

Comparison of skin hydration degrees based on moisturizing time in children's atopic dermatitis



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ABSTRACT

Background: Atopic dermatitis (AD) is a skin disease accompanied by an inflammatory reaction influenced by heredity and environment. Atopic dermatitis commonly occurs in infants and children. Overcoming dryness of the skin is an important strategy in the management of AD. One way is by using a moisturizer (emollient) to increase the skin barrier function. This study aimed to compare the degree of skin hydration based on moisturizing time in children with AD, immediately after bathing and 30 minutes after bathing.

Methods: This analytical study's design was quasi-experimental (*pre-post clinical trial*) conducted in dermatology-venereology policlinic of Universitas Sumatra Utara Hospital. Subjects who met inclusion criteria were children with AD, 2-14 years who met William's criteria, no recent use of topical preparations, and informed consent approved. The bath soap and moisturizer used were Johnson's® baby milk soap and those containing ceramide-3 (Atocalm®), respectively, applied twice a day. Moisturizing time is given immediately and 30 minutes after bathing on the volar part of the right forearm and left forearm, respectively. The degree of skin hydration was measured by Corneometer CM 825®, taken four times on the 1st, 8th, 15th, and 21st day, and categorized into very dry skin, dry skin, and normal skin. Test analysis using SPSS software with $p < 0.05$ was significant.

Result: Thirty-seven children with AD followed this study. The median age was 5 (2-13) years, female sex (21 children [56.8%]). There were differences in skin hydration between these groups. There was also significant right forearm volar skin hydration measured immediately after bathing, 1st, 8th, 15th, 21st day (42.3; 48.0; 55.3; 61.3 AU (Arbitrary Unit); $p < 0.001$), respectively. Skin hydration on the left forearm's volar part is significant between 30 minutes after bathing, respectively 1st, 8th, 15th, 21st day (42.3; 44th, 7th; 47.7; 52.0 AU; $p < 0.001$). The total amount of dry skin and very dry skin was more in the moisturizing group 30 minutes after bathing than immediately after bathing.

Conclusion: Significant difference in skin hydration degrees found between immediately after the bathing group (on the right forearm volar) and 30 minutes after bathing (on the left forearm volar).

Keywords: Atopic Dermatitis, Skin Hydration, Emollient Time.

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INTRODUCTION

Atopic dermatitis (AD) is the most common skin disease in infants and children, characterized by an inflammatory reaction in the skin and is based on hereditary and environmental factors.¹ It is often found in people with allergic rhinitis and asthma and among their family members.² The prevalence of AD in children is 10-20% in the United States, Northern, and Western Europe, Africa, Japan, Australia, and other industrialized countries.³ The incidence of AD has tended to increase 2-3 times in the last 30 years. AD children in Indonesia were found as many as 23.67% in 611 new

cases of skin diseases in 2000 and were the first rank of the ten most children skin diseases in 7 hospitals in five cities in Indonesia.^{1,2,4}

Skin barrier dysfunction has been encountered in the early stages of AD development and is an important pathological finding in AD patients.^{5,6} Skin inflammation due to genetic and acquired skin barrier function disorders triggers immune system activation.⁷ Inflammation in the affected skin by disrupting skin barrier homeostasis.⁷ Most AD patients have dry skin, including areas of skin that are not affected by dermatitis. This situation occurs because the damaged

skin barrier in AD can facilitate easier penetration of allergens into the skin, increasing irritation and inflammation.⁸ The damaged skin barrier is caused by impaired sweat function, the occurrence of transepidermal water loss (TEWL), changes in subcutaneous fat, and increased colonization of staphylococcus bacteria.⁹

An important strategy in the management of AD is to overcome skin dryness by improving the skin barrier's function.^{9,10} One of the therapeutic options is a moisturizer (emollient). Moisturizer works by maintaining an increase in skin water volume, especially in the outer layer of the stratum corneum.

