

RESEARCH ARTICLES

Analysis of Serumenolytic Agent of 2.5% Apple Vinegar and Coconut Oil in Children of the Putri Aisyiyah Orphanage, Medan City Secaral in Vitro

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Abstract : Cerumen impaction can occur in all types of ages, both children, adults, and the elderly which are influenced by various factors. Serumenolytic agents can soften and dissolve earwax, one of which is 2.5% Apple Vinegar and Coconut Oil used as alternatives. The purpose of this study is to analyze the effectiveness of cerumenolytic agents Apple Vinegar 2.5% and Coconut Oil as an alternative therapy for serum impaction in children of the Puteri Aisyiyah Orphanage, Medan City, in vitro. This type of research is an in vitro laboratory research using a UV-Vis spectrophotometer and a simple random sampling technique. The mean rank value for the effect of Apple Vinegar is 2.5% (32.40) while Coconut Oil is (16.60). In addition, a P-Value of $r(0.000)$ was obtained <0.005 so that it can be stated that there is a difference in the solubility of the serumen. Which means that the effect of Apple Vinegar is 2.5% greater than that of Coconut Oil. Based on the results of the research that has been conducted, it can be concluded that 2.5% Apple Vinegar has a more reverse effectiveness on serum solubility by showing a higher average value of Coconut Oil at each trial time.

Keywords: Apple Vinegar 2.5%, Coconut oil, Serum Impaction

INTRODUCTION

The ear is a very important organ as a means of hearing and balance of the body. If there is a disturbance in the ear, it can decrease the function of the senses of hearing and body balance.

One of the disorders that often occurs in the ear is the impaction of the cerumen.

Cerumen impaction can occur at any age, both children, adults, and the elderly which can be influenced by heredity, climate, and environmental factors.¹

According to the World Health Organization (WHO) 2021, more than 5% of the world's population has hearing loss, of which 432 million adults and 34 million in children.² The Ministry of Health of the Republic of Indonesia in 2018 stated that the prevalence in Indonesia at the age of 5 years and above experienced hearing loss was 2.6%, of which deafness was 0.09%, secretions in the ear canal were 2.4% and cerumen blockage was 18.8%.⁴ Hearing loss in school-age children is mostly caused by a blockage of dirt in the ear. Children who live in orphanages are generally still of school age and are usually required to be independent in maintaining their own hygiene. Ear hygiene and health still receive less attention so that it is a risk factor for the occurrence of cerumen impaction. The serum is a mixture of secretions from the apocrine glands and sebaceous glands found in one-third of the ear canal. Under normal circumstances, cerumen can come out on its own when chewing or swallowing food without realizing it. However, cerumen that cannot come out on its own can cause the cerumen to harden so that an impact of the cerumen occurs. Cerumen impaction can cause complaints of itching, pain, hearing loss, discomfort in the ears, vertigo and even chronic external otitis.⁷ Serumenolytic agents can help soften, and dissolve earwax. Commonly used water-based solutions such as hydrogen peroxide 3%, sodium docudate, and benzetonium chloride 0.03%. Oil-based solutions such as almond oil or minerals.⁶ There are other serumenolytic alternatives

before irrigation such as sodium bicarbonate 10%, chlorbutol 5%, arachis oil, coconut oil and acetic acid 2.5% as home treatment. Hydrogen peroxide is a serumenolytic agent that is most commonly used in the impaction of cerumen before irrigation. However, if hydrogen peroxide is not completely removed after irrigation, it can interfere with the ability to visualize the tympanic membrane.⁷ Apple cider vinegar contains active substances such as acetic acid, phenol, pectin, flavonoids, tannins that can be used as antibacterial.⁸ One of the alternative water-based serumenolytic agents is 2.5% acetic acid, where acetic acid is the active ingredient in apple cider vinegar. Coconut oil contains 92% saturated acid, with lauric acid as its main constituent which has anti-inflammatory and antimicrobial properties.⁹ In previous studies, coconut oil was used as a comparison of the effectiveness of several solvents against cerumen that functions as a lubricant. Coconut oil is an easily obtainable and safe fat solvent to use as a cerumenolytic alternative. Bahan-bahan alternatif serumenolitik ini masih perlu penelitian lebih lanjut untuk membuktikan manfaat dan khasiatnya secara ilmiah.¹⁰

The high prevalence of cases of cerumen impaction at all ages and complications that can cause ear infections, prompts researchers to discuss how the effects of apple cider vinegar and coconut oil as an alternative to serum softener can also prevent ear infections, because apple cider vinegar and coconut oil have the main function, namely as anti-inflammatory and

antibacterial. In addition to natural ingredients, apple cider vinegar and coconut oil are easy to obtain and relatively safe so that they can be used as alternative serumenolytic agents with minimal risk of side effects.

The purpose of this study was to determine the comparison of the effects of 2.5% apple cider vinegar and coconut oil in vitro in contact time of 5 minutes, 10 minutes, 15 minutes and 30 minutes.

