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CLINICAL EFFECTS OF ALKALINE IONIZATION WATER (AIW) AS A MOUTHWASH AGAINST THE REDUCTION OF DENTAL PLAQUE

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ABSTRACT

Objective: The purpose of this study was to determine whether it has effectiveness in the reduction of the number of dental plaque and can be used as a mouthwash.

Methods: Experimental research with pre-post with control design, with samples from 2nd-semester students of Faculty of Dentistry Hasanuddin University of 20 students. The number of treatment groups was 4 groups, ie AIW gargling group pH 7, pH 9, pH 11.5 and positive control group (chlorhexidine). Stage of the research process includes the examination of pH, salivary colonies and plaque state. For measurement of salivary pH and bacterial colony, 4 measurements were done before the intervention, first day, third day and seventh day.

Results: The highest percentage of dental plaque reduction before and after treatment for 7 d treatment for AIW group pH 9 was 26.6%, higher than the positive control group of 20.2%.

Conclusion: This study resulted in the strength of reducing the amount of plaque in the mouth is not different from the effectiveness of mouthwash which contains Chlorhexidine, it indicates that Alkaline ionized water (AIW) can be used as a mouthwash.

Keywords: Alkaline ionized water, Mouthwash

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INTRODUCTION

The use of alkaline water or mineral water by the public is becoming increasingly popular around the world, and the tools that make ordinary water into alkaline water are also increasingly being sold freely. but it is important to know the difference between plain water (mineral) and alkaline water [1]. In the human body has some ability to determine the acid-base balance, including at the cellular stage through chemical reactions that produce or consume H+, as well as in the blood in the aid of hydrogen carbonate, amino acids, albumin, globulin, and hemoglobin; and systemically generally by the flow of carbon dioxide from the lungs and hydrogen ions from the kidneys [2]. pH saliva contains carbonate which serves as a buffer for maintaining acid-base acids in the oral cavity. The pH of the oral cavity may be caused by many factors such as the frequency of eating containing sugar, the effect of drug use, systemic disease (reflux), gestation, stress, or eating acidic foods, the pH of the oral cavity becomes altered, resulting in addition to the process of caries becoming rapid also the dry mouth, and halitosis (bad breath) [2, 3]. As a dental health consideration, dental erosion is determined by a decreased tooth structure due to chemicals [1]. The average oral cavity has a pH of 6.3 but when the pH of the oral cavity decreases below 5.5 the demineralisation of the enamel begins, and the lower the pH of the ingested element, the demineralisation rate increases. People began to use AIW as an option to help in the intervention of several diseases as anti-diabetic [4], benefits in the body's metabolic process [5]. Several researchers related to the personal effects of AIW on other systemic diseases [3, 6-9] are summarized in the news report of Clinical Research Studies Relating to Ionized Water [10]. Ionizer alkaline water searches for free radicals and converts them into oxygen that the body can apply as the push to develop cells and tissues. Cancer and most diseases can't live in alkaline environments and oxygenation [10]. Some studies suggest that in some countries like Korea and Japan acknowledged the efficacy of AIW as a novel material for the progress of abnormal intestinal fermentation, chronic diarrhea, gastric hyperacidity and dyspepsia [3, 11]. It was reported that intake of AIW has various beneficial effects including removal of reactive oxygen species, improving constipation, suppressed collection of body fats, early ejection of melamine, reduction of ultraviolet radiation-induced skin damage, transition of immune reaction and ameliorating diabetes [11, 12]. That electrolytes oxidizing water may be a useful disinfectant for hospital infections, but its clinical application has still to be evaluated [13]. Acid levels in the oral cavity may be affected by external sources of the oral cavity, eg patients with reflux diseases. Jamie A. Kaufman reports that an AIW intake of pH 8.8 has the ability to support its hydrochloric acid, far exceeding conventional water pH [14]. In the area of dentistry, the clinical trial on the potency of AIW as a gargle has not been done much inquiry. One report in the area of dentistry where dental prothesis soaked in AIW solvent in 1 minute can dilute Staphylococcus aureus 209P bacterium on the control surface of a prosthesis [15]. According to BM Eley that gargle to suppress plaque, like anti-plaque and anti-gingivitis from agents, need to be considered for potency, guard and potential clinical purpose [16]. The use of mouthwash is quite widespread by the public, because the mouthwash is sold freely in stores, supermarkets or supermarkets, the public only knows the effects of mouthwash to prevent bad breath alone, without knowing the side effects when using with a long time. Based on the problem, the researcher is interested to know whether AIW solution has function like function of mouthwash that can inhibit plaque formation?

