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# Effectiveness of Rinsing the Mouth Using Solution of *Aloe vera* 25%, 50%, 75% and 100% on *Streptococcus mutans* Colony in Saliva

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**Abstract:** ***In general, the plaque firmly attached to the tooth surface has considerable potential for the occurrence of the disease in hard tissue of teeth and supporting tissue, a condition caused by plaque contains. various kinds of bacteria. Diseases that occur in hard tissue of teeth and the supporting tissues can be prevented with the use of Aloe vera asAaloe vera contains various active substances including saponins, the active substance has the ability to clean and can be called as a substance washers (detergent) was good. Detergents have the ability to lower the surface tension and loosen debris with gear that will help purge tartar. This study uses a true experiment design research laboratory, while sampling by purposive sampling of 25 people taken in Posyandu, Village of Pondok Labu, South Jakarta and laboratory test in the Laboratory of the Department of Polytechnic Jakarta III Analysts Health Programs in October 2016. The data processing using Kruskal Wallis test and Post-Hoc test Mann Whitney. Statistical test results with test Kruskal- Wallis test aloe vera with 100% concentration can inhibit the growth of Streptococcus mutans was obtained p = 0.12 (p<0.05), meaning that significant with inhibition zone of 18.66 mm.***

**Keywords:** *inhibition, Aloe vera, Streptococcus mutans*

## 1. Introduction

Basic health research data (RISKESDAS) in 2013 by the Ministry of Health of Indonesia 25.9 percent of Indonesians have dental and mouth problems in the last 12 months (potential demand). Among them, 31.1 percent received treatment and treatment from dental workers (dental nurses, dentists or dentists specialists), while another 68.9 percent were not treated (Riskesdas, 2013).Results of basic health research in 2007 showed that the prevalence of dental and oral health problems of Jakarta Capital City was 29.1%, and only 31.2% received treatment. Jakarta Prevalence Rate is generally higher than National prevalence.Caries is an infectious disease caused by the bacteria, especially *Streptococcus mutans* in the oral cavity that its existence is very influenced by eating habits or input sucrose (Sundoro. HE 2005).There oral cavity saliva has a protective function in maintaining oral health, general examination often developed to detect caries risk factors, one of which is a test of *Streptococcus mutans*. With presence in the cavity mouth indicates a cariogenic infection, (Sundoro, HE 2005). *Streptococcus mutans* is a bacterium that causes dental caries due Capable of immediately producing acid (the asidogenic properties) of fermentable carbohydrates. These bacteria can thrive in an acidic atmosphere (asiduric properties) and can stick to the tooth surface. Because of its ability to make extra-cell polysaccharide very sticky from carbohydrate foods (Kidd, & Joyson S, 1992).To prevent caries can be done by maintaining dental and oral hygiene, either by brushing teeth with fluoride toothpaste and by gargling antiseptic liquid. Aloe vera contains various kinds of active substances as antiseptic. *Acemannan saponin* is the active substance which has ability to clean / as a rinsing agent / detergent good and antiseptic, while *Acemannan* as antivirus, anti-bacterial, anti-fungal, and can destroy tumor cells, as well as increase endurance (Fitriana, 2005). Based on the facts and phenomena that occur at the top, the researchers are interested in doing research on this matter.

## 2. Methods

The study design was true experiment laboratory , because of its sampling is done randomly and interventions.The independent variables were Aloe vera solution with a concentration of 25%, 50%, 75% and 100%. And dependent variable was Bacteria *Sreptococcus mutans* in subjects saliva subject. The samples were *Streptococcus mutans* from saliva on subject appropriate research with predefined criteria. Before starting the study, researchers must obtain approval from the ethics committee and the permission of the Chairman of the Department of Nursing Dental Health Polytechnic Jakarta I. Providing information about the research to be conducted. Selection of research subjects is done by taking saliva in the morning, if willing to be the subject of research then sign a consent form (informed concent). Subjects were instructed to spit in a sterile pot as much as 3-5cc then stored in the refrigerator. Data collection was obtained from the observation and direct observation in the lab, where activities include: Viewing, recording and counting of important data related to this study. Data is collected directly by the researcher by counting the number of *Streptococcus mutans* before and after rinsing solution of aloe 25%, 50%, 75% and 100% ( *Aloe vera).*The data obtained in this study is data on the number *of Streptococcus mutans* before the respondent is given the treatment and the data amount of *Streptococcus mutans* after the respondent is given rinsing treatment with *Aloe vera* solution at a certain concentration in each treatment group. Then the data were analyzed by comparison of two mean the two groups to compare or distinguish whether both mean the same or different. Useful to test the ability of generalization (significant research in the form of a variable state comparison of two sample average.The first test using Kruskal Wallis test, the test is to determine or test the difference whether there are differences in the value of inhibition zone against the concentration of the test solution.

