Therapeutic Effects of Ultrasonic Sound to Scabies Patients

[1]Amalia Tri Utami, [2]Zidnal Mafaz, [2]Noor Rhoziq Ghulam Perdana
[1] Faculty of Medicine and Health Science, State Islamic University Maulana Malik Ibrahim, Indonesia
[2] Faculty of Medicine and Health Science, State Islamic University Maulana Malik Ibrahim, Indonesia

Abstract—: Objective: To evaluate the efficacy of ultrasonic sound to treat scabies patients. Methods: The total 21 patient with scabies was treat by ultrasonic sound. For the positive control, the scabies patient was treat by scabicide. And for the negative control, the scabies patient were not give any treatment. The severity of the disease was measured based on the degree of the severity from scabies each week until a month. Results:Based on table 1, it can be seen that the average decrease in the highest degree of disease in supersonic treatment was 4.74 ± 0.92, and the average decrease in the lowest disease degree in the negative control treatment was -1.30 ± 0.47 (anincrease in the degree of disease). To prove whether there ia statistically significant difference in the average decrease in the degree of disease, then one way anova statistical analysis will be carried out, but first it is tested for normality and homogeneity. Conclusion: Ultrasonic waves can damage soft tissues inside insects, and the scales die off as the blood spreads elsewhere. Ultrasound can damage eggs and cause liquid to leak out and kill eggs. In this study, the sounds heard in scabies were on the order of 60,000 Hz.

Keywords : Scabies, Ultrasonic Sound, Therapy

I. INTRODUCTION

Scabies is a common disease that is caused by *Sarcoptes scabiei var. hominis*. [1] This disease is usually characterized by skin lesions which forms straight or winding cunicullus berwarna white or gray. These lesions are usually located on the thin stratum corneum such as the fingers, wrists, skin folds etc. [2] Usually accompanied by itching at night (nocturnal prurius) and quickly spreads in dense environments.[3]

World Health Organization (WHO) states the number of scabies in 2014 was 130 million people in the world. In 2014 according to the International Alliance for the Control of Scabies (IACS) the incidence of scabies varied from 0.3% to 46%. Scabies is a skin disease caused by Sercoptes scabiei Var hominis. Scabies is found in all countries with varying prevalence. Some developing countries have a prevalence of scabies around 6% - 27% of the general population, attacking all races and age groups and tend to be high in children and adolescents. The incidence of scabies in 2015 also had a high prevalence in several countries including Egypt (4.4%), Nigeria (10.5%), Mali (4%), Malawi (0.7%), and Kenya (8.3 %). the highest incidence is found in children and adolescents.

Scabies is often found in Indonesia, this is because Indonesia is a tropical country. The prevalence of scabies in Indonesia according to data from the Ministry of Health of the Republic of Indonesia The prevalence of scabies in Indonesia has been quite a decrease from year to year as seen from the 2008 prevalence data of 5.60% - 12.96%, the prevalence in 2009 amounted to 4.9-12, 95% and the latest data obtained is that the prevalence of scabies in Indonesia in 2013 was 3.9 - 6%. Despite the decline in prevalence, it can be said that Indonesia is not free from scabies and is still one of the problems of infectious diseases in Indonesia.

As with other infectious diseases, this disease is easily spread in dense environments, poor hygiene, and lack of light exposure. Pesantren is a place that is often attacked by scabies. Pesantren or Islamic boarding school is a hostel that is used to study Islam. The lack of management costs and dense population, making hygiene in pesantren worse. This is what makes pesantren a favorite place for mites to breed.[4]

II. MATERIAL

A. *Scabies*

Scabies is a skin disease caused by infestation and sesitization of mites (Sarcoptes scabiei hominis varieties that) cause itching at night, affecting a group of people. The place of predilection is in thin, warm and moist skin areas such as between fingers, inguinal area, and buttocks.

Scabies has a close relationship with personal hygiene and neighborhoods so it often occurs in people who live together in densely populated settlements, for example in boarding schools with high population densities. Scabies often found in densely populated environments with close and prolonged skin contact such as in orphanages, care centers for the elderly, prisons, refugees, and boarding schools and even in hospitals.

Sarcoptes scabei var hominis can infect the skin directly and indirectly. Direct contact can occur through sleep simultaneously and during sex. Indirect contact can occur through bed linen, pillows, bolsters, towels, and others. After getting in contact with mites or mite extracts, then the mites will go to the surface of the skin and the female mites will make tunnels to store their eggs in the stratum croneum. Because the epithelium in the stratum croneum is thin, making it easier for mites to create tunnels there and manifestations will occur in areas with thin skin such as groin, buttocks, between the fingers, and others. Mites will produce 2-3 eggs per day and then the eggs will hatch for 2-4 days. After hatching and becoming an adult larvae, adult mites will bite and excrete feces and saliva which is a mite extract and can be an antigen from scabies

B. *Ultrasonic Sound*

Ultrasonic waves can damage the internal soft tissue of insect, and scabies will die when blood diffuses into other parts. Ultrasounic waves can damage the eggs so that the contents of the liquid leak out then the eggs die. In this study the sound heard on scabies is in the range of 60,000 Hz

C. *Ethical clearance to collect the eggs, nymphs and adults of head lice from human beings*

The protocol for treating scabies patient was approved by the Ethics Committee of UIN Maulana Malik Ibrahim Malang. All the patients were lived in Islamic boarding house around malang city, Indonesia.

