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RELATIONSHIP BETWEEN SKIN HYDRATION LEVELS WITH THE SEVERITY OF DIAPER DERMATITIS IN CHILDREN AGED 0-24 MONTHS

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ABSTRACT

Diaper dermatitis is a common dermatological condition in children, particularly those aged 0-24 months, characterized by mild to severe inflammation. Over hydration skin has been associated with the occurrence of diaper dermatitis, as it can disrupt the skin barrier and trigger inflammation. To determine the relationship between skin hydration levels and the severity of diaper dermatitis in children aged 0-24 months. A cross-sectional study was conducted on 87 children aged 0-24 months with diaper dermatitis. Skin hydration levels were measured using a Corneometer® CM 825. The severity of diaper dermatitis was assessed using the Buckley Scale. Data analysis used the Chi-Square test, and results were considered significant if p<0,05. The relationship between the level of skin hydration and the severity of diaper dermatitis showed significant results (p=0.034) where the majority of subjects had a sufficiently hydrated degree of skin hydration in the diaper area, which was 69 people. Skin with sufficiently hydrated has a higher risk of more severe diaper dermatitis.

KEYWORDS *diaper dermatitis, rash, severity, skin hydration, skin ph*

INTRODUCTION

Diaper dermatitis is a dermatological condition that is quite common in newborns, neonates, and children. This is characterized by inflammation in the skin which varies from mild to severe (Blume - Peytavi & Kanti, 2018). Therefore, the word "diaper/diaper" in this term does not mean diapers as a cause of dermatitis, but a non-specific term to describe skin reactions in diaper area. (Cohen, 2017; Dunk et al., 2022).

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The actual prevalence of the condition in the general population is still not known with certainty. It is estimated that this condition occurs in 16% to 65% of children. (Carr et al., 2020)The variation in the prevalence of this condition depends on the duration of diaper use, toilet training knowledge, and hygiene of the child. (Kubo & Amagai, 2019; Sikic Pogacar et al., 2018) In Indonesia, the incidence of diaper dermatitis is around 7-35%. (Oranje et al., 2019) The highest prevalence of diaper dermatitis occurs in children under 24 months of age with the peak incidence of this condition occurring at 9 to 12 months of age (Blume‐Peytavi & Kanti, 2018). This is because almost all children in this age range still need the use of diapers. (Demirtaş et al., 2023)

Progressive disruption of the skin barrier is the main trigger of diaper dermatitis. Prolonged use of diapers causes increased hydration of the stratum corneum (Saadatmand et al., 2017). Because the skin in the diaper area is always partially covered and is often exposed to urine, the skin in the diaper area is more hydrated than the area outside the diaper and also because of the occlusive nature of the diaper that prevents water loss on the skin during long-term exposure. This can cause maceration of the stratum corneum which increases susceptibility to frictional trauma between the skin and the diaper fabric, disrupts skin permeability, interferes with epidermal barrier function, and causes increased growth of microorganisms. The clinical consequence is seen as diaper dermatitis.(Fölster‐Holst, 2018).

Other factors that affect the severity of diaper dermatitis are urine and fecal enzymes (urease, protease, lipase) that break down the lipids and proteins of the stratum corneum. It also leads to an increase in the pH of the skin and leads to an increase in the colonization of microorganisms. The interaction of these factors disrupts the skin barrier and causes diaper dermatitis. (Blume‐Peytavi & Kanti, 2018)

Signs of diaper dermatitis are generally limited to mild erythema on the skin with or without signs of maceration (Rahma & Lane, 2022). These findings can be found in the buttocks, genitals, abdomen, perianal, and thigh areas. If there is progression, then there can be a moderate erythema with a sign of maceration. In more severe conditions, exudative or ulcerative lesions will form. (Suebsarakam et al., 2020)

Management of diaper dermatitis is in the form of preventing lesions by regularly changing diapers, choosing disposable diapers and providing topical moisturizers. If symptoms have occurred, therapy can be given to repair damaged skin. (Hertiš Petek et al., 2022)

Increased skin hydration has been linked to the occurrence of diaper dermatitis, because the condition also triggers skin barrier disorders and triggers inflammation. (Bonifaz et al., 2016) Based on the background described above, the researcher is interested in conducting a study with the theme "The Relationship between Skin Hydration Level and the Severity of Diaper Dermatitis in Children Aged 0-24 Months".

This study aims to determine the relationship between the level of skin hydration and the severity of diaper dermatitis in children aged 0-24 months. Specifically, the study examined the severity of diaper dermatitis, analyzed the hydration level of the skin in the diaper area. This research is expected to provide benefits in the field of education by increasing knowledge about the relationship between skin hydration and diaper dermatitis, as well as providing new supporting examination options for health institutions. In addition, the results of this research can be the basis for further research and provide valuable information for the public regarding this topic (Mojumdar et al., 2017).

