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THE ABILITY OF ALOE VERA EXTRACT (ALOE VERA) AS ANTISEPTIC COMPARED WITH POVIDONE IODINE 10% ON CONTAMINATED WOUND ON WISTAR RAT

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ABSTRACT

Contaminated wound incidents is still high and it can be an infected wound. People usually treat contaminated wound with antiseptic agent such as povidone iodine 10% but it can cause skin colour change and irritation. Aloe vera extract has active compounds suspected to act as antiseptic such as saponin and phenol. This experiment was conducted to know the ability of Aloe vera extract as antiseptic against bacteria reduction compared with povidone iodine 10% on contaminated wound. Twenty four female wistar rats were randomly devided into six groups. A 2,5 cm incision wound was made on each sample's back that opened for three hours. The treatment groups were treated with 50%, 60%, 70%, 80%, and 90% Aloe vera extract, control group was treated with Povidone iodine 10%. Data obtained were analyze by one-way ANOVA. The result showed there were differences in concentration changes of Aloe vera extract and and povidone iodine 10% to the bacteria reduction (p=0,029). Aloe vera extract 90% showed the highest bacteria reduction but wasn't significantly different with Povidone iodine 10%. Correlation test showed the relationship between the concentration of extract with bacteria reduction (R=0,646; p=0,001). Based on the result, it can be concluded that Aloe vera extract 90% has the same effectiveness with Povidone iodine 10% in reducing bacterial on contaminated wound.

KEYWORDS: Aloe vera extract, Antiseptic, Povidone iodine 10%.

INTRODUCTION

Skin is the most extensive organ of the body and is located on the outermost part of the body, so it is very susceptible to injury. Wounds occur when normal anatomical structures and functions are damaged due to pathological processes originating from internal or external and affecting certain organs. Wounds are classified into several groups based on the status of skin integrity, healing time, severity, and level of cleanliness. Based on the healing time, wounds are divided into chronic wounds and acute wounds. One type of acute wound, especially a cut, is a wound that heals well and heals according to the estimated time. However, wound healing will be hampered if there are microorganisms that will infect the wound. The results of cultures on incisional wounds that were left exposed to free air for 3 hours showed that there were many bacterial colonies in the wound and most of them were gram-positive bacteria, especially the coccus type. It is possible that bacteria other than gram-positive bacteria can also infect wounds. Therefore, the use of appropriate antiseptics is necessary to prevent the growth of bacteria in the wound.[1][2] [3] [4][5]

According to research conducted in vitro, a solution of povidone iodine which has a concentration of more than 0.05% is toxic to granulocytes and some monocytes. The Agency for Health Care Policy and Research (AHCPR) clinical guidelines state that povidone iodine is a type of solution that is toxic to fibroblasts. In addition, wound care using 10% povidone iodine has several side effects, including irritation of the skin and allergic reactions such as itching, swelling of the mouth or face and difficulty breathing.[6] [7] [8]

With the various side effects of povidone iodine, it is hoped that medicinal plants can be used as alternative therapies in wound care. Besides being considered to have fewer side effects than drugs derived from chemicals, the price of medicinal plants is also more affordable.[9][10] One of the medicinal plants that is aloe vera. Since ancient times people have known aloe vera as

a medicine to cure various diseases, ranging from drugs for skin, hair growth, lowering high cholesterol levels, anemia, laxatives, and others. However, the efficacy of aloe vera as an antiseptic so that it can accelerate wound healing, especially cuts, not many people know about it.[11]

Most of the content of aloe vera or Aloe vera plays a role in helping wound healing. The results of previous research conducted by Widagdo (2004) stated that aloe vera contains anti-thromboxane A2, vitamin A and vitamin E which play a role in accelerating the healing process of second-degree burns by increasing blood flow to injured cells thereby accelerating normalization of damaged epithelial cells. The presence of several ingredients such as vitamin C bradykinase and salicylic acid in aloe vera acts as an anti-inflammatory which inhibits the arachidonic acid metabolic pathway thereby shortening the inflammatory phase.[12][13]