The second test using test *Post-Hoc Mann Whitney* test or the test is to determine the ratio between the concentration of the treatment groups against *Streptococcus mutans*

## 3. Result

This research shows that *Aloe vera* extracts could inhibit the growth of bacteria *Streptococcus mutans* . Having in mind the effectiveness of the inhibition of microorganisms from *Aloe vera* extract, the inhibition test is then performed to determine how much inhibition or inhibition zone of *Aloe vera* extract on the growth of *Streptococcus mutans* is based on the results obtained. The results of observations of the effectiveness of inhibitory after an incubation period of 24 hours shown in Figure 1.

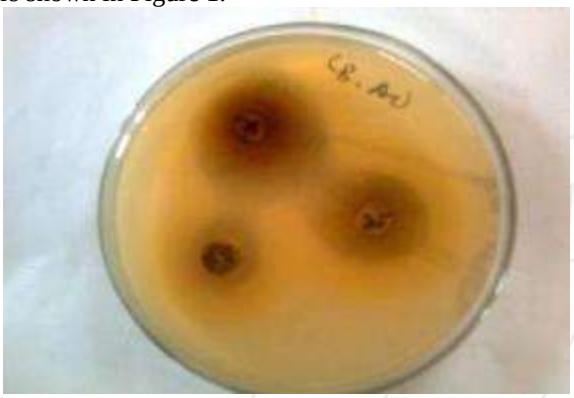

**Figure 1:** Inhibition effectiveness image

Research on the effectiveness of the inhibition of aloe vera with a paper disc diffusion method of Kirby-BAURER on the growth of *Streptococcus mutans* have been conducted with three treatments, the concentration of 25%, 50%, 75% 100%, amoxicillin and distilled water. Inhibition zone measurement results of each treatment can be seen in the table below

**Table 5.1:** Inhibition Zone Diameter Aloe vera against *Streptococcus mutans*

| Replication | Concentration | | | | Control | |
|---|---|---|---|---|---|---|
| | 25% | 50% | 75% | 100% | Amoxcillin | Aquades |
| I | 10 | 15 | 15 | 19 | 19 | 0 |
| II | 9 | 15 | 16 | 18 | 19 | 0 |
| III | 11 | 16 | 17 | 19 | 20 | 0 |
| Jumlah | 30 | 46 | 48 | 56 | 58 | 0 |

| Mean | 10 | 15,33 | 16 | 18,66 | 19,33 | 0 |
|---|---|---|---|---|---|---|
| level | Less | Moderate | Strong | Very Strong | | |

Inhibition zone measured including paper and disc diameter in millimeters (mm) From Table 5.1 shows that the solution of *Aloe vera* has the ability to inhibit the growth of *Streptococcus mutans* . At a concentration of 100% has a power resistor value by an average of 18.66 mm, which is higher than the concentration of 75%, 50%, 25%, each of which has a value of respectively 16 mm, 15.33 mm, 10 mm. The results showed a minimum inhibitory concentration of *Aloe vera* that they can inhibit the growth of *Streptococcus mutans* is at a concentration of 25%, which establish the average diameter zone of inhibition of 10%. Comparator antibiotics are amoxicillin-clavulanate formed inhibitory zone diameter with an average diameter of 19.00 mm. The result of inhibition zone diameter (Table 3) and then analyzed using ANOVA test, but to perform ANOVA test, previously had to qualify the distribution of normal data to test data normality and variance data that must be homogeneous with the homogeneity test. Of the second proviso to test ANOVA test this, the data normality test section for the results of amoxicillin clavulanate and concentration of *Aloe vera* have a normal distribution of data p <0.05, while for the data distribution of distilled water (distilled water) and a 25% concentration of *Aloe vera* and 50%, 75%, the result was not obtained because the distribution obtained a constant value, thus omitted, therefore ANOVA test can not be done because it does not qualify ANOVA, alternatively Kruskal-Wallis test Obtained the following results:

