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RESEARCH ARTICLES

Comparison of the Effectiveness of 2% Acetic Acid and Mineral Oil on Serum Prop Children of Aisyiyah Orphanage Medan in Vitro

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Abstract: Serum prop is an accumulation of a substance secreted by the sebaceous glands and seruminous composed also with corneal desquammation from the stratum corneum in the ear canal which can cause symptoms or interfere with the assessment of the ear canal, tympanic membrane, and audiovestibular system. Corrosive acetic acid can destroy serum prop as well as mineral oil as a lubricant that can make cerumen come out of the ear canal. This study aims to analyze the comparison of the effectiveness of 2% acetic acid and mineral oil on serum prop children of the Putri Aisyiyah Orphanage Medan in vitro at 5, 10, 15, and 30 minutes. This study is an in vitro experimental with a quasy experimental type using a simple random sampling technique involving 25 serum prop samples, each sample will be tested with 2% acetic acid and mineral oil with a UV-Vis spectrophotometer. The data collected were analyzed using the ANOVA repeated measures parametric test and the non-parametric Kruskal wallis test. The intervention of 2% acetic acid and mineral oil on in vitro cerumen was most significant at 30 minutes, In comparison the effectiveness of 2% acetic acid was obtained higher results than mineral oil against in vitro cerumen which was known from the mean difference in each test solution. 2% acetic acid has a higher effectiveness against in vitro serum intervention compared to mineral oil.

Keywords: Acetic acid; mineral oil; serum prop

INTRODUCTION

Serum prop is a public health problem that has a proportion of shared health problems with varying prevalence. According to the World Health Organization (WHO), serum prop varies with different prevalence according to age, namely 10% in children, 5% in healthy adults to 57% found

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in elderly people living in nursing homes and 36% in mentally retarded patients.[1] It was also found that the estimates from several studies in the European continent have a prevalence of serum prop between 2-6% and some studies in the African continent 10-20%, in Indonesia itself based on research conducted by the Indonesian Ministry of Health (KEMENKES) there is a high incidence of serum prop in children reaching 30-50%, this problem needs attention because it can affect the process of social development, cognitive, and learning absorption.[2, 3] Serum prop is one of the main causes in primary care consultation also occurs in common comorbidities in otorhinolaryngology patients.[3] Serum prop is a biological fluid composed of a large diversity of biomarker compound classes including lipids, proteins, amino acids (AA), carbohydrates, volatile organic compounds (VOCs). The cerumen is the result of a process in which there is a buildup of alloys by the result of apocrine secretion from the cerumanous gland and oil from the sebaceous gland that unites with the hair and the release of epithelial elements in the ear canal which function as a protector, lubricate the ear canal, and transport epithelial debris to prevent dryness of epidermal tissue, physiologically cerumen can be expelled through natural jaw movements when speaking and swallowing.[4]

Excessive cerumen production can occur due to self-ear cleaning, listening to songs with headphones can close the external auditory canal which has the potential to block the ear canal which will cause hearing loss due to a mechanical obstruction of the ear examination, hearing loss, vertigo, and infection so that proper treatment is needed.[5]

Treatment for serum prop involves the use of cerumen softeners (serumenolytic) where ear drops that can be used include water, oil, non-water and non-oil types. In this study, I will apply it to water-based (acetic acid 2%) and oil-based (mineral oil) ear drops.[6]

Acetic acid has high efficiency as a serumenolytic, Acetic acid is an organic compound with the formula (CH3COOH), is a carboxylic acid consisting of a bonded methyl group ear examination, hearing loss, vertigo, and infections so that proper treatment is needed.[5]

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Acetic acid has high efficiency as a serumenolytic, Acetic acid is an organic compound with the formula (CH3COOH), is a carboxylic acid consisting of a bonded methyl group in the carboxyl functional group that functions as anti-bacterial, anti-fungal and serumenolytic. In a comparative study of serumenolytic agents conducted by Nair P with 2.5% acetic acid intervention by syringe against 21 ears with serum prop, the results of 57.14% of ear serum prop release

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were obtained.[10] Meanwhile, studies by Carr M and Smith C have compared 10% sodium bicarbonate and 2.5% acetic acid to get the same efficacy results.[11] Acetic acid can increase lipid solubility allowing for increased accumulation of fatty acids on cell membranes or other cell wall structures.[7, 8]

Mineral oil consists of hydrocarbon mixtures isolated from crude petroleum, produced from crude mineral oil in various refining steps including distillation, extraction and crystallization followed by refinement through acid treatment and/or catalytic hydrogenation.[9] Research conducted by Spiro S stated that the use of mineral oil before irrigation can soften the cerumen.[10] Mineral oil, apart from being an oil-based type of cerumenolytic, is also used in a mixture of basic ingredients for a variety of cosmetic products such as skin creams, lotions, cleansers or lipcare products. Patzelt et al in an in vivo study on humans found that the penetration of mineral oil in human skin was only limited to the upper layer of the stratum corneum on the skin of the forearm.[11]