Another study related to the efficacy of aloe vera which proved that aloe vera applied topically to cuts can stimulate reepithelialization, fibroblasts, and angiogenesis. Aloin and glucomannan contained in aloe vera have also been investigated and proven that these ingredients can reduce the area of the lesion (bleeding) in the stomach. Aloe vera contains antiseptic agents in the form of saponins and phenols.[14] These antiseptic agents work simultaneously so that they can inhibit growth and cause bacterial death.[15] Based on the above background, it is necessary to conduct research on the antiseptic effect of aloe vera (Aloe vera) extract compared to 10% povidone iodine on contaminated cuts in Wistar rats.[16] [15]

MATERIALS AND METHODS

The research design used in this study was a research design. The design of this study was true-experimental with a pretest–posttest approach using a control group. In this design, the number of bacteria was measured before and after the experiment, to compare the data obtained from the treatment group and the control group. The sampling technique used is simple random sampling. In this study there were 6 treatment groups, namely the administration of aloe vera extract with concentrations of 50%, 60%, 70%, 80% and 90% and the control group using 10% povidone iodine. The number of samples for each group was 4 rats. The inclusion criteria in this study included 1) Wistar strain, 2) Female sex, 3) Age about 2.5 months, 4) Average body weight of rats 150-200 grams, 5) No thickening or inflammation on the backs of rats the incision will be made, 6) Health is indicated by active movement, 7) Not receiving any previous treatment.

Making aloe vera extract is a process of separating compounds from a mixture of other ingredients using 96% ethanol as a solvent because it dissolves in water and is made with a Soxhlet extractor. To make the incision contaminated is to shave about 3-5 cm of hair around the skin area to be incised, then disinfect the skin area by injecting lidocaine intramuscularly. Make an incision using a scalpel, the length of the wound is about 2.5 cm with a depth to the subcutaneous area, then place the mouse in each drum and leave the wound for about 3 hours so that it is contaminated with bacteria in the air. Give treatment according to the group (50, 60%, 70%, 80%, and 90% aloe vera extract treatment group and 10% povidone iodine control group) and cover the wound with sterile gauze. Bacterial culture making is a process that bacteria were planted on Nutrient Agar Plate (NAP) which were then incubated in an incubator at 37°C for 18-24 hours. This planting is to see the growth of bacterial colonies. After incubation, the resulting colonies were observed and counted using the colony counter method.

The pretest data collection was in the form of a swab method which was carried out 3 hours after the incision was made, then streaked in NAP and incubated at 37°C for 18-24 hours, the colony count was carried out after incubation. Posttest data collection in the form of a swab method carried out during wound care, then streaked on NAP and incubated at 37°C for 18-24 hours, colony calculations were carried out after incubation.

The results were tested using SPSS 16.0 for Windows software with One-way ANOVA test and Post Hoc Tukey HSD test, then continued with correlation test. Before analyzing the data using ANOVA, it is necessary to fulfill several data assumptions, namely the data must have a normal distribution and homogeneous variance. For this reason, the normality and homogeneity of the data were tested first.

RESULTS

Based on the research conducted, the following results were obtained:

Table 1: Bacterial Colony Calculation on NAP (n = 24)

Group	Repetition	Pretest	Posttest	Bacterial Reduction (Δ)	Mean ± SD
1 Aloe vera extract 50% v/v	1	230	121	109	92 ± 36.2
	2	331	196	135	
	3	95	32	63	
	4	214	153	61	
2	1	203	54	149	152 ± 38.8

Aloe vera extract 60% v/v	2	268	108	160	
	3	128	26	102	
	4	300	104	196	
3 Aloe vera extract 70% v/v	1	346	130	216	173 ± 55.5
	2	344	119	225	
	3	178	59	119	
	4	204	73	131	
4 Aloe vera extract 80% v/v	1	346	33	313	229 ± 64.8
	2	196	22	174	
	3	297	51	246	
	4	212	30	182	
5 Aloe vera extract 90% v/v	1	479	1	478	304 ± 136.3
	2	155	2	153	
	3	346	20	326	
	4	268	11	257	
6 *Povidone iodine* 10%	1	438	8	430	262 ± 125.6
	2	146	4	142	
	3	232	36	196	
	4	342	61	281	