**Table 5.2:** Distribution of average inhibition zone diameter results in a concentration of *Aloe vera* to the colonies *Streptococcus mutans* in saliva

| Variable | N | Mean Rank | p value |
|---|---|---|---|
| control | 3 | 13,33 | |
| concentration 25% | 3 | 2,00 | |
| concentration 50% | 3 | 5,83 | 0,012 |
| concentration 75% | 3 | 7,17 | |
| concentration 100% | 3 | 11,67 | |

In the Kruskal Wallis test, obtained p = 0.012, for p <0.05, it can be concluded there are significant differences in the value of the diameter of inhibition zone the concentration of test solution, but to find out between which the test solution which have different, then analyzed *post hoc (Mann Whitney)* for each test solution. Man Whitney test results obtained value of p as following:

**Table 5.3:** Test Results Summary of *Post-Hoc Mann Whitney* effectiveness of *Aloe vera* Power Inhibitory Concentrations between Each treatment against *Streptococcus mutans* Comparison between concentrations

| Comparison among *Aloe vera* solution | | p (p<0,05) | Meaning |
|---|---|---|---|
| **100%** | 25% | 0,046 | There is difference |
| | 50% | 0,043 | There is difference |
| | 75% | 0,460 | No difference |
| | **control** | **0,197** | No difference |
| **75%** | 25% | 0,050 | There is difference |
| | 50% | 0,346 | No difference |
| | Control | 0,046 | There is difference |
| **50%** | 25% | 0,046 | There is difference |
| | Control | 0,043 | There is difference |
| **25%** | Control | 0,046 | There is difference |
| | | | |

The test results *of post-hoc maan Whitney* shows that there is a significant difference (p <0.05) of any comparison between concentrations of *Aloe vera* and comparison with the positive control.

## 4. Discussion

In this study, use of sterile distilled water (distilled water) as a negative control of diluting solution, which does not have the ability to inhibit the growth of *Streptococcus mutans* as

