





Solution Inhibitory of Ant Nest (*Myrmecodia Pendans*) Extract on the Formation of Plaque in Children with Early Childhood Caries


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Abstract

Objective: To evaluate the effectiveness of gargling the solution of ant nest extract against plaque formation in children who experience Early Childhood Caries (ECC) when used as a mouthwash. **Material and Methods:** This study uses a pretest-posttest design with a control group. Thirty children with ECC, which were divided into three groups, namely the treatment group which was given a solution of extracts of ant nests concentrations of 5% and 10% and the control group gargling Aquades. Plaque scores were measured using the Greene and Vermillion method before and after the intervention. The paired t-test was used, with a significance level of 0.05. **Results:** Significant differences were found before and after the treatment of ant nest extract ($p < 0.05$). The increase in OHI-S mean in the control group before treatment was 2.41 ± 0.72 and after treatment 2.53 ± 0.69 while in the treatment group there was a decrease in the OHI-S average in the group of 5% before treatment 2.66 ± 0.90 and after treatment 2.29 ± 0.95 and group concentration of 10% before treatment 2.51 ± 0.89 and after treatment 1.82 ± 0.75 . **Conclusion:** The distribution of ant nest extract solution extract with the concentration of 5% and 10% would be more effective with ant nest concentration of 10% where it can inhibit dental plaque formation, and there is a significant difference in mean plaque scores between the control group and the treatment groups.

Keywords: Dental Plaque; Phytotherapy; Plants, Medicinal; Plant Extracts.

Introduction

Oral and dental health is one component of general health and is also the most important factor in the normal growth of children. Oral health problems can affect children's general development, general body health, and can also have a negative impact on the quality of life. One of the dental and oral health problems that occur in children is dental caries [1].

Dental caries is a localized infectious disease that attacks the hard tissues of the oral cavity, which is teeth, and involves Positive Gram is *Streptococcus mutans* [1]. Common baby teeth caries type is Early Childhood Caries [2]. Caries in baby teeth or Early Childhood Caries (ECC) is the most common chronic disease in children, describing public health problems that affect infants and preschoolers around the world, especially disadvantaged people both in developing countries and industrialized countries [3]. Caries is often found in children under five years of age (toddlers), with the highest spread in children aged three years [2].

In Indonesia, the prevalence of caries in children aged 3-5 years continues to increase. The prevalence of caries in children under five in Indonesia is around 90.05%. Because the high prevalence can affect the quality of life of children and has a high risk of caries for baby teeth, the ECC is the most serious condition that can harm children [3]. This shows a lack of attention of parents, especially mothers, to maintain dental health and the mouth of the child [4].

There are three types of early childhood caries (ECC), namely: a) Type I ECC (mild to moderate), there are lesions in the molar and or incisors (often occurring between the age of two and five years); b) ECC type II (moderate to severe), there are lesions in the labial and palatal parts of the maxillary incisors and permanent molars, and c) ECC type III (severe), almost all teeth, including mandibular incisors [3].

Etiology of ECC is very complex and is influenced by mineralization of primary teeth, diet, breast milk or bottle milk, sugar-containing foods or drinks, frequent consumption of cariogenic foods and drinks between meals, poor habits and poor oral hygiene lead to the early colonization of acidogenic microorganisms and development plaque. Below will be discussed the risk factors for ECC. Socioeconomic status has been reported as an important risk factor for ECC in several studies, especially in low-income communities. Children from low-income families had a decay, missing, and filled teeth score (dmft) four times higher than children from high-income families, this was due to the high cost of dental care. The high dmft score is related to the level of parental education, and their knowledge of dental health can also be associated with ECC. A study of 149 Hispanic children in San Francisco, USA, showed a significant correlation between maternal education level and ECC [5,6].

Kelor (*Moringa Oleifera*) is a type of tropical plant that is easy to grow in tropical regions such as Indonesia. Moringa plants are shrub plants with a height of 7-11 meters and thrive from lowlands to an altitude of 700 meters above sea level. Moringa can grow in tropical and subtropical regions on all soil types and is resistant to drought with drought tolerance of up to 6 months [7].