Table 1. shows that there are differences in the concentration of aloe vera extract in the treatment giving different effects on the number of bacterial colonies. The effect of giving aloe vera extract began to be seen where the decrease in the number of bacterial colonies increased after being treated with aloe vera extract at a concentration of 50%. The decrease in the number of bacterial colonies tends to increase when given a higher concentration. At a concentration of 90% the effect was greater than the decrease in the number of bacterial colonies in the positive control group (Povidone iodine 10%) although the difference was not significant.

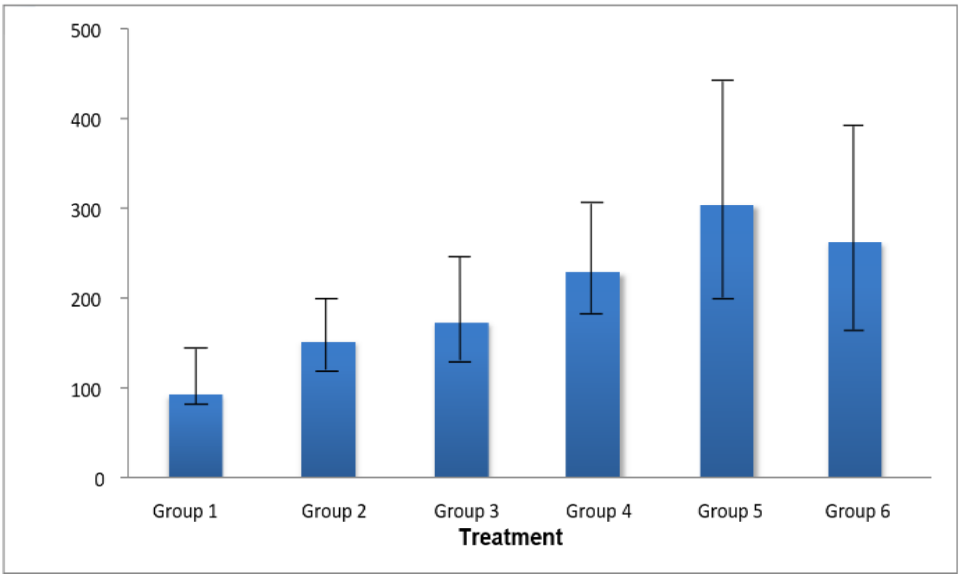

Fig.1 Reduction of Bacterial Count After Treatment With Aloe Vera Extract and Povidone iodine 10%

In Figure 1, it can be seen the effect of each treatment with aloe vera extract on decreasing the number of bacteria produced in the NAP, namely the higher the concentration of aloe vera extract, the higher the decrease in the number of bacteria.

Table 2: Post Hoc Tukey HSD test Bacterial Colony Calculation.

Group	N	Subset for alpha = 0.05	
		1	2
Aloe vera extract 50%	4	92.0000	
Aloe vera extract 60%	4	151.7500	151.7500
Aloe vera extract 70%	4	172.7500	172.7500
Aloe vera extract 80%	4	228.7500	228.7500

Povidone iodine 10%	4	262.2500	262.2500
Aloe vera extract 90%	4		303.5000
Sig.		.104	.178

From the Post Hoc Tukey HSD test, it can be seen that there is a significant difference between the 50% aloe vera extract treatment group and the 90% aloe vera extract group with p=0.028 (p<0.05). In the output of the Homogeneous Subsets table, the six sample groups fall into two subsets. In subset 1 filled with aloe vera extract with concentrations of 50%, 60%, 70%, 80% and 10% povidone iodine. This means that the five groups do not have a significant average difference. In subset 2 filled with aloe vera extract with concentrations of 60%, 70%, 80%, 90% and 10% povidone iodine. This means that the five sample groups also do not have a significant average difference. Of the six groups, only the 90% concentration group was not found in subset 1, as well as the 50% concentration group which was not in subset 2. This means that there are significant differences between the two groups. Pearson correlation value of 0.646 indicates a positive correlation with a strong correlation strength. A positive correlation can be interpreted that an increase in the concentration of aloe vera extract tends to increase the decrease in the number of bacteria.