MATERIALS AND METHODS

Quasi-experimental research with pre-post with control design, with a sample of the student of Dentistry Faculty of Hasanuddin University 2nd semester as many as 20 people. The sampling method used is purposive sampling. The number of samples using the Federer formula that the sample size of each group of at least as many as 5 people. The treatment group was 4 groups, ie gargling group AIW 7, pH 9, pH 11.5 and positive control group (chlorhexidine). The AIW pH level is known from the label listed on the AIW bottle. This study received approval from the ethics research committee of the Faculty of Medicine, Hasanuddin University. The stage of the research process includes an examination of pH, salivary colonies and plaque state. For measurement of salivary pH and bacterial colony, 4 measurements were done before the intervention, first day, third day and seventh day. The check is done in the morning between the hours of 9-11 AM. Each group performed a 10 ml mouthwash for 3 seconds in the morning and afternoon after brushing for 7 d in a row. Measurement of salivary pH with pH meter, saliva taken captured in a sterile

container. And some saliva is needed to check bacterial colonies. The taking of saliva in this method is the method of separation. Bacterial colonies were calculated by Plate Count Agar method (PCA) and measured in units of CFU/ml concentration. Assessment of plaque using Quigley-Hein Plaque Index is done in the morning between 09:00 and 11:00. Participants were instructed not to eat, drink, and oral hygiene habits for 2 h before assessment. The plaque was scored according to the Turesky modification of the Quigley-Hein Plaque Index. A score of 0-5 is assigned to each buccal and lingual surface, examination of the surface of all the teeth The following criteria: score 0: No plaque; score 1 is the plaque present on the cervical surface of the tooth; Score 2 is a thin plaque up to 1 mm thick on the servibal surface of the incisal tooth; Score 3 is a plaque that covers the tooth surface of less than 1/3 of the crown surface of the tooth; Score 4 is a plaque that covers the tooth surface at least 1/3, but less than 2/3 of the crown surface of the tooth; Score 5 is a plaque that covers 2/3 or more surfaces of the dental crown [17].

RESULTS AND DISCUSSION

Table 1 shows the statistical distribution of colony counts before and after the AIW solvent rinsing for all intervention groups and there was a significant difference in amounts of colonies in saliva before and after AIW solvent rinsing for pH 7, pH 9, pH 9.5 and pH 11.5. Anova statistic test results obtained p-value<0.05.

Table 1: Difference of mean values of bacterial Colonies (CFU) before and after treatment of AIW solution gargle

Experiment group	Before (mean±SD)	After the first day (mean±SD)	After the third day (mean±SD)	After the seventh day (mean±SD)	p values*
AIW pH 7	5.0842 x 10^6± 4.711555 x 10^6	4.702 x 10^5±4.44714 x 10^5	3.0988 x 10^6±3.249558 x 10^6	8386 x 10^5±9.59582 x 10^5	0.043
AIW pH 9,00	4.142 x 10^6±3.096582 x 10^6	2.066 x 10^5±2.92961 x 10^5	4.0522 x 10^6±3.034107 x 10^6	5.5482 x 10^5±6.15899 x 10^5	0.012
AIW pH 9,5	1.88542 x 10^6±1.940792 x 10^6	3.604 x 10^5±4.40999 x 10^5	2.71 x 10^6±3.043846 x 10^6	1.30522 x 10^5±2.128146 x 10^5	0.019
AIW pH 11,5	1.0342 x 10^6±1.442579 x 10^6	1.6522 x 10^5±1.51808 x 10^5	3.25 x 10^6±2.2154 x 10^6	5.784 x 10^5±3.81343 x 10^5	0.033

*Analysis of Variance Test → p<0,05 (Significant) table 2, shows that the salivary pH from the third day to the seventh day for all intervention groups was obtained pH saliva can exist maintained in an AIW pH>7.