III. METHOD TO EVALUATE THE SCABICIDE ACTIVITY FROM ULTRASONIC

This research was conducted in two Islamic boarding schools, namely Darul Falah, Batu, East Java and Sabilur Rosyad, Malang, East Java. From both Islamic boarding schools, 23 samples were obtained, ranging in age from 13-24 years. In these 23 samples, we will provide treatment with ultasonik therapy.

As for the control, we got from the clinic which also numbered 23 people. We made two kinds of controls, positive controls and negative controls. Positive control is a patient who use scabimite in the treatment of scabies. And negative control consisted of patients with scabies without treatment.

We gave each of samples an Mp3 containing an ultrasonic that duration is about 3 hours. We educate them to wear it every night before going to bed. This is done because scabies start active at night.

Before administering this drug, we assess the samples using the scoring system below.

1
2
3
4

Table 1. The Scoring System **of** Severity in Scabies

A: Distribution and extent of crusting
1. Wrists, web spaces, feet only (<10% Total Body Surface Area)
2. Above plus forearms, lower legs, buttocks, trunk or 10-30% TBSA
3. Above plus scalp OR >30% TBSA

B: Crusting / Shedding
1. Mild crusting (<5mm depth of crust), minimal skin shedding
2. Moderate (5-10mm) crusting, moderate skin shedding
3. Severe (>10mm), profuse skin shedding

C: Past Episodes
1. Never had it before
2. 1-3 prior hospitalizations for crusted scabies OR depigmentation of elbows, knees
3. >=4 prior hospitalizations for crusted scabies OR depigmentation as above PLUS legs/back or residual skin thickening / ichthyosis

D: Skin Condition
1. No cracking or pyoderma
2. Multiple pustules and/or weeping sore and/or superficial skin cracking
3. Deep skin cracking with bleeding, widespread purulent exudates

Grade 1: Total score 4-6
Grade 2: Total score 7-9
Grade 3: Total score 10-12

Treatment: Ivermectin 200mcg/kg rounded up to nearest 3mg.
Grade 1: 3 doses - Days 0, 1, 7
Grade 2: 5 doses - Days 0, 1, 7, 8, 14
Grade 3: 7 doses - Days 0, 1, 7, 8, 14, 21, 28

All patients also treated with benzyl benzoate and 5% tea tree oil 2nd daily alternating with Keratolytic cream.

We will reassess the disease level every week with the same scoring system. We compare the samples with positive and negative controls.

IV. STATISTICAL ANALYSIS

A completely randomized design was used in this experiment. Mortality of scabies were analyzed by analysis of variance (ANOVA) with an SPSS program. Significantdifferences between treatments were determined at P<0.05. The effectiveness of the ultrasonic sound were compared with the control.

V. RESULT

Table 2. The Average Result of The Treatment

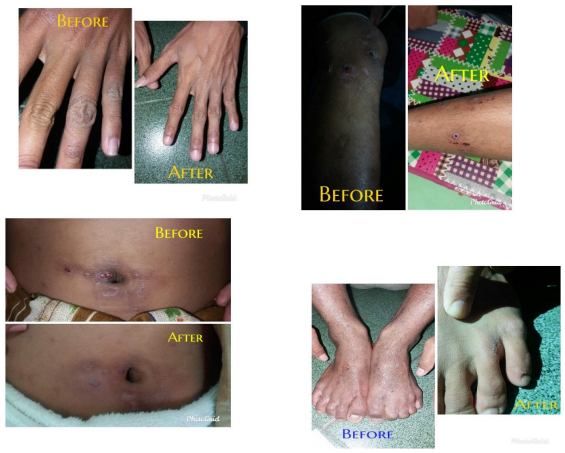
The Treatment	The Mean Before Treatment	The Mean After a Week Treatment
Ultrasonic	5,2173	0,4782
Positive control	5,3913	4,2860
negative control	4,7826	6,0869

In ultrasonic treatment, there is a dramatically reduction in the degree of disease (see picture 1). In treatment using scabimite, the reduction is not too significant. Meanwhile, without treatment, the degree of disease is increased.The statistical analysis can be seen in the following table 3.

