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Comparison of Tea Tree oil 5% Cream, Tea Tree Oil 5%+Permethrin 5% Cream, and Permethrine 5% Cream in Child Scabies

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Abstract: Scabies is a common ectoparasit infection caused by a tick of *Sarcoptes scabiei var. hominis*. The World Health Organization (WHO) categorizes scabies as "Neglected Tropical Diseases" in 2013. Scabies is more common in the tropics, especially child scabies. TTO has been used in communities internationally for over 90 years. TTO is an essential oil derived from leaf distillation and terminal branch of *Melaleuca alternifolia* plant. TTO has been shown to be effective (in vitro) bactericidal activity, to bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA). TTO was used to reduce colonization of MRSA and as an anti-bacterial, anti-fungal, and anti-viral skin infection. TTO is also used as a topical antipruritic drug. The TTO component is described specifically by the International Organization for Standardization Standard (ISO 4720), so the side effects of botanical products can be avoided. An experimental analytical study using randomized clinical trial and double blind parallel design comparing TTO 5% cream (treatment 1), TTO cream 5%+permethrin 5% (treatment 2) with permethrin 5% cream (control) on child scabies. The population of the study were the affected scabies students of junior high school (SMP), age 11-15 years, in 2 Islamic boarding school. Patient were examined on week 0, 1, 2, and 3, in order to decide whether the treatment should be continued or stopped. If complete remission were achieved, treatment was stopped. Examination data were collected and saved in medical records. Statistical analysis were processed using SPSS. At week 1, full recovery occurred in 1 patient (4.2%) in permethrin 5% group, 4 patients (16.7%) in TTO 5% group, and 3 patients (12.5%) in TTO 5%+permethrin 5% group. Chi-square test showed p value = 0.374 which means that there was no significant difference in three groups. At week 2, there were 4 patients (16.7%) in the permethrin 5% group, 13 patients (54.2%) in the TTO 5% group, and 5 patients (20.8%) in the TTO 5%+permethrin 5% group. Chi-square test showed p = 0.008 which means there was significant difference between permethrin 5% group, TTO 5% group, and TTO 5%+permethrin 5% group. We assume that TTO 5% cream is more effective than permethrin 5% cream in child scabies, TTO 5%+permethrin 5% more effective than permethrin 5% cream, TTO 5% cream is more effective than TTO 5%+permethrin 5% in child scabies. There are side effects, irritation in the permethrin 5% group, TTO 5%, and TTO 5%+permethrin 5%, which improved at week 2 of treatment.

Keywords: Tea Tree Oil, Child, Scabies

1. Introduction

Scabies is a common ectoparasit infection caused by a tick of *Sarcoptes scabiei var. hominis*. This disease causes increased morbidity of secondary infections and complications such as Acute Glomerulonephritis after Streptococcus infection [1]. The World Health Organization (WHO) categorizes scabies as "Neglected Tropical Diseases" in 2013 [2]. Scabies is more common in the tropics, especially child scabies [3].

WHO predicts that the global prevalence of scabies is 0.2% -2.4% [4]. In Australia, scabies is a health problem in Aboriginal indigenous communities, with a prevalence of 25% in adults and 30% - 65% in children [5], [6]. Based on

the data of the Indonesian Child Dermatology Study Group (KSDAI) in 2001, from 9 major hospitals in 7 cities in Indonesia, there were 892 scabies patients. Surabaya ranks 7th with 82 cases (9.2%). Some predisposing factors affecting the epidemiology of scabies in low socio-economic communities, such as social behavior, population movement, malnutrition, lack access of health care, inadequate therapy, and lack of hygiene [7-9].