Table 1. The baseline characteristics of Atopic Dermatitis patients

Characteristics	n = 37
Gender, n(%)	
Male	16 (43,2)
Female	21 (56,8)
Age, (year), Median (min-max)	5 (2-13)

Table 2. The skin hydration level of the volar right forearm (application of moisturizer immediately after bathing) to the day of measurement

Day	Skin hydration level (immediately after bathing)			p-value
	n	Median	Min-Max	
D -1	37	42,3	(19,7 – 54,0)	<0,001
D -8	37	48,0	(27,3 – 59,3)	
D -15	37	55,3	(37,0 – 67,3)	
D -21	37	61,3	(45,3 – 72,3)	

Friedman Test. Significant (p<0,05)

Table 3. Post-Hoc Wilcoxon the skin hydration level of the volar right forearm (application of moisturizer immediately after bathing) to the day of measurement

Skin hydration level (immediately after bathing)	p-value
Day-1 vs Day-8	p<0.001
Day-1 vs Day-15	p<0.001
Day-1 vs Day-21	p<0.001
Day-8 vs Day-15	p<0.001
Day-8 vs Day-21	p<0.001
Day-15 vs Day-21	p<0.001

Post-Hoc Wilcoxon

Table 4. The skin hydration level of the volar left forearm (application of moisturizer 30 minutes after bathing) to the day of measurement

Day	Skin hydration level (30 minutes after bathing)			p-value
	n	Median	Min-Max	
D -1	37	42.3	(20.0 – 53.7)	<0,001
D -8	37	44.7	(23.0 – 56.0)	
D -15	37	47.7	(29.0 – 60.3)	
D -21	37	52.0	(35.3 – 63.3)	

Friedman Test. Significant (p<0,05)

The European Academy of Dermatology and Venereology (EADV) guidelines provide recommendations for using ointments that act as barriers, bath oils,

and soaps as topical agents. However, the AD management guidelines do not specify “when” emollients are administered. The Consensus Conference Guidelines on

Paediatric Atopic Dermatitis recommend using topical agents followed by application of moisturizer immediately after bathing but does not explain the frequency of bathing.¹¹ This study aimed to compare the degree of skin hydration based on the timing of moisturizer application to children’s AD immediately after bathing compared with 30 minutes after.

METHODS

This study used a quasi-experimental research design with a pre-post clinical trial approach to analyze the comparison of the degree of skin hydration in AD in children who are given moisturizer immediately after bathing with those given a moisturizer 30 minutes after. It was held at the Universitas Sumatra Utara Hospital’s dermatology and venereology polyclinic from December 2019 until November 2020. The population is all the children who are diagnosed with AD. This study has obtained the ethical clearance of the Health Research Ethics Committee of the Medical Faculty of The University of North Sumatra by the number 158 / TGL / KEPK FK USU-RSUP HAM / 2020.

The research subjects had met the inclusion criteria of children with AD aged 2-14 years who met William’s criteria, free from the use of other topical preparations in the past week, and the parents had approved the informed consent. Patients who were allergic to the moisturizing agent in this study (atocalm®), patients with speech-impaired parents who did not follow the instructions for using moisturizers during the three weeks of the study, did not revisit, were excluded from the study. By using the proportion of children with AD in children of 23%, with an alpha of 5% and a research power of 80%, the effect size determined is 0.25, so the number of children with AD patients participating in the study is estimated to be 37 patients.

The bath soap used by children is Johnson’s® baby milk soap. The moisturizer used is a containing ceramide-3 (Atocalm®), applied twice a day. Applying moisturizer was given immediately after bathing on the volar part of the right forearm and 30 minutes after bathing on the volar part of the left forearm. Basting is done at home, smeared as much as 1 Finger

Tip Unit (FTU) = 0.5 gr covering 2% BSA (Body Surface Area). The skin hydration level was measured with the Corneometer CM 825[®], and measurements were made four times on the 1st, 8th, 15th, and 21st day. The results with the Corneometer were categorized as very dry skin (<30 AU), dry skin (30 -45 AU), and normal skin (> 45 AU).

The significance of the comparison of skin hydration level based on the time of

moisturizer application (immediately after bathing and 30 minutes after it) in this study used statistical tests. Characteristics of subjects with categorical data are presented in the form of frequency distribution, and numerical data are presented with mean and standard deviation. To see the difference of the skin hydration level between days 1, D-8, H-15, D-21, the test used was Repeated Anova or the Friedman alternative test and

continued with the Post Hoc Wilcoxon test. To see the skin hydration level ratio between right forearm volar (applying moisturizer immediately after bathing) and left forearm volar (giving moisturizer 30 minutes after bathing) on H-1, H-8, H-15, H-21, by testing Chi-square. Test analysis using SPSS software.