Table 3. Analytical Result Of The Treatment

Treatment	Average	Standard Deviation	Notation
Supersonic	4.7391	0.91539	c
Positive Control (Scabimite)	0.5652	0.72777	b
Negative Control (without any treatment)	-1.3043	0.47047	a
Signifikancy normality	= 0.000		
Significancy homogenity	= 0.009		
Chi-square count	= 61.994		
p-value	= 0.000		
Chi-square table	= 5.991		

Based on table 1, it can be seen that the average decrease in the highest degree of disease in supersonic treatment was 4.74 ± 0.92, and the average decrease in the lowest disease degree in the negative control treatment was -1.30 ± 0.47 (an



Picture 1. The Decrease of Severity of Disease

increase in the degree of disease). To prove whether there ia statistically significant difference in the average decrease in the degree of disease, then one way anova statistical analysis will be carried out, but first it is tested for normality and homogeneity.

The results of the normality test with the Kolmogorov Smirnov test showed a significance value smaller than α (0,000 <0.050), so the data were not normally distributed. The significance value in the homogeneity test of data variance of 0.009 which is smaller than α (0.05) proves that the data variance is not homogeneous. Because the data used does not meet the two assumptions, then a replacement kruskal wallis test is performed.

Based on the results of the Kruskal Wallis test, the calculated chi-square value is greater than the chi-square table (61,994> 5,991) and the p-value is smaller than α (0,000 <0.050), the H0 decision is rejected, so it can be concluded that there is Significant difference in the average decrease in the degree of disease between treatments. To see the location of the difference, a further test was carried out with the mann whitney test with the results of the notation in table 1. From the notation column the results were obtained that the supersonic treatment with the average value of the highest degree of disease decreased and was significantly different from the other groups. Or in other words, supersonic can be considered an effective method to reduce the degree of disease.

VI. DISCUSSION

Ultrasonic waves are sound waves with a frequency higher than the hearing ability of the human ear which is above 20,000 Hz. Ultrasonic waves have an important role in the fields of general medicine and dentistry. The field of general medicine uses ultrasonic waves with frequencies between 2,000,000 Hz to 10,000,000 Hz (Bushberg, Seibert, Leidholdt, & Boone, 1994). Ultrasonic waves used in diagnostic procedures have a frequency of 700,000 Hz to 3,000,000 Hz while for therapeutic procedures use frequencies between 3,000,000 Hz to 7,000,000 Hz (Cosgrove, 1993).

In the field of low-frequency ultrasonic wave dentistry (20,000 -100,000 Hz) it is used as a driver of ultrasonic scaling with a wave frequency within the limit of 25,000 Hz as an ultrasonic scaling device (Walmsley, 1992). In the field of endodontics, the use of ultrasonic waves as ultrasonic files, one of the mechanical irrigation techniques to clean the smear layer of the root canal (Dalai DR, 2014).

Low-frequency ultrasonic waves, namely 20,000-100,000 Hz are classified as "power ultrasound", which is a low-frequency ultrasonic wave that has an important cavitation effect in bacterial cell death. Ethics et al. Also found that ultrasonic frequencies with the right length of exposure could be used as a form of control of wood destroying insects Dinoderus Minutes.

Ultrasonic waves can damage the internal soft tissue of fleas, and fleas will die when blood diffuses into other parts. Ultrasonic waves can damage the eggs so that the contents of the liquid leak out then the eggs die. Beetle insects especially *Cicadellidae* and Scarabaeidae are known to be able to respond to sounds at high frequencies or ultrasonic frequencies ranging from 20,000 Hz to 100,000 Hz (Mason & Pollack, 2016). In mosquito insects (*Culicidae*) control devices have been developed using ultrasonic frequencies, even software from these controls is available. Dileep 2016 reports that there is no effect caused by ultrasonic waves for the human body.

In this research, the authors find that the ultrasonic sound effectively to treat scabies's disease among the islamic boarding house's students. The ultrasonic sound can destroy the scabies by making the scabies's egg damage, so that the contents of the liquid leak out then the eggs die. Beside that, the researchers found that the soft tissue of the scabies becoming warm and finally collapse after using ultrasonic sound. Ultrasonic waves can damage the internal soft tissue of scabies, and scabies will die when blood diffuses into other parts.

In this research, we found there was no side effect caused by ultrasonic sound among islamic boarding house's student. We are developing the therapeutical frequency for scabies's disease. And we found that the effective frequency is 65,000 Hz. The researchers also try to make the simple device that can make this device suitable in the densely populated home.

The device is known as Electronic Ultrasonic Emitter with a version of basic. This device consists of 4 electronic components including the 2 pin jumper and the black wire. The project is controlled by a microcontroller which is the Arduino Nano Atmega 328P. It has one speaker that emits frequency from 20.000 Hz to 65.000 Hz. These ranges are safe and not annoying because it is completely no noise from this device. It has a light indicator, which is the RGB Module. The RGB is an indicator to the device to recognize the device is working.

VII. CONFLICT OF INTEREST STATEMENT

The author declare that she has no conflict of interest.

VIII. CONCLUSION

Ultrasonic waves can damage soft tissues inside insects, and the scales die off as the blood spreads elsewhere. Ultrasound can damage eggs and cause liquid to leak out and kill eggs. In this study, the sounds heard in scabies were on the order of 60,000 Hz.

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