The Mass Drug Administration (MDA) program uses Ivermectin to control scabies in endemic communities around the world, with the reports of Permethrin resistance to ectoparasites. This is consistent with the reported increased resistance of acaricid drugs resulting in treatment failure. Data on the scabies tick sensitivity to the main acaricid drug (Ivermectin and Permethrin) in the last 10 years showed a median increase of 2-3 times. The failure of permethrin's treatment as an acaricid drug in indigenous Australians (after MDA) has been documented. Singh and his colleagues suggested in his study that the cure rate for scabies was 89.5% (170 out of 190 patients) [10]. Permethrin 5% was widely used in the 1980s, healing achieved over 90% [11-14]. Permethrin resistance to scabies ticks has been reported in animal experiments. MDA programs with low patient compliance will increase the risk of resistance.

The ideal acaricid drug is expected to have an ovicid, antibacterial, anti-inflammatory, and/or antipruritic effect, and is effective in preventing recurrence (which is a results of hatching ticks), improving inflammatory reactions (from tick antigens), and pyoderma. The ideal drug has a low incidence of resistance and does not cause resistance to other drug agents. The use of botany has been proved useful in the treatment of skin inflammation [15, 16]. This has been studied extensively and updated in recent publications [16]. Of some botanists, Tea Tree Oil (TTO) is an ideal candidate for researches.

TTO has been used in communities (in Australia and internationally) for over 90 years. TTO is an essential oil derived from leaf distillation and terminal branch of *Melaleuca alternifolia* plant [17]. TTO has been shown to be effective (in vitro) bactericidal activity, to bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA). TTO was used to reduce colonization of MRSA and as an anti-bacterial, anti-fungal, and anti-viral skin infection [18]. TTO is also used as a topical antipruritic drug. The TTO component is described specifically by the International Organization for Standardization Standard (ISO 4720), so the side effects of botanical products can be avoided [19].

2. Method

This is an experimental analytical study using randomized clinical trial and double blind parallel design comparing TTO 5% cream (treatment 1), TTO cream 5%+permethrin 5% (treatment 2) with permethrin 5% cream (control) on child scabies. The population of the study were the affected scabies students of junior high school (SMP), age 11-15 years, in 2 Islamic boarding school. The inclusion criteria is the existence of typical tunnel and/or scabies lesion, itchy sensation especially at night, similar complaints of the family or person on the same room, one of the following were found on light microscopy examination: eggs, larvae, scabies or lice's fecal material, willing to be included on the research and sign the informed consent. The sampling method is consecutive sampling, which is every child scabies patient that fulfill the inclusion criteria in boarding school. Patient were examined on week 0, 1, 2, and 3, in order to decide whether the treatment should be continued or stopped. If complete remission were achieved, treatment was stopped. If the clinical manifestation haven't completely healed, the treatment were repeated until the upcoming week. Examination data were collected and saved in medical records. Statistical analysis were processed using SPSS.

3. Result

This study was conducted on 72 samples. The control group consisted of 24 patients receiving permethrin 5% cream treatment, treatment group 1 consisting of 24 patients receiving Tea Tree Oil (TTO) 5% cream, and treatment group 2 consisted of 24 patients who received TTO 5% cream+permethrin 5%.

The subjects of this study consisted of 63 boys (87.5%) and 9 girls (12.5%). Permethrin 5% group consists of 23 boys (95.8%) and 1 girl (4.2%). The TTO 5% group consisted of 20 boys (83.3%) and 4 girls (16.7%), while the TTO 5%+permethrin 5% group consisted of 20 boys (83.3%) and 4 girls (16.7%). The average age of permethrin 5% cream group was 12.96 ± 1.04 years old with the mean age of the TTO 5% cream group was 13.17 ± 1.34 years old. Mean age of TTO 5%+permethrin 5% cream is 13.63 ± 1.21 years old (table 1)

Table 1. *Basic characteristic of patient.*

Variable	Total			Total (n=72)	p=0,05
	Permethrin 5% (n=24)	TTO 5% (n=24)	TTO 5%+Permethrin 5% (n=24)		
Gender					
Male. n (%)	23 (95.8)	20 (83.3)	20 (83.3)	63 (87.5)	
Female. n (%)	1 (4.2)	4 (16.7)	4 (16.7)	9 (12.5)	0.319
Age (year)					
Mean rank	32.1	34.96	42.44		
Mean (year) ± SD	12.96±1.04	13.67±1.34	13.63±1.21	72(100)	0.185
Height (cm)					
Mean rank	34.04	39.73	35.73		