RESEARCH METHOD

This study is an observational study with a cross-sectional design conducted between February and May 2024 at the Dermatology and Venereology Polyclinic and the Pediatric Polyclinic at two hospitals in Medan. This study targeted children aged 0-24 months with diaper dermatitis as a population, and samples were taken consecutively until a minimum of 87 patients met the inclusion and exclusion criteria. This study measured the severity of diaper dermatitis, skin hydration levelusing special tools such as the CM 825 Corneometer®, with the results processed using the Chi-square test at SPSS. This research was carried out after obtaining an ethical permit from the Research Ethics Commission of the University of North Sumatra.

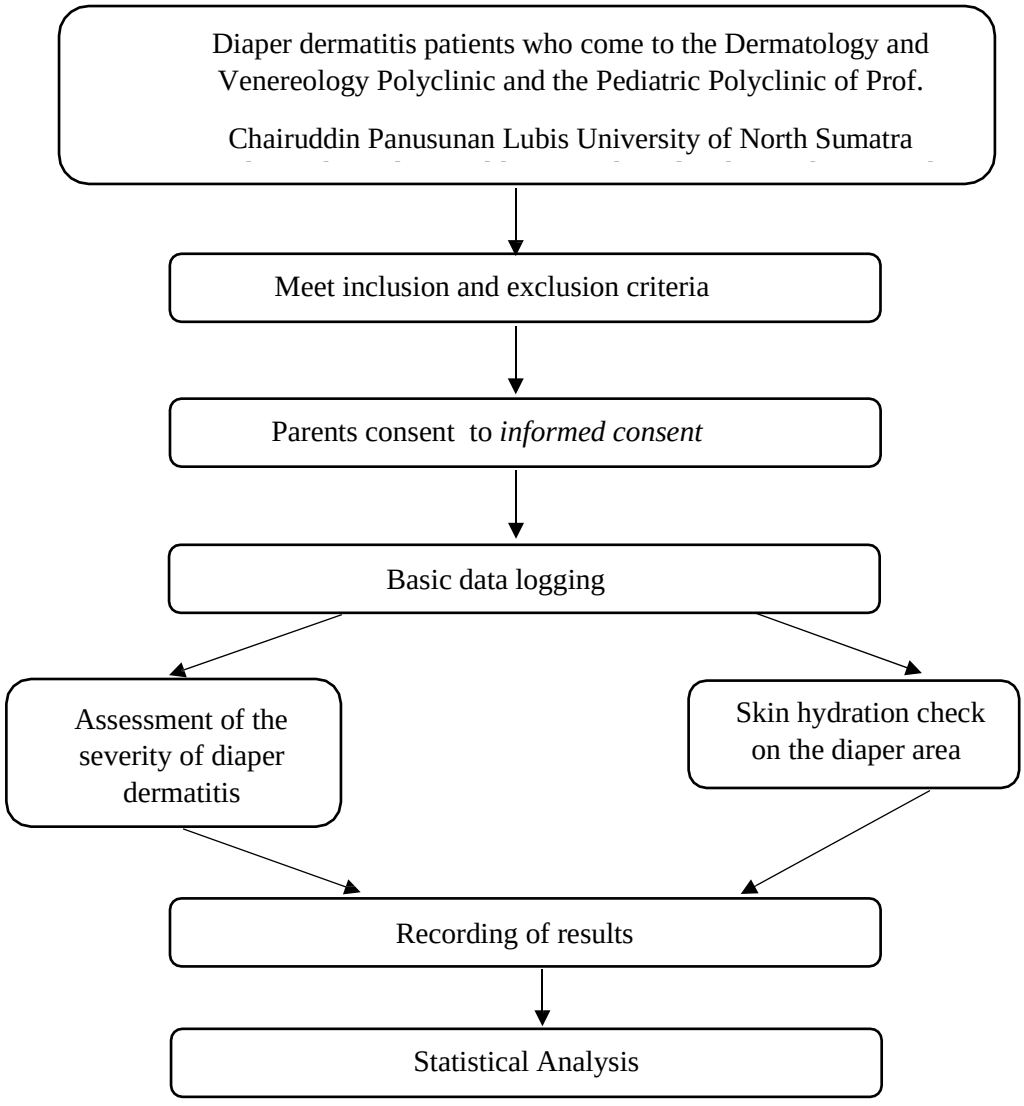

Figure 1. Operational Framework Diagram

RESULT AND DISCUSSION

Characteristics of Research Subjects

Patient characteristics by gender and age are presented in the following Table 1.