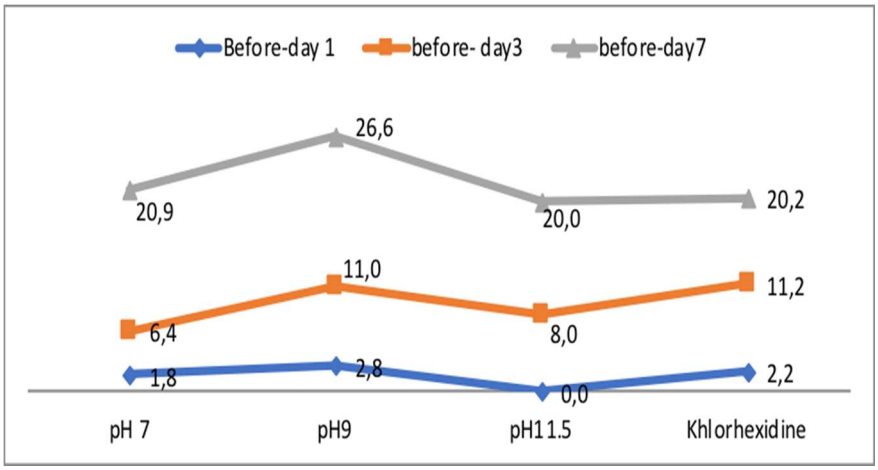

Fig. 1: Percentage reduction plaque before-after base on pH of AIW

Fig. 1 shows the potency of each AIW pH level for plaque decrease before and after the intervention. For AIW pH 7 before and after intervention for the first, third and seventh days severally were 1.8%, 64,% and 20.9%. For AIW ph scale 9 was 2.8%, 11.0% and 26.6%. For AIW the pH of 11.5% is 0%, 8% and 20.0%, whereas Chlorhexidine gargle, is a gargle as a standard gold, severally as follows 2.2%, 11.2% and 20.2%. Noting the effect of plaque decrease after 7 d intervention from 4 groups, AIW pH 9 was greater than plaque reducing percent compared to chlorhexidine gargle.

Fig. 2 shows the potency of the AIW solvent between the time of the first day, the third and the seventh day that an AIW solvent of pH 9 has an effectual plaque decrease of 24.5% higher when compared with a chlorhexidine solvent of 18.4%.

Table 2: Differences of mean value of pH saliva before and after treatment of AIW solution gargle

Experiment group	Before (mean±SD)	After the first day (mean±SD)	After the third day (mean±SD)	After the seventh day (mean±SD)	p values*
AIW pH 7	6.8±0.45	6.8±0.45	7.6±0.55	7.6±0.55	0.047
AIW pH 9,00	6.60±0.55	6.40±0.55	6.80±0.45	7.8±0.45	0.015
AIW pH 9,5	6.80±0.45	6.40±0.55	7.20±0.45	7.00±0.71	0.131
AIW pH 11,5	7.60±0.45	6.80±0.45	7.20±0.45	7.60±0.55	0.116

*Analysis of Variance Test → p<0,05 (Significant)