Variable	Total			Total (n=72)	p=0,05
	Permethrin 5% (n=24)	TTO 5% (n=24)	TTO 5%+Permethrin 5% (n=24)		
Mean height (cm) ± SD	148.42±7.93	156±10.55	152.41±6.55	72(100)	0.01*
Weight (kg)					
Mean weight (kg) ± SD	44.2±10.8	48.5±14.92	43.79±5.34	72(100)	0.621
Body Surface Area (BSA)					
Mean BSA	1.38	1.56	1.45	72(100)	0.875

*Significance difference
TTO: *tea tree oil*; SD: standard deviation

At week 0, 29 patients (40.3%) complained of severe itchy, followed by 18 patients (25%) complained of moderate itchy, 14 patients (19.4%) complained of mild itchy, 11 patients (15.3%) complained of terrible itchy intensity (table 2)

As many as 38 patients (52.8%) complained of severe sleep disturbance, 19 patients (26.4%) complained of moderate sleep disturbance, 11 patients (15.3%) complained of terrible sleep disturbance, 4 patients (5.6 %) complained of mild sleep disturbance. Physical examination were performed by examining papules, erythema, excoriation (scratching), and erosion. At week 0, there were papules and erythema lesions in 71 patients (98.6%). The value of p = 0.363 indicated that there was no significant difference in papule and erythema of the three groups. Excoriation was obtained in 22 patients (30.6%) with p = 0.632 which showed no significant difference within the three groups. Erosion were present in 23 patients (31.9%) with p <0.0001. which means that there were significant differences in the three groups. Most of patients (16 of 24 patients. 66.7%) in the TTO 5%+permethrin 5% group had erosion (table 2)

On the first week, the patient's itchy pattern changed. The majority of patients. 38 patients (59.4%) complained of mild itchy. A total of 19 patients (29.7%) complained of moderate itchy. 8 patients (11.1%) said the itch has absent. 5 patients (7.8%) complained itching with severe intensity, and 2 patients with terrible itchy intensity. The Kruskal-Wallis test showed a p value of 0.675, meaning there was no significant difference in the degree of itching between groups (table 3).

On the sleep disturbance complaint during the 1st week, 36 patients (56.2%) said sleep disturbance was absent, 15 patients (23.4%) said there were mild sleep disturbance, 7 patients (10.9%) said there were moderate sleep disturbance, 5 patients (7.8%) said there were severe sleep disturbance, and 1 patient (1.6%) said there were terrible sleep disturbance. The Kruskal-Wallis test showed a value of p = 0.047, which means there was a significant difference in the sleep disturbance aspect (table 3).

Table 2. *Patient complaint, physical examination, and additional examination on week-0.*

Variable	Permethrin 5% (n=24)	TTO 5% (n=24)	TTO 5%+Permethrin 5% (n=24)	Total (n=72)	p=0.05
Itchy					
Absent, n (%)	0(0)	0(0)	0(0)	0(0)	
Mild, n (%)	8(33.3)	5(20.8)	1(4.2)	14(19.4)	
Moderate, n (%)	7(29.2)	5(20.8)	6(25)	18(25)	
Severe, n (%)	8(33.3)	10(41.7)	11(45.8)	29(40.3)	
Terrible, n (%)	1(4.2)	4(16.7)	6(25)	11(15.3)	0.015*
Sleep disturbance					
Absent, n (%)	0(0)	0(0)	0(0)	0(0)	
Mild, n (%)	2(8.3)	1(4.2)	1(4.2)	4(5.6)	
Moderate, n (%)	8(33.3)	5(20.8)	6(25)	19(26.4)	
Severe, n (%)	13(54.2)	14(58.3)	11(45.8)	38(52.8)	
Terrible, n (%)	1(4.2)	4(16.7)	6(25)	11(15.3)	0.186
Papules, n (%)	24(100)	24(100)	23(95.8)	71(98.6)	0.363
Erythema, n (%)	24(100)	24(100)	23(95.8)	71(98.6)	0.363
Excoriation, n (%)	7(29.2)	6(25)	9(37.5)	22(30.6)	0.632
Erosion, n (%)	3(12.5)	4(16.7)	16(66.7)	23(31.9)	<0.0001*
Degree of lesions severity					
Mild, n (%)	16(66.67)	12(50)	7(29.2)	35(48.6)	
Moderate, n (%)	5(20.8)	10(41.7)	11(45.8)	26(36.1)	
Severe, n (%)	3(12.5)	2(8.3)	6(25)	11(15.3)	0.039*
Scraping					
Eggs, n (%)	0(0)	0(0)	2(8.3)	2(2.8)	
Larvae, n (%)	0(0)	0(0)	0(0)	0(0)	
Mites, n (%)	0(0)	0(0)	0(0)	0(0)	
Fecal, n (%)	0(0)	0(0)	2(8.3)	2(2.8)	0.128