Table 1. Characteristics of Research Subjects by Gender

	Total
Gender	87 (100%)
Boys	37 (42,5%)
Girls	50 (57,5%)
Age (month)	**87 (100%)**
0 - 12	63 (72,4%)
13 - 24	24 (27,6%)

Based on the data in Table 1, it was found that most of the diaper dermatitis patients were girls with a total of 50 people (57.5%). The results of this study are in line with the study of Suebsarakam et al. in Thailand with a majority of girl patients of 73 people (52.5%). A study by Ersoy- Evans et al. in Turkey also showed that the majority of dermatitis patients were girls, accounting for 35 (55.6%) of the 63 participants. Similar findings were also obtained in a study by Reick in Germany, where the majority of diaper dermatitis patients were girls, a total of 12 people.

The results of this study are different from Carr et al.'s study of 591 children in China, 316 children in Germany, and 276 children in the United States, respectively, showing that diaper dermatitis patients are the majority of boys, 319 (54.0%) in China, 164 (51.9%) in Germany, and 143 (51.8%) in the United States. (Bante et al., 2023). also obtained similar results from a study of 671 children with diaper dermatitis in Ethiopia, where boys tended to have a higher incidence of diaper dermatitis compared to girls (54,67%).

The findings in this study are suspected to be due to the anatomical differences in women who have a shorter distance between the anus and urethra compared to men, which can increase the likelihood of contamination and the spread of irritation. And women have more skin folds in the diaper area, especially around the vulva, which can trap moisture and irritation, making the skin more susceptible to rashes. But globally, the prevalence of diaper dermatitis does not show a statistically significant difference in relation to the sex of the child. Differences in the number of subjects in some studies, as well as studies that included multiple dermatoses simultaneously, with diaper dermatitis being only one of them, appear to contribute to the variability in results.

Based on characteristics by age, most diaper dermatitis patients were 0-12 months old with a total of 63 people (72.4%). This is in line with studies such as those conducted by Li et al. on 454 children of which 261 (47.05%) of children aged 1-12 months had diaper dermatitis. Accordance with the study of Bante et al. on 664 children in Ethiopia of which 478 (71.99%) were children aged 1-12 months. Sukhneewat et al. also found similar results in a study of 416 children in Thailand, where 361 (78.8%) of children who suffer from diaper dermatitis are 0-6 months old.

As for most of the literature, it is stated that the peak incidence of diaper dermatitis is around the age of 9 months to 12 months. This is supported by increased activity in children between the ages of 1-12 months to become more active, starting to crawl and move, which can cause more friction between the diaper and the skin, increasing the risk of irritation. And at about 4-6 months of age, it has entered the stage of introduction of solid foods that can change the pH and composition of the stool where. This increase in pH contributes to the activity of fecal enzymes, proteases, urease, and lipase, which are highly irritating to the skin. In children aged 0-6 months, the frequency of urination and bowel movements is more frequent than in older children, which causes prolonged contact with urine, feces, and friction from diapers making them more susceptible to skin irritation. Diaper dermatitis is less common in children aged 13-24 months due to the decreasing use of diapers, and many children start toilet training. Reduced diaper use reduces exposure to primary irritants (urine and feces) that cause dermatitis.

Degree of Severity of Diaper Dermatitis

The distribution of diaper dermatitis subjects in children aged 0-24 months based on severity classified based on the score of (Buckley et al., 2016) in Table 2 showed that the majority of study subjects experienced moderate diaper dermatitis severity in 35 people (40.2%).

Table 2. Degree of Severity of Diaper Dermatitis

Degree of Severity of Diaper Dermatitis	**n**	**%**
Mild	27	31,0
Moderate	35	40,2
Severe	25	28,8
Total	87	100.0

The results of this study are in line with the study of Stamatas et al. which found that the majority of dermatitis severity was moderate (45%). A study by Ersoy-Evans et al. on 63 children with diaper dermatitis also found that the majority of dermatitis severity was moderate (57.4%).

This result is different from the Bante et al. study where of the 237 children who were assessed as the severity of diaper dermatitis, 187 (79%) of the children experienced mild degrees. Odio and Friedlanser also found that the majority of dermatitis severity was mild (49%).

Carr et al., found that children with moderate-severe diaper dermatitis were only seen in at least 1.3%-14.9% of the total population, significantly lower than the findings in this study which stated that the incidence of diaper dermatitis was >60.0%.3 One possible reason for the difference in these findings is the population analyzed by Carr et al., which was located in relatively colder regions such as China, Germany, and the United States; thus, the potential for diaper dermatitis may be estimated to be lower. This is in contrast to this study, which evaluated diaper dermatitis patients in Indonesia, which is tropical country.

The things that are considered to be most related to the severity of diaper dermatitis in general are the degree of redness of the skin, the extent of skin involvement, the presence of papules and pustules, as well as the presence of deep skin lesions that can be assessed by the Buckley et al. scoring system. The high proportion of patients who experience moderate-severe diaper dermatitis in this study is the result of the scoring.

