THE EFFECTIVENESS OF GARGLE CONTAIAN EXTRACT OF *MORINGA OLEIFERA* LEAVES TO INHIBIT PLAQUE FORMATION ON *EARLY CHILDHOOD CARIES* (ECC)

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ABSTRACT

Objective: This study aimed to look at the activity of the extract solution of *moringa oleifera* on plaque formation of children with ECC when used as a mouthwash.

Methods: This study used a pre-test/post-test design with the control group. A total of 30 people were chosen that suffer from ECC. Samples were divided into three groups: the treatment groups were given a solution of 5% and 10% *moringa oleifera* extract, and the control group was given a distilled water rinse. Data were analyzed using SPSS version 22.0 for Windows.

Results: The Independent t-test showed a significant difference before and after rinsing with *moringa oleifera* extract solutions ($p<0.05$). The average OHIS increased in the control group from 2.41 ± 0.72 before rinsing with distilled water and 2.53 ± 0.69 after. The treatment group's average OHIS decreased at 5% concentration from 2.66 ± 0.90 before treatment and 2.29 ± 0.95 after treatment. The 10% concentration group also decreased from 2.51 ± 0.89 before treatment to 1.82 ± 0.75 after treatment.

Conclusion: Providing a solution of *moringa oleifera* extract at 5% and 10% concentrations can inhibit the formation of dental plaque where the 10% concentration is more effective than 5%. There are significant differences in the mean plaque score between the control group and the treatment group 5% and 10%. The 10% treatment group plaque scores were lower than the control group.

Keywords: *Moringa oleifera*, Dental plaque, Early childhood caries (ECC)

INTRODUCTION

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

ECC is the most common chronic disease in children, describing public health issues affecting infants and preschoolers around the world, especially in disadvantaged people in both developing and industrialized countries [2]. These caries are often found in children under five years of age, with the highest spread among children aged three years.

Dental caries has historically been considered the most important component of global oral disease burden. Health facilities and education of dental health education have been done, but the knowledge of the community about dental caries is still low [3]. According to the World Health Organization survey data, it is recorded that worldwide 60-90% of children have dental caries [4].

In Indonesia, the prevalence of caries in children aged 3-5 y continues to increase. The prevalence of caries in children under five in Indonesia is about 90.05%. The high prevalence of caries can affect the quality of life of children and the potential for high dental caries risk, ECC is the most serious condition that can harm children [5]. This shows the lack of attention of parents, especially mothers to the maintenance of dental health and the mouth of the toddler [6].

Dental caries is a pathological process of progressive tooth decay caused by a combination of direct factors such as diet, host, microflora, and interplay time with each other. Diet is a carbohydrate intake, host of quantity, quality of saliva and teeth. Microorganisms, such as Streptococci and Laktobasilus sp., are colonic acidogenic bacterium on the tooth surface. Time is the duration of exposure time of the tooth by inorganic produced by bacteria from dental plaque [7].

Animal studies show that plaque is dominated by Streptococcus mutants and lactobacillus and causes caries. Streptococcus mutans and lactobacillus are cariogenic bacteria because they are able to immediately form the acid from carbohydrates that can be distributed.

The germ can thrive on an acidic atmosphere and can stick to the tooth surface because of its ability to make extracellular polysaccharides. These extracellular polysaccharides consist primarily of glucose polymers that cause plaque matrix to have a consistency like gelatin, as a result, the bacteria are helpful to attach to each other. The plaque is getting thicker, so it will inhibit the function of saliva to perform its antibacterial activity. One way to prevent caries is to cleanse plaque regularly. Plaque control can be done by mechanical cleansing of plaque and the use of antibacterial material especially to suppress the growth of Streptococcus mutans [8].

Currently, the plaque control is complemented by the addition of a type of active ingredients containing natural or synthetic substances as an anti-germ salt. They are available in the form of mouth rinses and toothpaste [9].

Research on natural materials itself has been widely studied in Indonesia. This is related to the active ingredient content as a result of secondary metabolism in plants that can provide many benefits, one of which is found in plants that are nutritious as anti-cancer, anti-bacterial, hypotensive, inhibiting bacterial and fungal activity [10].

MATERIALS AND METHODS

Material

The type of research used is laboratory and field experiment using Pre-test/Post-test with control group research design on 30 students of Al Abrar Makassar kindergarten. The study was conducted on May-July 2017. The samples were divided into three groups of gargling treatment of 5% concentration of maize leaf extract, 10% concentration of mole leaf extract, and aquades solution. This study measured the Oral Hygiene Index (OHIS) according to Greene and Vermillion theory 2 times for each group.

Measurements were collected before and after an intervention. The total number of research results collected and recorded and conducted management and data analysis using SPSS version 22.0.