*Significance difference
TTO: tea tree oil

At week 1, clinical papules were obtained in 60 patients (93.8%), erythema in 57 patients (89.1%), excoriation in 17 patients (26.6%), and erosion in 35 patients (54.7 %). Pearson chi-square test showed p = 0.15 in clinical papules indicating that there were no significant differences in clinical papules of the three groups. The value of p = 0.323 in erythema showed that there was no significant difference in clinical erythema of the three groups. A p = 0.028 mark in excoriation showed a significant difference in the excoriation complaint of the three groups. A p value of 0.046 in erosion showed significant differences in clinical erosion of all three groups. Irritation was obtained in 2 patients (3.1%) and no allergy was found. A p value of 0.624 shows no significant difference of irritation in all three groups. There were 39 patients (65%) with mild lesion severity. A total of 13 patients (21.7%) included in moderate lesion. 8 patients (13.3%) included in severe lesion (table 3).

Clinical manifestations of papules, erythema, excoriation, and erosion have decreased in week 2. Clinical papules were present in 45 patients (90%). Pearson chi-square test showed a p value of 0.053, meaning no significant differences were found within the three groups. Erythema was obtained in 39 patients (78%). Pearson chi-square test showed p = 0.236 which means there was no significant difference in all three groups. Excoriation was obtained in 10 patients (20%), with Pearson chi-square test p = 0.012 which means that there were significant differences in all three groups. Erosion was obtained in 1 patient (2%), with Pearson chi-square test was p value = 0.435 which means no significant difference in three groups (table 4)

Table 3. *Patient complaint, physical examination, and additional examination on week-1.*

Variable	Permethrin 5%	TTO 5%	TTO 5%+Permethrin 5%	Total	p=0.05
Itchy					
Absent. n (%)	1(4.3)	4(20)	3(14.3)	8(11.1)	
Mild. n (%)	12(52.2)	13(65)	13(61.9)	38(59.4)	
Moderate. n (%)	8(34.8)	5(25)	6(28.6)	19(29.7)	
Severe. n (%)	2(8.7)	2(10)	1(4.8)	5(7.8)	
Terrible. n (%)	1(4.3)	0(0)	1(4.8)	2(3.1)	0.675
Sleep disturbance					
Absent. n (%)	8(34.8)	14(70)	14(66.7)	36(56.2)	
Mild. n (%)	8(34.8)	3(15)	4(19)	15(23.4)	
Moderate. n (%)	4(17.4)	2(10)	1(4.8)	7(10.9)	
Severe. n (%)	2(8.7)	1(5)	2(9.5)	5(7.8)	
Terrible. n (%)	1(4.3)	0(0)	0(0)	1(1.6)	0.047*
Papules. n (%)	22(95.7)	20(100)	18(85.7)	60(93.8)	0.15
Erythema. n (%)	21(91.3)	19(95)	17(81)	57(89.1)	0.323
Excoriation. n (%)	4(17.4)	3(15)	10(47.6)	17(26.6)	0.028*
Erosion. n (%)	16(69.6)	12(60)	7(33.3)	35(54.7)	0.046*
Degree of lesion severity					
Mild. n (%)	17(77.3)	11(61.1)	11(55)	39(65)	
Moderate. n (%)	4(18.2)	4(22.2)	5(25)	13(21.7)	
Severe. n (%)	1(4.5)	3(16.7)	4(20)	8(13.3)	0.528
Scraping					
Eggs. n (%)	0(0)	1(5)	0(0)	1(1.6)	0.327
Larvae. n (%)	0(0)	0(0)	0(0)	0(0)	.
Mites. n (%)	0(0)	0(0)	0(0)	0(0)	.
Fecal. n (%)	0(0)	1(5)	0(0)	1(1.6)	0.327
Recovery					
Cured. n (%)	1(4.2)	4(16.7)	3(12.5)	8(11.1)	
On therapy. n (%)	23(95.8)	20(83.3)	21(87.5)	64(88.9)	0.374
Side effects					
Irritation. n (%)	1(4.3)	0(0)	1(4.8)	2(3.1)	
Allergy. n (%)	0(0)	0(0)	0(0)	0(0)	0.624