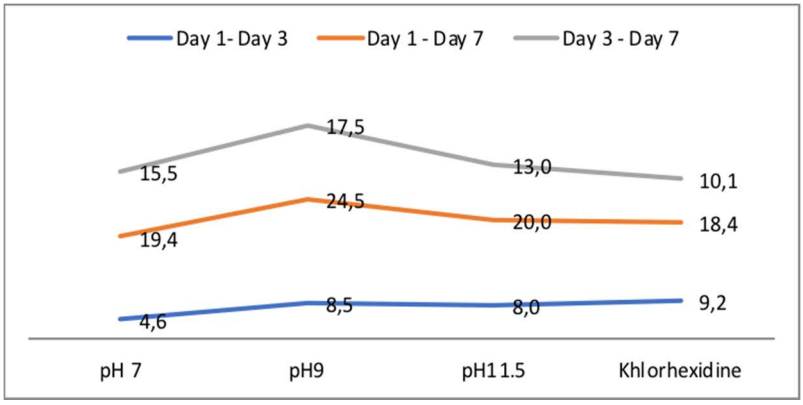

Fig. 2: Percentage of reduction plaque on based after Day 1, day 3 and day 7

The effort to remove dental plaque has been done in several methods, mechanical plaque control is the most common method of plaque control. Generally mechanically using toothbrush and toothpaste. Toothpaste contains basic ingredients and active ingredients. Active substances including chemicals contain Fluoride and combined with antibacterial ingredients. mouthwash by the community is increasingly widespread and knowledge of the correct use has not many people know. Due to old and irregular mouthwash will affect the normal state of flora in the mouth. The impact appears other diseases in the oral cavity like mucosal abnormalities. This chemical activity of mouthwashes is an adjuvant for mechanical removing of plaque [18]. Acid production by dental plaque is a key factor in the caries process. Using simple tests this process can be demonstrated to patients and used to screen patients for pathogenic plaque [19]. According to research Diane Osso explains supporting the effectiveness of antiseptic mouth rinses in reducing plaque and gingivitis as an adjunct to home care. Insufficient evidence is available to support the claim that antiseptics can reduce the risk of developing periodontitis or the rate of progression of periodontitis [10]. Regular supragingival plaque is essential in maintaining proper oral hygiene and preventing caries and periodontal disease [20]. The salivary pH tends to be acidic while the tongue pH tends to be alkaline. Gargling of triclosan solution and essential oils increase salivary pH rapidly after rinsing [21].

Taking into account the results of this study where AIW pH 9 is a treatment group that can inhibit the growth of plaque form by 26.6%, is the same result with a mouthwash containing chlorhexidine. This inhibitory mechanism is due to the pH of AIW can maintain salivary pH levels in normal pH. The results of this study the condition of saliva pH at treatment time to 7 d, pH saliva remain above pH 7. consequently bacteria in the mouth can not develop. Proven results of this study there are differences in the number of colonies before and after treatment.

The development of active ingredients in mouthwash by leaps and bounds, especially active ingredients from herbs. As the results of research from Bhat Nagesh *et al.* [22]. Obtained no difference in the antimicrobial property between the two types of mouthwash (Chlorhexidine and Herbal). It was concluded the herbal and chlorhexidine mouthwash were equally effective invitro suggesting that herbal mouthwash may be therapeutically in the future to inhibit oral microbial growth [22]. What is interesting is the finding that from participants who cleaned their teeth before the examination, still have plaques that look almost a third of their teeth. This gives an indication of the ability to clean dental plaque is still lacking [17]. Research on the effectiveness of mouthwash has been done from different active ingredients and as a comparison is a chlorhexidine as the standard gold ingredient. Mouthwashes containing chlorhexidine digluconate (CHX) as a standard gold rinse have been shown to be effective against gram positive and gram negative oral microorganisms [23, 24]. It was concluded that chlorhexidine is still the best mouthwash available [25]. Another research like using gel agent can reduce plaque reduced by 45% as measured by control agents [26].

After two weeks of use, the essential oil (Eos) rinse was superior to cetylpyridinium chloride (CPC) rinse inhibiting the development of gingivitis, plaque and haemorrhage, with a reduction of 9.4% and 6.6 % compared to CPC for gingivitis and plaque. Both rinses are superior to the negative control rinses [8]. The results of the present study indicated that Aloe vera may prove an effective mouthwash due to its ability in reducing dental plaque. This result resembles the results of the effectiveness of herbal mouthwash and chlorhexidine as effectively as *in vitro* which suggests that herbal mouthwash can be used therapeutically in the future to inhibit oral microbial growth [22]. According to Eley BM, that mouthwashes as anti-plaque have no place in the treatment of existing periodontal disease, either gingivitis or periodontitis since they can't reach the sub-gingival environment or penetrate thick layers of established plaque [16]. So from the results of this research need to do further research on the effectiveness of AIW solution as an alternative in the treatment of periodontal disease.

CONCLUSION

This study resulted in the gargling of AIW solution pH 9 having the effective strength of reducing the amount of plaque in the mouth (26.6%) like effective mouthwash containing Chlorhexidine, it indicates that Alkaline ionised water (AIW) with pH 9 is useful for health generally as drinking water, can also be used as a function as a mouthwash.

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AUTHORS CONTRIBUTIONS

BDP as a design and participate in conducting research, analyzing data and compiling articles.