RESULT

This study was followed by 37 subjects with the observation of applying a moisturizer to the volar of the right forearm immediately after bathing and applying to the volar of the left forearm 30 minutes after bathing, the characteristics of AD patients are presented in (Table 1). In this study, it was found that the subjects were dominated by female children (N = 21 patients, 56.8%) and male as many as 16 patients (43.2%). The median subjects' age was five years old, with a minimum and maximum age are 2 and 13 years old, consecutively.

The Corneometry examination on the volar right forearm found a significant

Table 5. Post-Hoc Wilcoxon the skin hydration level of the volar left forearm (application of moisturizer 30 minutes after bathing) to the measurement day.

Skin hydration level (30 minutes after bathing)	p-value
Day-1 vs Day-8	p<0.001
Day-1 vs Day-15	p<0.001
Day-1 vs Day-21	p<0.001
Day-8 vs Day-15	p<0.001
Day-8 vs Day-21	p<0.001
Day-15 vs Day-21	p<0.001
Post Hoc Wilcoxon	

Table 6. The difference in skin hydration level by moisturizer applied time moisturizer 30 minutes after bathing compared to immediately after bathing by day measurement.

Applied time	Day	Skin hydration level n (%)			Total	p-value
		Very dry skin (<30 AU)	Dry skin (30-45 AU)	Normal skin (> 45 AU)		
Volar right forearm (immediately after bathing)	1st	3 (2,0)	23 (15,5)	11 (7,4)	37 (25,0)	<0,001
	8th	1 (0,7)	8 (5,4)	28 (18,9)	37 (25,0)	
	15th	0 (0,0)	2 (1,4)	35 (23,6)	37 (25,0)	
	21th	0 (0,0)	0 (0,0)	37 (25,0)	37 (25,0)	
	Total	4 (2,7)	33 (22,3)	111 (75,0)	148 (100)	
Volar left forearm (30 minutes after bathing)	1st	3 (2,0)	23 (15,5)	11 (7,4)	37 (25,0)	<0,001
	8th	1 (0,7)	19 (12,8)	17 (11,5)	37 (25,0)	
	15th	1 (0,7)	8 (5,4)	28 (18,9)	37 (25,0)	
	21th	0 (0,0)	3 (2,0)	34 (23,0)	37 (25,0)	
	Total	5 (3,4)	53 (35,8)	90 (60,8)	148 (100)	

result between the skin hydration level of the volar right forearm (application of moisturizer immediately after bathing) to the day of measurement presented in [table 2](#). On the first day, the median skin hydration level was 42.3 (19.7 - 54.0) AU, on day 8 was 48.0 (27.3 - 59.3) AU, on the D-15, which was 55.3 (37.0 - 67.3) AU, and D-21 was 61.3 (45.3 - 72.3) AU. The Wilcoxon Post hoc test analysis was carried out to determine the skin hydration level each day. There was a significant difference in skin hydration by day with a p-value <0.001 ([Table 3](#)).

There is a significant difference between the volar left forearm's skin hydration level (application of moisturizer 30 minutes after bathing) to the day of measurement ([Table 4](#)). On the first day, the median skin hydration level was 42.3 (20.0 - 53.7) AU, on the 8th day was 44.7 (23.0 - 56.0) AU, on the 15th day was 47.7 (29.0 - 60.3) AU, and for day 21 was 52.0 (35.3 - 63.3) AU. To determine the difference in skin hydration level each day, we used Wilcoxon Post hoc test analysis. There was a significant difference in skin hydration by day with a p-value <0.001 ([Table 5](#)).

There was a significant difference in skin hydration level by moisturizer applied time, statistically with p-value <0.001. The total number of dry and very dry skin patients was higher in the group with applied moisturizer 30 minutes after bathing than immediately after bathing. The total number of normal skin was higher in the group given the moisturizer immediately after bathing ([Table 6](#)).

