interaction.

Fluoride Content	Condition of OHIS	Periodontal Disorder													
		Condition of Gingivitis						p	Condition of Periodontitis						p
		Heavy		low		Total			heavy		low		Total		
n	%	n	%	n	%	N	%	N	%	N	%				
High	High	69	43.1	91	56.9	160	100	0.00	147	91.9	13	8.1	160	100	0.00
	Mild	3	11.1	24	88.9	27	100		15	55.6	12	44.4	27	100	
	Total	72	38.5	115	61.5	187	100		162	86.6	25	13.4	187	100	
Mild	High	35	62.5	21	37.5	56	100	0.00	49	87.5	7	12.5	56	100	0.24
	Mild	1	8.3	11	91.7	12	100		9	75	3	25	12	100	
	Total	36	52.9	32	47.1	68	100		58	85.3	10	14.7	68	100	

Table 3. Examination Results between Gingival Index Against OHI-S versus Fluoride Content.

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