DISCUSSION

Based on the results of colony calculations that have been carried out, the 50% concentration which has an average decrease in the number of bacteria is 92 colonies, 60% concentration is 152 colonies, 70% concentration is 173 colonies, 80% concentration is 229 colonies and 90% concentration has an average an average of 304 colonies, even in the preliminary study showed that at a concentration of 100% no longer found bacterial growth on NAP media. This shows that the higher the concentration of aloe vera extract used, the higher the antiseptic effect. The ability of aloe vera extract in reducing the number of bacteria is due to the presence of active ingredients that have antibacterial power, namely phenols and saponins. Phenol is an acidic alcohol, so it is also known as carbolic acid. Bacterial growth can be disrupted due to the presence of a phenolic compound contained in aloe vera extract. Acidic conditions in the presence of phenol can affect the growth of bacteria.[17]

The presence of a protein layer on the surface of bacteria makes it difficult for antibacterial substances to penetrate into bacterial cells. Phenol has the ability to denature proteins and damage cell membranes. Phenol binds to proteins through hydrogen bonds, causing the protein structure to be damaged. Most of the structure of the cell wall and cytoplasmic membrane of bacteria contains proteins and fats. Instability in the cell wall and cytoplasmic membrane of bacteria causes the function of selective permeability, active transport function, controlling the protein composition of bacterial cells to be disturbed. Disruption of cytoplasmic integrity results in the escape of macromolecules, and ions from the cell. Bacterial cells lose their shape, and lysis occurs.[18] Phenolic compounds are bacteriostatic or bactericidal depending on their concentration. Bacterial cell death means the permanent loss of the ability of bacteria to reproduce. Phenol can also form chelates with Fe and Cu ions, then the chelate form is transferred into bacterial cells. High levels of metal ions in cells cause impaired function of enzymes so that microorganisms die.[19][17]

Saponins are said to be natural detergents, capable of reducing the surface pressure between molecules on the surface of an object or liquid (surface active agent). Detergent can be condensed on the surface of an object or liquid because it has a fat-soluble hydrocarbon group (located on the cell membrane) so that it can cause the cells in the cytoplasmic membrane to lyse. Saponins also have a membrane-damaging action plasma from bacteria. Like aloe vera which has phenols and saponins as antiseptics, Povidone iodine 10% also has its own mechanism as an antiseptic. Iodine contained in 10% povidone iodine combines with the amino acid tyrosine which is used for respiration in the cell membrane of microorganisms and causes protein denaturation, resulting in damage to the cell membrane of these microorganisms. In addition, the iodinization of amino acids carried out by 10% povidone iodine will interfere with microorganisms in the protein formation process so that these microorganisms will die.[20]

From the Post Hoc Tukey test results, it can be seen that there is a significant difference between the 50% aloe vera extract treatment group and the 90% aloe vera extract group. This shows that the aloe vera extract group with a concentration of 90% had a more optimal effect in reducing the number of bacteria in contaminated cuts compared to the aloe extract group with a concentration of 50%. From the comparison of the 90% aloe vera extract group with the 10% povidone iodine group as a control, there was no significant difference, so it can be concluded that the two groups had the same effectiveness in reducing the number of bacteria in contaminated cuts. The maximum result from aloe vera extract as an antiseptic was shown in a preliminary study that at a concentration of 100% no bacterial growth was found on NAP at all.

CONCLUSION

Based on the results of the study, it can be concluded that 90% aloe vera extract has the same effectiveness as 10% povidone iodine in reducing the number of bacteria in contaminated cuts.

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