DISCUSSION

This study's results align with the study conducted by Sinaga et al. They studied AD in the playgroup and kindergarten-age children. The study found that the subjects were dominated by girls with a percentage of 59.3%.¹² Egeberg et al. in 2019 conducted a study related to AD patients' characteristics involving 3834 patients. Egeberg found that AD patients were predominantly female, both in the asymptomatic group (64%); mild atopic dermatitis (70.2%); moderate atopic dermatitis (68.1%); and severe atopic dermatitis (67.8%).¹³ Atopic dermatitis is continuously increasing with an incidence of 10% to 20% among the pediatric

population. This condition mainly develops at an early age, with 45% occurs in children, rarely do the symptoms start to appear less than six months. In 60% of patients, symptoms appear before the first year of life, and 30% of children have new symptoms before age 5. Whereas 10% of AD is diagnosed in the population aged 6 to 20 years old.¹⁴

This study found a significant increase in the skin hydration level in AD patients given moisturizers immediately after bathing or 30 minutes after. The use of moisturizers (emollients) is very important for the successful management of AD. Emollients can contain occlusive substances, which provide a lipid layer on the skin's surface, slowing down water loss and increasing skin moisture. It also contains humectants that can increase the capacity to retain moisture.^{15,16} In a randomized controlled study by Claris P et al. involving 30 patients with mild to moderate AD, it was found that the use of hydrophilic cream for weeks was able to reduce the total body area affected, itching scores, and the Eczema Area and Severity Index (EASI) score. Twice a day for three weeks reduced itching complaints significantly. AD therapy was successful based on a global investigative assessment in 58% of children aged three months to 16 years old.¹⁷

This study also showed a difference in skin hydration level between patients who were given a moisturizer immediately after bathing and 30 minutes after (p<0.001). Nowadays, the guidelines for the management of AD do not consistently provide recommendations regarding the optimal frequency of emollient administration and its association with bathing. The Consensus Conference on Paediatric Atopic Dermatitis recommends patient keep showering every day and immediately apply topical therapy followed by emollients.¹¹

The Canadian Practical Guide for the Treatment and Management of Atopic Dermatitis states that bathing is a critical component in the management and hydration of dry skin. These guidelines recommend that patients bathe one or more times per day using lukewarm water (Lukewarm) for about 5 minutes. The addition of emulsifying oil is useful

in helping the body retain moisture. The moisturizing application should be made within 3 minutes after bathing to help the skin retain moisture. The choice of moisturizer depends on the body's area, the degree of dryness, and the skin scale.¹⁸ The Asia-Pacific Consensus Group for Atopic Dermatitis recommends the management with regular moisturizers is the main pillar of AD therapy. Emollients should be applied two to three times a day or whenever the skin feels dry, depending on the climate and air conditioning usage. It is also recommended to apply emollients before and after bathing or swimming while the skin is still damp (within 5 minutes).¹⁹

The International Consensus Conference On Atopic Dermatitis II (ICCAD II) states that emollients keep skin hydrated and reduce itching complaints. These guidelines recommend the regular use of emollients at least twice during the day, even if there are no complaints of illness, and should also be applied after swimming or bathing.²⁰ Meanwhile, The National Institute for Health and Clinical Excellence recommends: "Moisturizing frequently and in sufficient quantities, a lot especially after bathing"²¹

Guidelines for atopic dermatitis management: Section 2 states that bathing once a day is good for eliminating squama, crusts, irritants, and allergens. It provides an opportunity to moisturize the skin. Use of water is recommended at lukewarm temperatures. Using soaps, shampoos, and shower gels that are foamy are avoided as they can irritate and dry out the skin even more. It is easiest to apply moisturizer before showering, then massage it into the skin when moistened with water. It is advisable to wipe the body skin with a soft towel and apply moisturizer again immediately afterward. This moisturizer should be applied frequently, ideally when the skin is still damp after showering. Its use should be given thoroughly in the direction of the hair follicle to avoid folliculitis.²²

CONCLUSION

There was a significant difference between the skin hydration level in AD patients who were given moisturizer immediately after bathing on the volar right forearm

and 30 minutes after bathing on the volar left forearm to the measurement days. There was a statistically significant difference between the degree of skin hydration in the application of moisturizer immediately after bathing (on the right forearm) with the moisturizer application 30 minutes after (on the volar of the left forearm).

DISCLOSURE

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Author Contribution

All authors have contributed to this research process, including preparation, data gathering, analysis, drafting, and approval to publish this manuscript.

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Conflict of Interest

No conflicts of interest.

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