evidenced by the formation of inhibition zone. The use of amoxicillin-clavulanate 30 mg / disk as the comparator antibiotics in this study is that amoxicillin is a semisynthetic antibiotic having a broad spectrum of the Gram-positive and Gram-negative bacteria. Amoxicillin works as bactericidal against susceptible microorganisms through inhibition of the biosynthesis of the cell wall by binding Penicillin Binding Proteins (PBD). Clavulanic acid has the ability as inhibitors of beta-lactamase enzymes. Amoxicillin-clavulanate have proved active against bacteria *Streptococcus mutans* that do not produce beta-lactamase and beta-lactamase-producing ( *www.fda.gov* , 08.09.2016; Kaur, SP, et al., 2011: 33). Amoxicillin clavulanate in this study were used as positive controls had an average diameter of 19.00 mm zone of inhibition. According to Clinical and laboratory Standards Institute in the Christian, N., (2010: 92) states that the standard interpretation of inhibition zone against the antibiotic amoxicillin-clavulanate *Streptococcus mutans* is <19mm categorized resistant and> 20mm categorized as sensitive. So the activity of amoxicillin clavulanate towards *Streptococcus mutans* in this study is intermediate.Table 5.1 shows that increasing concentrations of treatment can increase the sensitivity of *Streptococcus mutans* , which is indicated by the increase in the diameter of inhibition zone. The test results showed that the concentration of 25%, 50%, 75% and 100% aloe vera has antibacterial activity on the growth of *Streptococcus mutans* . The inhibitory activity is indicated by an inhibition zone around the paper disk. According to Pratt (2005: 40) clear zone around the paper disk showed antibacterial activity. From the research that has been done the higher concentration of *Aloe vera*, the more extensive the resulting inhibition zone diameter. This is due to the high the higher the concentration of active substance therein so as to produce a broader inhibition zone. Pelczar and Chan (1988: 453) states the higher concentration of an antimicrobial agent, then higher its effect. According to Pan, et al (2009.599), the diameter of inhibition zone formed can be categorized based on the reduced diameter inhibition zone 5 mm diameter paper disc. The diameter of inhibition zone owned *Aloe vera* on growth of *Streptococcus mutans* at a concentration of 100% categorized as very strong, at a concentration of 25%, 50%, 75% categorized as moderate, inhibitory zone formed by *Aloe vera* when compared to the antibiotics used illustrate that the bacterium *Streptococcus mutans* is resistant to *Aloe vera*. This suggests that the extract of *Aloe vera* juice effectively comparable to amoxicillin clavulanate in the treatment Apsari According to the study, PD, and Susanti, H (2011: 37) and Tina, R., (2009: 17), the *Aloe vera* contains anthocyanin compounds, tannins and saponins. This is because the water solvent in this study serves to dissolve the active substance in Rosella flower petals in the form of flavonoids and anthocyanins. (Www.lpi.oregonstate.edu, 10.27.2016). Anthocyanins are water soluble pigments that are naturally present in various types of *Aloe vera*. juice. The higher the concentration, the higher anthocyanin content in the steeping. This is consistent with research Schaefer, Renzsch, and BAURER in 2008: 1269 to indicate that the darker the color of the plant, the higher the anthocyanin content the higher the effect produced by the anthocyanin. The active substance which causes red anthocyanins in these plants contain delfinidin-3-siloglukosida, delfinidin-3-glucoside, sianidin-3-siloglukosida. Anthocyanins can inhibit the oxidation of glucose and binding of iron needed by the bacteria so as to inhibit the metabolism of bacteria. Antibacterial mechanism works by interfering with cell respiration process, inhibit the enzyme activity of bacteria, suppress the translation of certain product regulation, and hinder the normal synthesis of the bacterial cell wall. Synthesis abnormal cause osmotic pressure inside the bacterial cell is higher than the outside of the cell, then the damage to the bacterial cell wall which would cause leakage of bacterial cells (Riwandy, A., 2014: 34). In the extract of aloe vera juice contains tannins that are antibacterial. This is because the tannin has characteristics that can be dissolved in water so that these substances can come out in a solution of *Aloe vera* (www.ansci.cornell.edu, 10.24.2016). In research Akiyama (2001: 488), tannins can inactivate bacteria cell adhesin, causing cell lysis thereby inhibiting bacterial cell growth. In addition, tannins forming a stable bond with the protein, causing coagulation of protoplasm bacteria. Other Ingredients contained in the juice is saponin. Saponin has the characteristics of easily soluble in water. When treated with water and carried by strong agitation will form durable foam (www.farmasi.asia). Saponin is a strong quaternary ammonium compounds that can reduce the surface tension of the cell (Miranti, M., Prasetyorini, Suwary, C., 2013: 15). According to the journal Alvato et al in 2006 (Rahayu, ID, 2009: 32) states saponin have a high activity against bacteria gram positve, such as *Bacillus sublitis, Bacillus cereus, Staphylococcus aureus, Streptococcus* and *Enterococcus faecalis.* The absorption of saponin on the cell surface will create permeability rise resulting in damage or leakage of the cell membrane, so that the essential ingredients needed by the bacteria for life is lost and can cause cell death. This study has limitations include a measurement that does not use measuring calipers so that the less scrupulous, and the use of paper disc has not been standardized so that the absorption is less than perfect.

## 5. Conclusion

From the research that has been done on the effectiveness of *Aloe vera* inhibition against the bacteria *Streptococcus mutans* can be concluded that *Aloe vera* known solution concentration of 25% has a 10 mm zone of inhibition against the bacteria *Streptococcus mutans* in saliva. *Aloe vera* known solution has a concentration of 50% inhibitory zone was 15.33 mm against the bacteria *Streptococcus mutans* in saliva . Unknown solution concentration of 75% *Aloe vera* has a 16 mm zone of inhibition against the bacteria *Streptococcus mutans* in saliva. Aloe vera known solution 100% concentration had inhibitory zone 18.66 mm against the bacteria *Streptococcus mutans* in saliva . Unknown most effective inhibitory zone aloe vera solution with a concentration of 100% against *Streptococcus mutans* in saliva. Statistical test results with test *Kruskal-Wallis* obtained p value of 0.012, meaning at alpha 5% seen no significant differences concentration of aloe vera to the inhibition of *Streptococcus mutans* colony in saliva. Statistically *Aloe vera* solution with a concentration of 100% can inhibit the growth of *Streptococcus mutans*, the inhibition zone was 18.

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