METHOD

This study is an experimental in vitro laboratory using 48 serum specimens that have been taken from the ear canal without limitations in terms of serum characteristics (wet, dry, and mixed). Serum samples were collected and mixed and then weighed with an average weight of 50 µg and then placed in a tube. About 2-3 cc of 2.5% apple cider vinegar test solution and coconut oil are added into each polypropylene test tube. The serumen that has been given the solution will then be placed in a 10 x 10 x 45 mm cuvette to measure light absorbance at 600 nm in a UV-Vis spectrophotometer with a time range of 5, 10, 15 and 30 minutes in vitro and in photographic documentation based on a time frame of 5, 10, 15 and 30 minutes.

Population and Sample

The sampling technique in this study uses Non-Probability Sampling, namely Consecutive Sampling. This research population will take serum samples from the ear canals of children at the Aisyiyah Orphanage, Jalan Santun, Medan Kota. The

calculation of the size of the group in this study used a minimum sample size to test the hypothesis of the difference between the two group proportions

Data Analysis

Data analysis was carried out statistically using the parametric method, if the data was normally distributed, homogeneous and in the form of numerical categorical variables from 2 unpaired groups, the data was analyzed using the t-test test. If it is non-parametric with the Kruskal Wallis and Mann-Whitney tests so that it can be found out if there is an effect of the test solution on the development of the serumen. Then the data was analyzed using the Statistical Program For Social Science (SPSS).

RESULT

Description of Research Variables

To find out the effect of 2.5% Apple Vinegar and Coconut Oil with the results of changes in serum absorbance in the 5th, 10th, 15th, and 30th minutes

Table 1. Serum Absorbance Average

Solvent	Times			
	5 Minute	10 Minute	15 Minute	30 Minute
apple cider vinegar 2.5%	0.113	0.129	0.036	0.054
Oil Coconut	0.091	0.033	0.018	0.019

Based on Table 1. Information was obtained that there was an increase in the average value of the effect of Apple Vinegar by 2.5% from minute 5 to minute 10, and after that there was a decrease from minute 10 to minute 15 and an increase in minute 15 to minute 30. In coconut oil, information was obtained that there was a decrease in the average value from 5 minutes to 15 minutes and an increase from 15 minutes to 30 minutes. In the normality test, it was found that malyoritals had a p-value < 0.05 . Based on this, the test uses the Kruskal Wallis test with Post Hoc Mann Whitney.

In vitro serum absorbance analysis of serumenolytic intervention of 2.5 % apple cider vinegar and coconut oil at 5, 10, 15, and 30 minutes.

The analysis of the Kruskal Wallis test or numerical comparative hypothesis test of more than two groups of unpaired abnormally distributed and will be continued with the post hoc Mann Whitney. The table consists of the number of subjects in each group, the median of each group, the minimum and maximum of each group, and the value of P.

Table 3. Kruskal Wallis Test Results Serumenolytic Agent Apple Vinegar 2.5% and Coconut Oil

Variable	Minute	Mean \pm DI	P value
Apple Vinegar	5	0.112 \pm 0.048	<0.001*
	10	0.13 \pm 0.056	
	15	0.036 \pm 0.008	
	30	0.054 \pm 0.009	
Coconut oil	5	0.091 \pm 0.11	<0.001*
	10	0.033 \pm 0.043	
	15	0.018 \pm 0.013	
	30	0.019 \pm 0.026	

(P<0.05)

The results of the Kruskal Wallis test of 2.5% apple cider vinegar and coconut oil showed a p value of <0.001 which means that there was a significant difference in serum absorbance using 2.5% apple cider vinegar and coconut oil at the 5th, 10th, 15th and 30th minute times.

Table 4. Post hoc results of Mann Whitney Serumenolytic Agent of Apple Vinegar 2.5% and Coconut Oil in each Group

Variable	Time	VS	N	P Value
Apple Vinegar	5 Menit	10 Min	24	0.781
		15 Min	24	<0.001
		30 Min	24	<0.001
	10 Menit	15 Min	24	<0.001
		30 Min	24	<0.001
		30 Min	24	<0.001
Coconut oil	5 Menit	10 Min	24	0.019
		15 Min	24	0.001
		30 Min	24	<0.001
	10 Menit	15 Min	24	0.337
		30 Min	24	0.082
		30 Min	24	0.408

The results of Mann Whitney's Post Hoc test on the 2.5% apple cider vinegar serumenolytic agent showed that there was a significant difference in: 5 minutes vs 15 minutes, 5 minutes vs 30 minutes, 10 minutes vs 15 minutes, 10 minutes vs 30 minutes, 15 minutes 30. As for coconut oil serumenolytic agents, there are differences in: 5 minutes vs 10 minutes, 5 minutes vs 15 minutes, 5 minutes vs 30 minutes.

Serumenolytic Effectiveness of Apple Vinegar 2.5% against in vitro serum absorbance

The results of the study that have been carried out show that Apple Vinegar is 2.5% in accordance with the results of univariate analysis shown in the 5th minute (0.115), 10th (0.129), 15th (0.036), and 30th (0.054) against in vitro serum intervention. Some studies state that water-based solutions are more effective in breaking down the components of the serumen. In previous studies, serumenolytic agents sodium bicarbonate 10% and acetic acid 2.5% were administered in vivo to patients in community family practice clinics.