METHOD

This study is an experimental in vitro laboratory research using an experimental quasy type with a simple random sampling technique. The calculation of sample size uses a minimum sample size which aims to test the hypothesis of the difference between two independent group proportions so that the value n1=n2 is obtained is 25 research subjects. The population in this study was 60 children at the Aisyiyah Children's Orphanage, Jl. Santun No. 17, Medan, North Sumatra. The research will be carried out in the Biochemistry laboratory, Faculty of Medicine, University of Muhammadiyah North Sumatra. Sampling was carried out on January 22, 2023 and laboratory research was carried out from January 24 to 28, 2023. The existing data was tested for normality with Shapiro Wilk. If the data is normally distributed, it will be tested with a parametric test, namely Repeated Measures ANOVA, if it is not normally distributed, the data will be tested with a non-parametric, namely Kruskal wallis. The work procedure carried out consisted of sampling and serumenolytic intervention. There are two serumenolytics in this study, namely, 2% acetic acid and mineral oil. Serumen is taken by manual remover without serumenolytic intervention from 25 samples which are then placed on plastic clips and in each sample will be intervened by both types of serumenolytics. Each test tube is filled with 50 mg of serumen. Both serumenolytics are dripped as much as 2 ml into each test tube differently and at intervals of 5, 10, 15 and 30 minutes. then incubated in the waterbath at 370C at intervals of 5, 10, 15, and 30 minutes the test tube is removed from the waterbath and the cerumenolytic containing the result of the disintegration of the cerumen in the test tube is taken using a dropper and dripped into a cuvette which is then inserted into a UV-Vis spectrophotometer at a wavelength of 600 nm (reflecting color, lipids, and other elements released from the cerumenolytic

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serumen) the results of serum absorbance are recorded in the form of numbers in the time range of 5, 10, 15, and 30 minutes and then the results of the data are collected and compared with the average effectiveness of serum absorbance in the form of a calibration curve.[21]

RESULT

Average Serum Absorbance

The description of the data from the contact is effective based on the 5-minute, 10-minute, 15-minute, and 30-minute time periods.

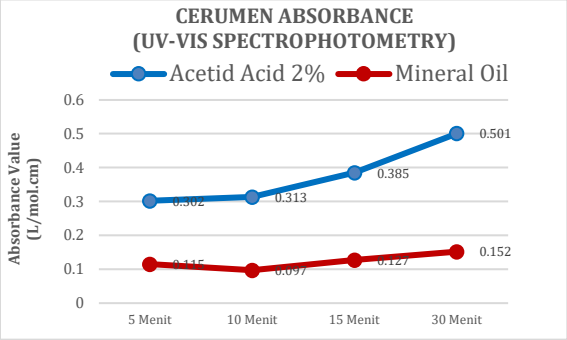

Figure 1. Average serum absorbance curve

Based on Figure 1 above, it is known that the average absorbance of serum given a 2% acetic acid solution shows an increase over time. Meanwhile, the average absorbance of serum given mineral oil solution increased in the 5th minute and decreased in the 10th minute, then increased again in the 15th and 30th minutes.

In vitro serum absorbance analysis of 2% acetic acid serumenolytic intervention at 5, 10, 15, and 30 min times.

In this section, an effectiveness test will be carried out using 2% acetic acid based on serum absorbance at any time determined using ANOVA Repeated Measures:

Table 1. Acetic acid effectiveness 2%

Cerumenolytics		Mean ± Standart deviation (L/mol.cm)	p-value
Acetid acid 2% (N=25)	5 minute	0.302 ± 0.198	0.002*
	10 minute	0.313 ± 0.207	
	15 minute	0.385 ± 0.221	
	30 minute	0.501 ± 0.258	

*Signifikan secara statistik (p<0.05)

The results of the One Way ANOVA test in Table 1. show a significance value smaller than α (0.05). So that the results of the effectiveness test can be declared to have a significant effect, meaning that significant serum absorbance occurs at 5, 10, 15, and 30 minutes in a 2% acetic acid solution.