Ant nest is one part of the Moringa plant that has been investigated for its nutrient content and usefulness. Ant nests are very rich in nutrients, including calcium, iron, protein, vitamin A, vitamin B, and vitamin C. Ant nests contain higher iron than other vegetables, which is 17.2 mg / 100 g. In addition, ant nests also contain various kinds of amino acids, including amino acids in the form of aspartic acid, glutamic acid, alanine, valine, leucine, isoleucine, histidine, lysine, arginine, phenylalanine, tryptophan, cysteine, and methionine. Based on the research conducted by Ant nests contain phenols in large quantities known as antidotes to free radical compounds. Phenol content in fresh ant nests is 3.4% while in ant nests that have been extracted is 1.6% [8].

Ants Nest extracts (*Myrmecodia pendans*) with ethanol solvents play a very significant role in *Staphylococcus aureus* and *Escherichia coli* bacteria. The amount of active antimicrobial compounds contained in extracts affects the inhibitory produced. Ant nest extract using ethanol solvents can attract most of the active compounds contained in ant nests, and from the results of these studies, there has been the same method, so there is no difference; thus it shows the appropriate results that the ant nest has compounds that can inhibit bacterial growth. The results of this study also provide the same results that the use of ethanol solvents to extract active compounds in ant nests provides a zone of inhibition of tested bacteria [6,8,9].

The purpose of this study is to know the presence of the influence of Kelor leaves extract solution against the formation of teeth plaque of children with early childhood caries.

Material and Methods

Study Design

The type of research used was laboratory and field experiments with the design of Pretest-Posttest with the control group at the Phytochemical Laboratory of Faculty of Pharmacy, Hasanuddin University, TK Al Abrar Makassar and TKIT Albina Makassar in May-July 2017.

Data Collection

All groups were measured their plaque scores based on Oral Hygiene Index Simplified (OHI-S) consisting of index debris and index calculus [7].

The sample consisted of 30 children less than 71 months (3 to 6 years-old), based on Frederer's formula, who had early childhood caries by assessing the patient's oral hygiene index after administering an ant nest extract mouth rinse using disclosing solution. The control group was composed by Aquadest and ant nest extract with a concentration of 5% and 10%.

The flow of this research began with socializing to the school concerned, filling out an informed consent sheet, examining (completeness and regularity of teeth), checking OHI-S, giving a solution of 10 mL of Moringa leaf extract orally. The treatment group of a gargle with an ant nest extract solution of 5% and 10% and left it in the oral cavity for 30 seconds, then discarded, OHI-S examination returned.

The procedure for extracting ant nests began with the stage of preparing samples, where at

this stage the ant nest was dried and milled with a blender to be made as a powder to facilitate the extraction process. The dried ant nest powder was packaged in a plastic bag and stored in the freezer before the extraction process [8]. Next, the maceration stage, ant nest extract was obtained by maceration. Ant nests were inserted into Erlenmeyer, then soaked with 96% ethanol solution, covered with aluminum foil and left for five days while stirring occasionally. After five days, the soaked sample was filtered using filter paper to produce one filtrate and one residue. The residue was then added with a 96% p.a. ethanol solution of 250 ml, covered with aluminum foil and left for two days while stirring occasionally. After 2 days, the sample was filtered using filter paper to produce two filtrates and residues. Filtrates 1 and 2 were mixed, then evaporated using a rotary evaporator; thus, the thick extract of the ant nest was obtained. The thick extract produced was put into the water bath and evaporated until all ethanol solvents were evaporated. The extract was weighed and stored in a closed glass container before being used for testing [9]. The last step was making a concentrated solution of 5% and 10% through dilution using distilled water.

Data Analysis

The data obtained were then processed using IBM SPSS Statistics Software, version 20 (IBM Corp., Armonk, NY, USA) with a paired t-test, with a significance level set at 5%.

Ethical Aspects

This research has been getting information escaped conduct with numbers: 8/H04.8.4.5.31/PP36-KOMETIK/2017 and registration number UH17010020 on April 6th, 2017.

Results

Table 1 presents the characteristics of children according to sex and age. It was found that there was an equal distribution between the sexes, more often in children aged 6 years (30%).