In this case, no difference in effectiveness was found between 10% sodium bicarbonate and 2.5% acetic acid, but it was more effective when administered to children than adults.¹⁷ Apple cider vinegar has the main active ingredient in the form of acetic acid which can destroy bacteria that expose the membranes where this protein is found.¹¹ The efficiency of organic acids against many microorganisms is attributed to the presence of bioactive compounds such as organic acids and phenolic compounds in apple cider vinegar.¹² shows residual effects to prevent the growth of pathogenic microbes. The ability of organic acids to release H⁺ protons into the cell lowers intracellular pH, inducing the destruction of bacterial membrane cells. Apple cider vinegar contains the main active substance, namely acetic acid which can increase lipid solubility so as to increase the accumulation of saturated fatty acids and corneocytes in the ear canal, this acetic acid intervention is suspected to make the cerumen soften, swell

due to acidic properties, low pH and corrosive to tissues.¹³ This type of water-based serumenolytic is hydrogen peroxide 3%, phenol glycerol, sodium dokusalt, sodium bicarbonate, triethanolamine polypeptide oleate-condensate, NaCl 0.9% and benzetonium chloride 0.03%.⁶

Effectiveness of cerumenolytic Coconut Oil against serum absorbance in vitro

The results of the study that have been carried out with univariate analysis show that the average absorbance that Coconut Oil has effectiveness in the 5th minute (0.091), 10th (0.033), 15th (0.018), and 30th (0.019). In a previous study, it compared the effectiveness of six solvents, namely aquadest, NaCl 0.9%, coconut oil, olive oil, carboglyserin 10% and sodium docusate 0.5% against cerumen obturans in vitro, with the result of NaCl 0.9% and aquadest being the most effective serum solvent. Coconut oil and olive oil are the solvents with the lowest effectiveness. In aquadest and NaCl, the 0.9% moisture content it contains results in hydration of keratin cells which can induce keratolysis so that the disintegration of the cerumen bolus occurs. Meanwhile, olive oil and coconut oil are the least effective solvents against cerumen obturans because of the oil's function which tends to be a softener and does not result in the disintegration of the serum bolus. However, coconut oil is a fat solvent available in households, easy to obtain and relatively safe so that it can be used as a serumenolytic alternative.¹⁶

Comparison of in vitro serum absorbance to the intervention of 2.5% Apple Vinegar with Coconut Oil

The results of the study that have been carried out show that the serumenolytic intervention of 2.5% apple cider vinegar and coconut oil has different effectiveness against cerumen in vitro, this is proven With the test using Mann Whitney which obtained a significance number (p-value) of $p=0.000$ with 2.5% apple cider vinegar of 35.04 (mean rank) and coconut oil of 13.96 (mean rank) in the 10th minute, it is known that a difference of 21.08 (mean rank) shows that the results of apple cider vinegar are 2.5% higher than coconut oil against serum absorbance in vitro with a UV-Vis spectrophotometer.

According to this study, coconut oil has a lower effectiveness than apple cider vinegar 2.5% which is shown based on the lower serum solubility value at 5 to 30 minutes. This is in line with Dharmaratne's (2020) research which also shows that coconut oil is the least effective solvent for dissolving cerumen. This is suspected to be due to the function of the oil which tends to be a softener and does not result in the destruction of the cerumen bolus¹⁵. Based on the results of the research that has been conducted, it can be concluded that the effect of 2.5% apple cider vinegar as a cerumenolytic agent will be effective in 10 minutes, where 2.5% apple cider vinegar has a more reverse effectiveness on the solubility of cerumen because it shows a higher average value than coconut oil at each time of the experiment. Serumenolytic

agents can be used with or without a combination of irrigation and manual instrumentation in removing cerumen¹⁸. The use of ear drops is better in treating cerums but it is necessary to know which formula is superior¹⁹. Although ear drops have the advantage of both their easy use and the absence of risk of mechanical damage.

However, it has some side effects that may occur such as ear canal irritation and contact dermatitis²⁰. This study has many limitations because the results of the effectiveness of several solvents are based on this study in vitro, so to be able to apply it directly to patients it is necessary to have a trial with in vivo research. This is important considering that if the research is carried out in vivo, it will be influenced by several factors such as the anatomy of the ear canal, the surface area of the cerumenolytic cerumenolytic, the dosage and technique and the method of administration

CONCLUSION

Based on the results of this study, it can be concluded that the in vitro serum absorbance of 2.5% apple cider vinegar as a serumenolytic agent is most effective at the 10th to 30th minute, because at that time there is an increase in the severity of the cerumen. Meanwhile, the use of coconut oil did not have significant effectiveness against serum impaction therapy in vitro at the 5th, 10th, 15th, and 30th minutes. Apple cider vinegar 2.5% has a higher effectiveness against in vitro serum intervention than coconut oil.as a therapy of serum impaction

in children of the Puteri Aisyiyah Orphanage, Medan City, in vitro at 5, 10, 15, and 30 minutes.

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