Based on the results of ANOVA's Repeated Measures which showed that the use of 2% acetic acid had an effectiveness in the 5th, 10th, 15th, and 30th minutes on the absorbance of the serumen, then a follow-up test (post-hoc) was carried out to see at what minute the 2% acetic acid solution showed its effectiveness. Here are the results of further tests with LSD:

Table 2. Post Hoc Test Results of Acetic Acid 2%

Cerumenolytics	Time interval		N	p-value
Acetid Acid 2%	5 minute	10 minute	25	0.773
		15 minute	25	0.043*
		30 minute	25	0.004*
	10 minute	15 minute	25	0.036*

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		30 minute	25	0.006*
	15 minute	30 minute	25	0.032*

*Statistically significant (p <0.05)

Based on the post-hoc tests in table 2 above, it showed that at the 30th minute after administering 2 cerumenolytic acetic acid, the cerumen absorbance experienced the most significant effectiveness. Thus it can be stated that the absorbance of cerumen intervened with 2% cerumenolytic acetic acid has the best effectiveness at 30 minutes.

In vitro serum absorbance analysis of mineral oil serumenolytic intervention at 5, 10, 15, and 30 minutes.

In this section, an effectiveness test will be carried out on the use of mineral oil based on serum absorbance at any time determined using Kruskall Wallis:

Table 3. Effectiveness of mineral oil

Ceruminolytics		Mean ± Standart deviation (L/mol.cm)	p-value
Mineral oil (N=25)	5 minute	0.115 ± 0.142	0.001*
	10 minute	0.097 ± 0.055	
	15 minute	0.127 ± 0.131	
	30 minute	0.152 ± 0.005	

*Statistically significant (p<0.05)

The results of the Kruskall Wallis test in Table 3. show a significance value smaller than α (0.05). So that the results of the effectiveness test can be declared to have a significant effect, meaning that significant cerumen absorbance occurs at 5, 10, 15, and 30 minutes in cerumenolytic mineral oil.

Based on the results of the Kruskall Wallis, a post-hoc test was carried out to see at what minute the mineral oil solution showed its best effectiveness. Here are the results of further tests with Mann Whitney:

Table 4. Results of Post Hoc Mineral Oil Tests

Ceruminolytics. Time	interval	N	p-value
5 minute	10 minute	25	0.337
	15 minute	25	0.121
	30 minute	25	0.001*
Mineral oil	15 minute	25	0.491
10 minute			
	30 minute	25	0.001*
15 minute	30 minute	25	0.003*

*Statistically significant (p<0.05)

Based on the post-hoc test in Table 4. above, it shows that in the 5th, 10th, and 15th minutes there was no significant effectiveness in the use of mineral oil. Meanwhile, the absorbance of serum at the 30th minute after being given a mineral oil solution experienced the best effectiveness.

Comparative analysis of serum absorbance in vitro against 2% acetic acid and mineral oil interventions was conducted.

In this section, the comparison between the 2% acetic acid serumenolytic intervention with mineral oil against serum in vitro will be tested using the Mann Whitney test

Table 5. Comparison between acetic acid 2% and mineral oil

Ceruminolytics	Mean ± Standardeviation (L/mol.cm)	p-value

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Acetid acid 2% (N=25)	0.375 ± 0.233	0.001*
Mineral oil (N=25)	0.123 ± 0.105	

*Statistically significant (p<0.05)

Based on the results of the Mann Whitney test in Table 5. showed a significance value of 0.001 (p<0.05). So it can be stated that the use of 2% cerumenolytic acid and mineral oil has different effectiveness against serum intervention in vitro, the difference can be seen from the mean value in each group, where 2% acetic acid has a higher mean value compared to mineral oil. Thus it can be concluded that 2% acetic acid has a higher effectiveness than mineral oil against serum intervention in vitro.

DISCUSSION

Effectiveness of 2% cerumenolytic acetic acid against in vitro serumen absorbance

The results of the study that have been carried out show that 2% acetic acid has good effectiveness over time according to the results of univariate analysis showing a gradual increase starting from the 5th, 10th, 15th, and 30th minutes respectively of (0.302), (0.313), (0.385), and (0.501) to serum intervention in vitro, this is also evidenced by testing using Repeated Measures ANOVA which obtained significance figures (p- value) of p=0.002. In addition, in this study, the use of 2% acetic acid showed the best effectiveness at the 30th minute in the LSD test results. Some studies state that a water-based solution will be more effective in breaking down the components of the serumen. This type of water-based serumenolytic is hydrogen peroxide, phenol glycerol, sodium doculate, sodium bicarbonate, triethanolamine polypeptide oleate-condensate, water and NaCl 0.9%.[6, 12-15]

In a comparative study of serumenolytic agents conducted previously with 2.5% acetic acid intervention by syringe against 21 ears with serum prop, the results of the release of prop irumen were obtained in 57.14% ears.[10] Meanwhile, other studies have compared serumenolytic interventions with sodium bicarbonate 10% and acetic acid 2.5% in serum prop adults and children with almost the same efficacy results, namely sodium bicarbonate 10% by 66% and acetic acid by 78% but higher intervention results for children by 96% and adults by 45%.[11] In another study with in vitro laboratory experiments with cultures of various bacteria intervened by acetic acid, it was found to be effective in preventing the formation of biofilms in bacteria and eradication of mature biofilms after isolation for three hours after exposure.[19]