*Significance difference
TTO: tea tree oil

At week 2, there was an increase of irritation in general, which was present in 18 patients (36%). Pearson chi-square test showed p value = 0.07 which means there was no significant difference in the three groups. No positive results were found on scraping results. Pearson chi-square test showed p value = 0.008 at 2 weeks cure. This suggests that there were a significant difference of recovery at week 2 in all three groups. Full recovery was achieved in 4 patients (16.7%) in permethrin 5% group, 13 patients (54.2%) in the TTO 5% group, and 5 patients (20.8%) in the TTO 5%+permethrin 5% group (table 4)

Table 4. *Patient complaint, physical examination, and additional examination on week-2.*

Variable	Permethrin 5%	TTO 5%	TTO 5%+Permethrin 5%	Total	p=0.05
Itchy					
Absent, n (%)	1(5)	1(9.1)	1(5.3)	3(6)	
Mild, n (%)	14(70)	10(90.9)	16(84.2)	40(80)	
Moderate, n (%)	5(25)	0(0)	2(10.5)	7(14)	
Severe, n (%)	0(0)	0(0)	0(0)	0(0)	
Terrible, n (%)	0(0)	0(0)	0(0)	0(0)	0.195
Sleep disturbance					
Absent, n (%)	7(35)	11(100)	16(84.2)	34(68)	
Mild, n (%)	8(40)	0(0)	3(15.8)	11(22)	
Moderate, n (%)	5(25)	0(0)	0(0)	5(10)	
Severe, n (%)	0(0)	0(0)	0(0)	0(0)	
Terrible, n (%)	0(0)	0(0)	0(0)	0(0)	<0.0001*
Papules, n (%)	20(100)	8(72.7)	17(89.5)	45(90)	0.053
Erythema, n (%)	15(75)	7(63.6)	17(89.5)	39(78)	0.236
Excoriation, n (%)	8(40)	0(0)	2(10.5)	10(20)	0.012*
Erosion, n (%)	0(0)	0(0)	1(5.3)	1(2)	0.435
Degree of lesion severity					
Mild, n (%)	20(100)	9(81.8)	19(100)	48(96)	
Moderate, n (%)	0(0)	2(18.2)	0(0)	2(4)	
Severe, n (%)	0(0)	0(0)	0(0)	0(0)	0.025*
Scraping					
Eggs, n (%)	0(0)	0(0)	0(0)	0(0)	
Larvae, n (%)	0(0)	0(0)	0(0)	0(0)	
Mites, n (%)	0(0)	0(0)	0(0)	0(0)	
Fecal, n (%)	0(0)	0(0)	0(0)	0(0)	.
Recovery					
Cured, n (%)	4(16.7)	13(54.2)	5(20.8)	22(30.6)	
On therapy, n (%)	20(83.3)	11(45.8)	19(79.2)	50(69.4)	0.008*
Side effects					
Irritation, n (%)	2(10)	6(54.5)	10(52.6)	18(36)	
Allergy, n (%)	0(0)	0(0)	0(0)	0(0)	0.07

*Significance difference
TTO: tea tree oil

After week 0, comparison on itchy sensation in permethrin 5% and TTO 5% with p value = 0.112 using Mann-Whitney test meaning that there was no significant difference between permethrin 5% and TTO 5%. Mean rank (27.56) in the TTO 5% group showed that the intensity of itchy complaints was higher (not significant) in the TTO group of 5% compared with permethrin 5% group.