Table 1. Sample distribution according to demographic characteristics.

| Variables | Groups | | | | | | Total | |
|-------------|---------|------|------------------|------|-------------------|------|-------|------|
| | Control | | Concentration 5% | | Concentration 10% | | N | % |
| | N | % | N | % | N | % | N | % |
| Sex | | | | | | | | |
| Male | 5 | 50.0 | 5 | 50.0 | 5 | 50.0 | 15 | 50.0 |
| Female | 5 | 50.0 | 5 | 50.0 | 5 | 50.0 | 15 | 50.0 |
| Age (Years) | | | | | | | | |
| 3 | 3 | 30.0 | 2 | 20.0 | 2 | 20.0 | 7 | 23.3 |
| 4 | 2 | 20.0 | 2 | 20.0 | 3 | 30.0 | 7 | 23.3 |
| 5 | 2 | 20.0 | 2 | 20.0 | 3 | 30.0 | 7 | 23.3 |
| 6 | 3 | 30.0 | 4 | 40.0 | 2 | 20.0 | 9 | 30.0 |

There was a change in the oral hygiene index from before treatment and after being given treatment. It can be seen that the number of samples before the good OHI-S category was treated as 1 sample into 4 samples after the treatment, OHI-S before the treatment as many as 22 samples after

treatment there was a change to be smaller with a percentage of 21 samples and poor OHI-S after treatment. As many as 7 samples and after the treatment, the number of samples became 5. Thus, there was a significant change in the effect of gargling the solution of ant nest extract.

Table 2. Difference of gargling effectiveness of kelor leaves extract solution based on teeth and mouth cleanliness value.

| Variables | Groups | | | | | | | |
|-----------|---------|------|------------------|------|-------------------|------|-------|------|
| | Control | | Concentration 5% | | Concentration 10% | | Total | |
| | N | % | N | % | N | % | N | % |
| Pre Test | | | | | | | | |
| Good | 0 | 0 | 1 | 10.0 | 0 | 0.0 | 1 | 3.3 |
| Fair | 8 | 80.0 | 6 | 60.0 | 8 | 80.0 | 22 | 73.3 |
| Bad | 2 | 20.0 | 3 | 30.0 | 2 | 20.0 | 7 | 23.3 |
| Post Test | | | | | | | | |
| Good | 0 | 0.0 | 2 | 20.0 | 2 | 20.0 | 4 | 13.3 |
| Fair | 8 | 80.0 | 6 | 60.0 | 7 | 70.0 | 21 | 70.0 |
| Bad | 2 | 20.0 | 2 | 20.0 | 1 | 10.0 | 5 | 16.6 |

The results of debris index measurement before treatment and after treatment showed a significant decrease in debris except in the control group. In the control group, there was an increase from 1.76 to 1.88 while for the treatment group a concentration of 5% decreased the debris index from 1.54 to 1.24 as well as the treatment group with a concentration of 10% from 1.18 to 0.71 (Table 3).

Table 3. Results of measurement of debris index.

| Group | Pre Test Mean ± SD | Post Test Mean ± SD | ΔMean | p-value |
|-------------------|-----------------------|------------------------|---------|---------|
| Control | 1.7660 ± 0.5161 | 1.8830 ± 0.5155 | -0.1170 | 0.132 |
| Concentration 5% | 1.5470 ± 0.4785 | 1.2470 ± 0.5349 | 0.3000 | 0.000 |
| Concentration 10% | 1.1840 ± 0.5585 | 0.7140 ± 0.4532 | 0.4700 | 0.000 |

The results of the calculus index measurements before treatment and after treatment showed a significant decrease in calculus except in the control group. In the control group before and after treatment the calculus score index remained whereas for the 5% treatment group there was a decrease in the calculus index from 1.11 to 1.04, but it was not effective in reducing the calculus index in contrast to the treatment group 10% concentration had a significant decrease in calculus index from 1.33 to 1.11 (Table 4).