Acetic acid can increase lipid solubility allowing for increased accumulation of fatty acids on cell membranes or other cell wall structures. The major contribution in the composition of cerums consists of the secretion products of the serum and sebaceous glands, namely saturated fatty acids and the result of corneocyte desquammation in the ear canal, thought to be because this makes the

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intervention of 2% acetic acid on the serum soften, swell, and disintegrate due to the acidic nature of acetic acid, low pH, and corrosive to a tissue. In this study, a 2% acetic acid solution will be effective at 30 minutes.[12-16]

Effectiveness of cerumenolytic mineral 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 the use of mineral oil has an effectiveness at the 5th, 10th, 15th, and 30th minutes respectively of (0.115), (0.097), (0.127), and (0.152) against in vitro serum intervention, this is evidenced by testing using Kruskall Wallis which obtained a significance (p-value) of p=0.001. In addition, in this study, the use of mineral oil was obtained showing the effectiveness of terabit at the 30th minute with Mann whitney.

Previous research has shown that the use of mineral oil before irrigation can soften the irumen. In another study, ex vivo serumen that was intervened with several serumenolytics, mainly using oil-based products CleanEars® which contain (mineral oil, squalene, spearmint oil) obtained a serum solubility of only <25% compared to water-based Co-phenylTM Forte products containing (lignocaine/phenylephrine) with a serum solubility result of 25-75%. Other studies conducted in vivo on humans found that the penetration of mineral oil in human skin was only limited to the upper layer of the stratum corneum on the skin The forearm.[11] Apart from being a serumenolytic, mineral oil is also used as a therapy for fecal impaction and constipation by lining the fecal and preventing fluid resorption.[20]

Serumenolytics with oil-based components are given with the purpose of lubricating and softening the serumen, but not too much breaking down the serumen fragments. However, some studies have found that oil-based serumenolytics are ineffective. Examples of oil-based components are peanut oil, olive oil, almond oil, camphor oil, turpentine oil, chlorbutol, paradichlorobenzene.[6,12-16]

Comparison of serum absorbance in vitro to 2% acetic acid intervention with mineral oil.

The results of the study that have been carried out show that the intervention of 2% acetic acid and mineral oil has different effectiveness on serum in vitro, this is evidenced by testing using Mann Whitney which obtained a significance (p-value) of p=0.001. Serumenolytic acetic acid 2% has a higher effectiveness compared to mineral oil against serum absorbance in vitro with UV-Vis spectrophotometer.

This study proves that the longer the wake intervenes of cerumenolytic acetic acid 2% with cerumen in vitro, the greater the disintegration of cerumen fragments that will be absorbed by the spectrophotometer, while mineral oil has an absorbance value that is much different from acetic acid 2%. This is reinforced by previous studies that

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obtained in vitro serum intervention at the 30th minute with water-based serumenolytics , namely phenol glycerol 10% (0.2362) and sodium docurate (0.2198), in contrast to oil-based serumenolytics , olive oil (0.0866) and coconut oil (0.0382) using spectrophotometer instruments 21, It is also supported by other studies with more effective water-based serumenolytic results , namely 3% H2O2 of (0.23867) and oil-based serumenolytic , namely coconut oil of (0.01600).[17,18] Another study conducted prospective ex vivo studies on 12 patients. The serumenolytics used are water-based, oil-based, and carbamide peroxide solutions. The evaluation was carried out after 1 minute, 2 minutes and 5 minutes and photo documentation was carried out, the results of the study showed that water-based serumenolytics were more effective than oil-based, while oil-based ones were declared ineffective. However, in the study, sterile water was statistically most effective and more effective than sodium docurate. Water is an effective and economical option, but long-term use can be a predisposition to otitis externa.[12, 15]

Mineral oil becomes a less effective serumenolytic compared to water-based serumenolytic against serum absorbance in vitro. This is suspected to be due to the oil-based function which tends to be more softening and slightly results in disintegration of the serum components. However, some oil-based serumenolytics available in households are easy to obtain and relatively safe so they can be used as an alternative to water-based.

CONCLUSION

Based on the results of this study, it can be concluded that in vitro serum absorbance of both 2% acetic acid and mineral oil interventions is effective at each specified minute and most effective at the 30th minute. 2% acetic acid has a higher effectiveness against in vitro serum intervention compared to mineral oil. The intervention of 2% acetic acid and mineral oil on serum absorbance in vitro had quite different results in the degree of effectiveness.

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