RESULTS AND DISCUSSION

From the results of research on the effectiveness of gargling mole leaf extract from plaque formation of children that experienced ECC obtained data as follows:

Table 1: Distribution of characteristics of the study sample

Characteristic	Group						Total	
	Control		Concentration 5%		Concentration 10%			
Age (year)	N	%	N	%	N	%	N	%
3	3	30	2	20	2	20	7	23.3
4	2	20	2	20	3	30	7	23.3
5	2	20	2	20	3	30	7	23.3
6	3	30	4	40	2	20	9	30
Gender								
Male	5	50	5	50	5	50	15	50
Female	5	50	5	50	5	50	15	50

In the table 1 of characteristics of the sample, there are characteristics of age and gender. In the table of age characteristics, age 3 y there were 7 samples with 23.3% percentage of 2 samples in 5% concentration group and 10% concentration and there were 3 control group samples 10%, age 4 y there were 7 samples with 23.3% each 2 samples in 5% concentration group and control group and there were 3 sample concentration group 10%, at age 5 y old there were 7 samples with 23.3% percentage of 2 samples in 5% concentration group and control group and there were 3 group samples concentration of 10%, while at age 6 y there were 9 samples with percentage of 30% each 4 samples in the concentration group 5%, 3 samples in the control group and there were 2 samples of concentration group of 10%. In the table of sex characteristics, there were 15 samples of male sex with percentage of 50% and 15 samples of female sex with percentage of 50%.

Table 2: The difference of effectivity of solid outflow *moringa oleifera* extract based on the value of dental and mouth hygiene

Characteristic	Group						Total	
	Control		Concentration 5%		Concentration 10%			
	N	%	N	%	N	%	N	%
Pre-test								
Good	0	0	1	10	0	0	1	3.3
Medium	8	80	6	60	8	80	22	73.3
Bad	2	20	3	30	2	20	7	23.3
Post-test								
Good	0	0	2	20	2	20	4	13.3
Medium	8	80	6	60	7	70	21	70
Bad	2	20	2	20	1	10	5	16.6

Table 2 shows the effectiveness of each mouth rinse used in this study, namely aquades and *moringa* leaf extract with concentrations of 5% and 10%. Through table 2, there was a change of oral hygiene index (OHIS) before treatment and after treatment. It can be seen that the percentage of the number of samples prior to the OHIS category treatment was either 1 sample to 4 samples after the treatment, the OHIS was before the treatment of 22 samples after the change treatment became fewer with the sample percentage of 21 and for the poor OHIS decreased after treatment of 7 samples and after treatment the number of samples to 5. Thus, seen a significant change to the effect of gargling solution leaf kelor extract.

Table 3: Debris index measurement results

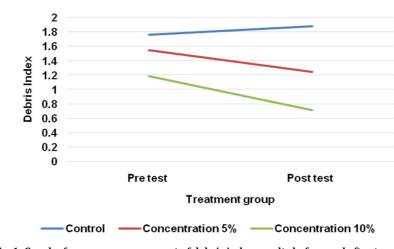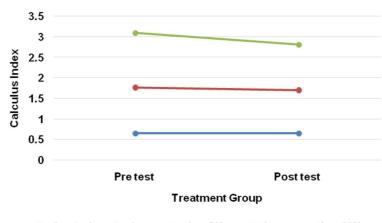| Group	Pre-test mean±SD	Post-test mean±SD	ΔMean	p Value
Control	1.766±0.516	1.883±0.515	0.117	0.132
Concentration 5%	1.547±0.478	1.247±0.534	0.300	0.000
Concentration 10%	1.184±0.558	0.714±0.453	0.470	0.000

Fig. 1: Graph of average measurement of debris index results before and after treatment

Based on table 3 and fig. 1, it is known that the results of the index debris measurements before treatment and after treatment showed significant debris decrease except in the control group. In the control group there was an increase from 1.766 to 1.883 while for the treatment group the concentration of 5% decreased the debris index from 1.547 to 1.247 as well as with the treatment group concentration 10% from 1.184 to 0.714.

Table 4: Calculus index measurement results

Group	Pre-test mean±SD	Post-test mean±SD	ΔMean	p Value
Control	0.649±0.289	0.649±0.289	0	1.000
Concentration 5%	1.115±0.478	1.048±0.478	0.067	0.059
Concentration 10%	1.33±0.496	1.115±0.431	0.215	0.010

Fig. 2: Graph average measurement of calculus index results before and after treatment

Based on table 4 and fig. 2, it is known that the results of calculus index measurement before treatment and after treatment showed significant calculus decrease except in the control group. In the control group before and after the treatment of calculus, score index was fixed while for the treatment group 5% concentration decreased calculus index from 1.115 to 1.048 but not yet effective in lowering calculus index is different from treatment group concentration of 10% there is a significant decrease calculus index from 1.33 to 1.115.