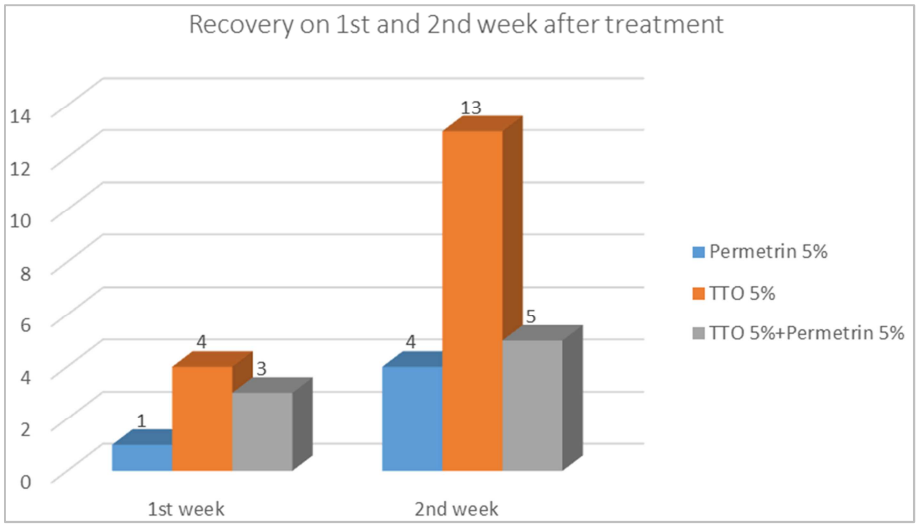

Figure 1. *Recovery on 1st and 2nd week after treatment.*

At week 1, there was a full recovery in 1 patient (4.2%) of permethrin 5% group, 4 patients (16.7%) in the TTO 5% group, and 3 patients (12.5%) in the TTO 5%+permethrin 5% group. Pearson chi-square test showed p value = 0.374 on 1st week cure rate, which means there was no significant difference in the cure rate of child scabies patients in all three groups (Figure 1).