Skin Hydration Level of Research Subjects

The distribution of research subjects based on the level of skin hydration in Table 3 shows that the majority of research subjects have a level of skin hydration in the diaper is sufficiently hydrated, which is as many as 69 people (79,3%). Followed by respondents with dry skin as may as 14 people (16,1%) and very dry skin as many as 4 people (4,6%).

Table 3. Characteristics of Research Subjects Based on Skin Hydration Level

Hydration Levels	n	%
Very dry skin	4	4,6
Dry skin	14	16,1
Sufficiently hydrated	69	79,3
Total	87	100.0

Previously, Garcia-Bartels et al., have mentioned that a change in normal conditions towards high hydration can induce diaper dermatitis, which is supported by higher levels of pro-inflammatory cytokines (IL-1α) in populations with high levels of skin hydration. Prolonged contact with urine and feces leads to the "occlusive" nature of diapers, increasing hydration in the diaper area where urine and fecal enzymes, namely protease and lipase, break down the protective proteins and lipids of the outer skin layer, causing disruption to the stratum corneum. Additionally, friction against the skin and maceration can lead to damage to the skin barrier and increased permeability to potential irritants. These factors make the skin more vulnerable to microbial invasion and inflammatory conditions. Blume-Peytavi et al. concluded that high skin hydration levels promote the degradation or breakdown of the "brick and mortar" structure of the stratum corneum, ultimately contributing to impaired barrier function. Therefore, it is hypothesized that increased skin hydration is more commonly observed in patients with diaper dermatitis.

The Relationship Between Skin Hydration Levels and the Severity of Diaper Dermatitis in Children Aged 0-24 Months

The results of the chi-square test listed in Table 4 show a p-value of 0.034 ($p<0.05$), which is a significant relationship between the level of skin hydration and the severity of diaper dermatitis. This is descriptively illustrated in the table, with the finding that around 37.69% of children with sufficiently hydrated skin levels have moderate diaper dermatitis severity, 31.88% of children with sufficiently hydrated skin levels have mild diaper dermatitis severity, and 30.43% of children with sufficiently hydrated skin levels have severe diaper dermatitis severity.

Table 4. The Relationship Between Skin Hydration Levels and the Severity of Diaper Dermatitis in Children Aged 0 – 24 Months

Skin Hydration Level	Severity of dermatitis				p value
	Mild	Moderate	Severe	Total	
	n (%)	n (%)	n (%)	n (%)	
Very dry	0	1 (25,0)	3 (75,0)	4 (100,0)	0,034
Dry	5 (35,7)	8 (57,1)	1 (7,2)	14 (100,0)	
Sufficiently hydrated	22 (31,9)	26 (37,7)	21 (30,4)	69 (100,0)	

Skin with an intact layer, low hydration, acidic pH, reduced transepidermal water loss, normal body flora, free fatty acids deposited on the surface with antimicrobial properties, and sphingosine all play roles in maintaining the integrity of the skin barrier function. The interaction between several risk factors, such as alkaline pH, friction on the skin inducing mechanical microtrauma, high hydration, and the involvement of microorganisms, is thought to be interrelated in the pathogenesis of irritant diaper dermatitis, increasing the risk of developing diaper dermatitis with greater severity.

Although there have been no specific studies on the relationship between skin hydration and the severity of diaper dermatitis, the current theory or understanding of the pathogenesis supports the findings in this study which show that the higher the level of skin hydration, the higher the percentage of patients who experience severe diaper dermatitis. This is due to the fact that increased hydration status of the stratum corneum can lead to maceration, disruption of the lipid bilayer structure, formation of amorphous intercellular areas, and degradation of corneodesmosomes. Increasing the level of hydration itself also affects the swelling of the corneocyte, the fluidity of the lipid membrane, and the permeability of molecular transport to exogenous materials. More hydrated skin will have a higher than normal coefficient of friction and can exacerbate mechanical trauma. The penetration of irritants into the living epidermis enhances the repair of the stratumcorneal barrier to produce abnormal structures with inadequate desquamation. Hydration and exposure to fecal enzymes (proteases, lipases) can lead to bacterial infections, so diaper dermatitis can occur more easily.

CONCLUSION

The study found a significant relationship between skin hydration levels and the severity of diaper dermatitis in children aged 0-24 months. The results showed that adequate skin hydration levels were associated with an increase in the severity of diaper dermatitis. This is because a more hydrated skin condition can cause disturbances in the function of the epidermal barrier, increase friction with diapers, and accelerate the growth of microorganisms that contribute to skin inflammation. Therefore, efforts to maintain a balanced level of skin hydration and reduce risk factors that affect the severity of diaper dermatitis are essential in the prevention and treatment of this condition. The results of this study are expected to be the basis for further research and provide useful information for health practitioners and parents in treating diaper dermatitis in children.

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