Based on table 5 and fig. 3, it is known that the results of OHIS measurements before treatment and after treatment showed a significant decrease except in the control group. In the control group there was an increase from 2.415 to 2.532 while for the treatment group the 5% concentration decreased the OHIS index from 2.662 to 2.295 as well as with the treatment group concentration 10% from 2.514 to 1.829. After the calculation of statistical analysis, showed significant changes from the results of paired T-tests conducted either the control group $p<0.05$ which means not significant while in the treatment group 5% concentration and treatment with a concentration of 10% showed test results <0.05 means the results obtained significant means there is influence on the treatment performed. This indicates that there is a significant decrease in the number of plaque in the treatment group intervention of *moringa leaf* extract with a concentration of 5% and 10%.

Table 5: OHIS measurement results

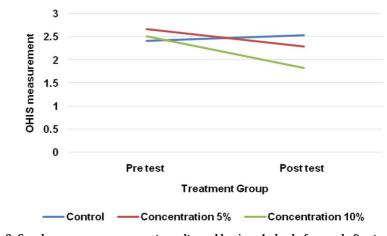| Group	Pre test mean±SD	Post test mean±SD	ΔMean	p Value
Control	2.415±0.725	2.532±0.693	-117	0.132
Concentration 5%	2.662±0.900	2.295±0.958	0.367	0.001
Concentration 10%	2.514±0.895	1.829±0.759	0.685	000

Fig. 3: Graph average measurement results oral hygiene Index before and after treatment

In the research that has been done proved that the results obtained in the control group p<0.05 which means not significantly different from the treatment group 5% and 10% showed significant results p<0.05. With the percentage value of OHIS for the control group there was an increase from 2.415 to 2.532 while for the treatment group the concentration of 5% decreased the OHIS from 2.662 to 2.295 as well as with the treatment group concentration 10% from 2.514 to 1.829.

From the results of this study it was concluded that the effectiveness of *moringa* leaf extract between the control group and the treatment group of 5% and 10% more effective concentration with a concentration of 10% which could significantly decrease the plaque amount in the specified time intervention is clearly seen in the table and the result graph measurement of OHIS in control group, treatment group either concentration of 5% and 10% concentration which is washed the mouth by children who experience ECC.

A study on the effectiveness of gargling salted leaf extract was done on plaque formation in children with ECC or under 71 mo of age. Sampling was done at the kindergarten students of Alabrar Makassar who entered in accordance with the inclusion criteria of having at least two caries.

Plaque is one of the soft greyish or yellowish-white deposits that are firmly attached to the tooth surface. Plaque can form after a day or two without oral hygiene. Plaque usually begins to form on one-third of the gingival surface and on the surface of the defective and rough tooth. Plaque control can be done by mechanical means of brushing and using mouthwash [10].

The results of the research conducted on 30 samples showed that the solution of leaf extract at 5% and 10% concentration with 96% ethanol solvent can inhibit the formation of dental plaque. This can happen because the leaves of *moringa* contain acetic acid, flavonoids and phenolic compounds that have antibacterial and antioxidant power.

Moringa leaf is one part of the *moringa* that has been studied the nutritional content and its usefulness. *Moringa* leaves are rich in nutrients, including calcium, iron, protein, vitamin A, vitamin B and vitamin C. *Moringa* leaves contain higher iron than other vegetables that is equal to 17.2 mg/100 g [10, 11].

In addition, *moringa* leaf also contains a variety 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.

This statement supports the results of a study conducted on children under 71 mo in kindergarten Alabrar Makassar, the results obtained a significant relationship about the effect of gargling solution of *moringa* leaf extract at concentrations of 5% and 10% in children who experience ECC. With the percentage of OHIS for the control group increased from 2.415 to 2.532 while for the treatment group the 5% concentration decreased the OHIS from 2.662 to 2.295 as well as with the treatment group concentration 10% from 2.514 to 1.829.

From the results of this study it was concluded that the effectiveness of *moringa* leaf extract between the control group and the treatment group of 5% and 10% is more effective concentration with a concentration of 10% which could significantly decrease the plaque amount in the specified time intervention is clearly seen in the table and the result graph measurement of OHIS in control group, treatment group either concentration of 5% and 10% concentration which is washed the mouth by children who experience ECC.

CONCLUSION

Based on the results of research conducted at Alabrar Kindergarten in May-June 2017, it can be concluded that *moringa* leaf extract solution (*moringa oleifera*) can inhibit the formation of dental plaque. Plaque scores on teeth given a 5% and 10% lower lemon extract solution than those without a lemon extract solution and plaque scores on teeth given lemon extract solution 10% more effective than a 5% extract solution of lime inhibiting the formation of dental plaque.

ACKNOWLEDGMENT

AUTHORS CONTRIBUTIONS

All the authors have contributed equally

CONFLICT OF INTERESTS

There are no conflict of interest in this study

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