CONFLICT OF INTERESTS

The authors report no conflict of interest

REFERENCES

1. Wright KF. Is your drinking water acidic? a comparison of the varied pH of popular bottled waters. J Dent Hyg 2015;89:6-12.
2. Huang YR, Hung YC, Hsu SY. Kangen water proof book table of contents. Food Control 2008;19:329-45.
3. Mousa HAL. Health effects of alkaline diet and water, reduction of digestive-tract bacterial load and earthing. Altern Ther Health Med 2016;22**:**24-33.
4. JIN D. Anti-diabetic effect of alkaline-reduced water on OLETF rats. Biosci Biotechnol Biochem 2006;70:31-7.
5. Burckhardt P. The effect of the alkali load of mineral water on bone metabolism: interventional studies. J Nutr 2008; 138:435S-437S.

6. Rubik B. Studies and observations on the health effects of drinking electrolyzed-reduced alkaline water. WIT Transactions Ecol Environ 2011;153:317-27.
7. Kunathathorn W, Thamtiwat N. Homeostasis effect after drinking alkaline water; 2011. p. 1-6.
8. Charles CA, McGuire JA, Sharma NC, Qaqish J. Comparative efficacy of two daily use mouthrinses: randomized clinical trial using an experimental gingivitis model. Braz Oral Res 2011;25:338-44.
9. Weidman J. Effect of electrolyzed high-pH alkaline water on blood viscosity in healthy adults. J Int Soc Sports Nutr 2016;13:1-13.
10. Water AI. Clinical research studies relating to ionized water; 2002. p. 1-40.
11. Ignacio RMC, Joo KB, Lee KJ. Clinical effect and mechanism of alkaline reduced water. J Food Drug Anal 2012;20:394-7.
12. Hayakawa T, Tushiya C, Onoda H, Ohkouchi H, Gifu H. Physiological effects of alkaline ionized water: effects on metabolites produced by intestinal fermentation. Alkaline Water and Intestinal Fermentation; 2017. p. 1-2.
13. Vorobjeva NV, Vorobjeva LI, Khodjaev EY. The bactericidal effects of electrolyzed oxidizing water on bacterial strains involved in hospital infections. Artif Organs 2004;28:590-2.
14. Koufman J, Johnston N. Potential benefits of pH 8.8 alkaline drinking water as an adjunct in the treatment of reflux disease. Ann Otol Rhinol Laryngol 2012;121:431-4.
15. Nagamatsu Y, Tajima K, Kakigawa H, Kozono Y. Application of electrolysed acid water to sterilissation of denture base part 1: examination of sterilisation effects on resin plate. Dent Mater J 2001;20:148-55.
16. Eley BM. Antibacterial agents in the control of supragingival plaque-a review. Br Dent J 1999;186:286-96.
17. Barnett ML. The rationale for the daily use of an antimicrobial mouthrinse. J Am Dent Assoc 2006;137:S16-S21.
18. Ghapanchi J, Moattari A, Lavaee F, Shakib M. The antibacterial effect of four mouthwashes against streptococcus mutans and escherichia coli. J Pak Med Assoc 2015;65:350-3.
19. Walsh LJ. Dental plaque fermentation and its role in caries risk assessment. Int Dent South Africa 2006;1:4-13.
20. Sadatullah S. Ozonated water an adjunct to tooth brushing and flossing. Myth or Reality; 2012. p. 1847-52.
21. Tolentino E-de S, Chinellato LEM, Tarzia O. Saliva and tongue coating pH before and after use of mouthwashes and relationship with parameters of halitosis. J Appl Oral Sci 2011;19:90-4.
22. Bhat N, Mitra R, Reddy JJ, Oza S, Vinayak KM. Evaluation of efficacy of chlorhexidine and a herbal mouthwash on dental plaque: an *in vitro* comparative study. Int J Pharma Bio Sci 2013;4:625-32.
23. Patrice J. Chlorhexidine mouthrinse as an adjunctive treatment for gingival health; 2010.
24. Jose A. A randomised clinical study to evaluate the efficacy of alcohol-free or alcohol-containing mouthrinses with chlorhexidine on gingival bleeding. Bdj 2015;219:125-30.
25. Venkataraghavan K, Shah S, Choudhary P, Shah S, Trivedi K. Effectiveness of a new generation anticavity mouthwash on streptococcus mutans and lactobacillus acidophilus count: a microbiological study. World J Dent 2014;5:152-6.
26. Schmiedebergs N, Pharmacol A. HHS Public Access; 2017;6:1-23.