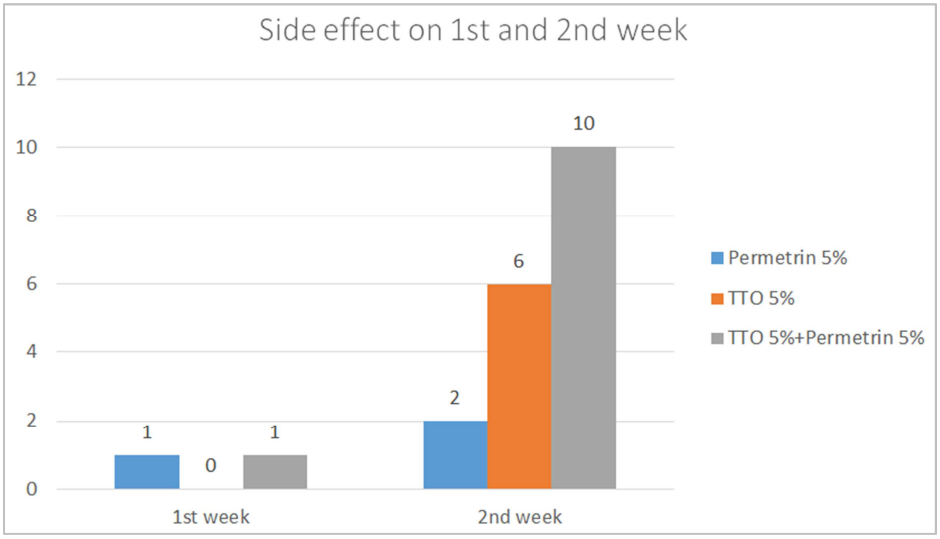

Figure 2. *Side effects on 1st and 2nd week.*

At week 2, there were 4 cured patients (16.7%) in the permethrin 5% group, 13 patients (54.2%) in the TTO 5% group, and 5 patients (20.8%) in the TTO 5%+permethrin 5% group. Pearson chi-square test showed p = 0.008 on week 2 cure rate, meaning that there was significant difference in the cure rate of child scabies patients in all three groups (Figure 1).

Figure 3. *Clinical progression of patient with TTO 5% cream therapy. (a) Week-0. (b) Week-1. (c) Week-2.*

4. Discussion

In this study, the sample was 72 patients (100%), consisting of 63 male patients (87.5%) and 12 female patients (12.5%). There were no significant differences between the number of boys and girls (p = 0.319). This result is consistent with previous research by Singh and friends [10] in Bangladesh, where the study was conducted in 380 patients consisting of 220 male patients (57.9%) and 160 female patients (41.9%). The greater number of male patients than women can be attributed to the greater number of male students than female students. Another possibility, in general, girls pay more attention to the cleanliness compared to boys.

Excoriation and erosion are considered an undesirable effect of the scabies treatment. The results shows improvement from week 0 to week 2 in permethrin 5% group, TTO 5% group, and TTO 5%+permethrin 5%. Erosion in permethrin 5% and TTO 5% were increased at week 1. This is contrast to some previous studies who mentioned that TTO with concentrations below 20% are said to be safe and rarely causing side effects such as irritation and also erosion in topical preparations [3]. In vitro research by Fang [2] mentioned that TTO 5% has an acaricid effect. A hospital in Darwin, North Australia uses a TTO 5% cream as

an ad hoc treatment base for Norwegian scabies. This is one of the foundations of this study using TTO 5% levels.

Drug side effects can be caused due to several factors, such as hygiene of the patient. Another factor that may affect, is the cleanliness of the room and also the patient's environment, which resulted in exposure of bacteria that can cause secondary infections from the skin of the patient.

At week 1, full recovery occurred in 1 patient (4.2%) in permethrin 5% group, 4 patients (16.7%) in TTO 5% group, and 3 patients (12.5%) in TTO 5%+permethrin 5% group. Chi-square test showed p value = 0.374 which means that there was no significant difference in three groups. No previous research has examined the effectivity of all three treatments simultaneously as an acaricid drug. As mentioned previously, permethrin 5% works by blockading sodium channels in parasitic organs, which will cause paralysis and also death from arthropods [19, 20]. The TTO 5% mechanism as an acaricid drug has not been clearly explained, but it is suspected that the mechanism of action is similar to other acaricid drugs, which blockade the sodium channels which will make paralysis of arthropods. TTO 5%+permethrin 5% is expected to have a potentiation effect that can accelerate the healing of scabies [20].

At week 2, there were 4 patients (16.7%) in the permethrin 5% group, 13 patients (54.2%) in the TTO 5% group, and 5 patients (20.8%) in the TTO 5%+permethrin 5% group. Chi-square test showed p = 0.008 which means there was significant difference between permethrin 5% group. TTO 5% group, and TTO 5%+permethrin 5% group.

5. Conclusion

Based on this research, we assume that TTO 5% cream is more effective than permethrin 5% cream in child scabies. TTO 5%+permethrin 5% more effective than permethrin 5% cream. TTO 5% cream is more effective than TTO 5%+permethrin 5% in child scabies. There are side effects, irritation in the permethrin 5% group. TTO 5%, and TTO 5%+permethrin 5%, which improved at week 2 of treatment

The results of this study still have limitations, there were side effects, the selection of samples do not use matching, and the use of TTO only at 1 titer level, so it is expected to be developed on further research

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