Table 4. Results of calculus index measurement.

| Group | Pre Test Mean ± SD | Post Test Mean ± SD | ΔMean | p-value |
|-------------------|-----------------------|------------------------|-------|---------|
| Control | 0.6490 ± 0.2891 | 0.6490 ± 0.2891 | 0 | 1.000 |
| Concentration 5% | 1.1150 ± 0.4784 | 1.0480 ± 0.4784 | 0.067 | 0.059 |
| Concentration 10% | 1.3300 ± 0.4967 | 1.1150 ± 0.4311 | 0.215 | 0.010 |

There was a significant decrease in OHI-S values before and after treatment, except in the control group (Table 5). In the control group, there was an increase from 2.41 to 2.53 while for the treatment group a concentration of 5% decreased the OHI-S from 2.66 to 2.29 as well as the treatment group with a concentration of 10% from 2.51 to 1.82.

Table 5. Results of OHI-S measurement.

| Group | Pre Test Mean ± SD | Post Test Mean ± SD | ΔMean | p-value |
|-------------------|-----------------------|------------------------|---------|---------|
| Control | 2.4150 ± 0.7253 | 2.5320 ± 0.6930 | -0.1170 | 0.132 |
| Concentration 5% | 2.6620 ± 0.9001 | 2.2950 ± 0.9585 | 0.3670 | 0.001 |
| Concentration 10% | 2.5140 ± 0.8954 | 1.8290 ± 0.7592 | 0.6850 | 0.000 |

Statistically significant differences were found for the 5% and 10% concentration groups. This indicates that there is a significant decrease in the amount of plaque in the intervention group treated with a solution of ant nest extract with a concentration of 5% and 10%.

Discussion

There has been researched which carried out on the effectiveness of gargling the solution of ant nest extract on plaque formation in children with Early Childhood Caries or under 71 months of age. Sampling was carried out at the Alabrar Makassar Kindergarten students who entered according to the inclusion criteria, namely having minimal caries [2].

Plaque is one of the grayish or yellow-white soft deposits that adhere tightly to the surface of the tooth. Plaques can form after one or two days without oral hygiene. Plaques usually begin to form on one-third of the surface of the gingiva and on the surface of the tooth that is deformed and rough. Plaque control can be done mechanically by brushing and using mouthwash [10].

The results of research conducted on 30 samples showed that the solution of ant nest extract at a concentration of 5% and 10% with 96% ethanol solvent could inhibit the formation of dental plaque. This can happen because ant nests contain acidic ascorbic, flavonoids, and phenolics which have antibacterial and antioxidant power.

Ant nest is one part of Moringa plants that has been investigated for its nutrient content and usefulness. Ant nests are very rich in nutrients, including calcium, iron, protein, vitamin A, vitamin B, and vitamin C. Ant nests contain higher iron than other vegetables, which is 17.2 mg / 100 g [6,8]. In addition, ant nests also contain various kinds of amino acids, including amino acids in the form of aspartic acid, glutamic acid, alanine, valine, leucine, isoleucine, histidine, lysine, arginine, phenylalanine, tryptophan, cysteine, and methionine [5,11].

Ant nest extracts (*Myrmecodia pendans*) with ethanol solvents play a very significant role in *Staphylococcus aureus* and *Escherichia coli* bacteria. The amount of content of active antimicrobial compounds contained in extracts affects the inhibitory power produced. Ant nest extract using ethanol solvents can attract most of the active compounds contained in ant nests, and from the results of these studies, it has been carried out the same method so there is no difference thus it

shows the appropriate results that the ant nest has compounds that can inhibit bacterial growth. The results of this study also provide the same results that the use of ethanol solvents to extract active compounds in ant nests provides a zone of inhibition of tested bacteria [12-14].

The statement supports the results of studies conducted on children under 71 months in Alabrar Kindergarten, Makassar. It was found that there was a significant correlation between the effect of gargling Moringa leaf extract solution at a concentration of 5% and 10% in children who experienced Early Childhood Caries with a percentage of OHI-S for the control group increased from 2.41 to 2.53 while for the treatment group a concentration of 5% decreased the OHI-S from 2.66 to 2.29 as well as the treatment group concentration of 10% from 2.51 to 1.82.

Conclusion

The administration of an ant nest extract solution (*Myrmecodia pendans*) can inhibit dental plaque formation, plaque scores on teeth given lime extract solution 5% and 10% lower than those not given lime extract solution, and the plaque score on teeth given a 10% lime extract is more effective than the 5% lime extract in inhibiting dental plaque formation.

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