

Diaper Dermatitis: Prevalence and Associated Factors in 2 University Daycare Centers

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Pornnipa Suebsarakam¹, Jitjira Chaiyarit¹,
and Leelawadee Techasatian¹

Abstract

Purpose: Diaper dermatitis is uncommon in children older than 2 years because the majority of these children are diaper independent. However, diaper dermatitis still occurs, especially in children in daycare settings. This study attempted to determine the prevalence of diaper dermatitis and its associated factors among children aged 2 to 4 years attending daycare centers. Cross-sectional analysis and tests for correlation were conducted to determine the factors associated with diaper dermatitis among the study population. **Results:** The prevalence of diaper dermatitis during the study period was 17.2%. Factors significantly correlated with the occurrence of diaper dermatitis were beginning toilet training later than 2 years of age (odds ratio [OR] = 2.84, 95% CI = 1.17-6.86, $P = .02$) and the use of oral antibiotics (OR = 15.92, 95% CI = 3.57-70.94, $P < .001$). **Conclusion:** Two major adjustable factors for preventing diaper dermatitis in the study population were toilet training before 2 years of age and avoiding the use of unnecessary oral antibiotics. These results may help in devising a preventive protocol for diaper dermatitis among this age group in the future.

Keywords

antibiotics, daycare, diaper dermatitis, risk factors, toilet training

Introduction

Diaper dermatitis is an inflammation of the skin due to prolonged contact with various irritants, such as stool, urine, and moisture, as a result of diaper use. The condition is occasionally enhanced by bacterial overgrowth.¹⁻³ The highest incidence is in children younger than 2 years^{1,4,5} because a high percentage of children use diapers in this age group. Thus, the incidence of diaper dermatitis decreases substantially after children are able to use the toilet by themselves, usually by the age of 2 years.⁶ Daycare centers tend to be focused on promoting children's development, including self-feeding and toilet training. However, they are also settings where there is a high risk of children contacting contagious diseases, especially respiratory and gastrointestinal tract infections. This may be one of the factors that influences the risk of diaper dermatitis among daycare populations. This study, thus, attempted to determine the prevalence of diaper dermatitis and its associated factors among children aged 2 to 4 years attending daycare centers. The results will assist in the future development of preventive plans for diaper dermatitis in children in this kind of setting.

Methods

Responses to self-administered structured questionnaires were collected from the participants' caregivers. Eligibility was defined as age 2 to 4 years and attendance at 1 of 2 daycare centers (Faculty of Medicine and Faculty of Nursing) at Khon Kaen University. Written informed consent was obtained from the participants' parents or guardians before data collection. Diaper dermatitis was defined to caregivers as a rash in the diaper region thought to be caused by the infant wearing a diaper.

Statistical analysis was performed using STATA software version 10. Cross-sectional analysis and descriptive statistical methods (mean, standard deviation, median, and frequency) were applied to analyze the demographic data. Chi-square, logistic regression, and Fisher's exact

¹Khon Kaen University, Khon Kaen, Thailand

Corresponding Author:

Leelawadee Techasatian, Department of Pediatrics, Faculty of Medicine, Khon Kaen University, Khon Kaen, 40002, Thailand.
Email: leelawadee@kku.ac.th



Table 1. Factors Associated With Diaper Dermatitis in the Study Population by Using Logistic Regression.

Associated Factors	% of Diaper Dermatitis	Odds Ratio	95%CI of Odds Ratio	P
Early toilet trained				.020
≥2 years	26.92	2.84	1.17-6.86	
<2 years	11.49	1		
Diarrhea				<.001
Yes	93.75	190	22.47-1606.85	
No	7.32	1		
Diaper dependent				.264
Yes	25.00	1.84	0.70-4.91	
No	15.32	1		
Use of oral antibiotics				<.001
Yes	31.88	15.92	3.57-70.94	
No	2.86	1		
Allergic background				.821
No	18.29	1.19	0.49-2.89	
Yes	15.79	1		

tests were used to test correlation and differences between factors.

Statistical significance was defined as a *P* value <.05. The study was approved by the Institutional Review Board #HE581296.

Results

Demographic Data

A total of 190 questionnaires were sent out to 2 Khon Kaen University daycare centers (Faculty of Medicine and Faculty of Nursing) of which 139 (73.1%) were returned. Sixty-six respondents were male (47.4%) and 73 were female (52.5%), making the male to female ratio 0.9. The children's ages ranged from 24 to 48 months, with an average age of 36.4 months (SD = 3.2). The majority of the children were the only child in the family (87/139, 62.5%), and the primary caregivers were the children's parents in most cases (104/139, 74.8%). The ages of the primary caregivers were recorded as ranges, with most being between 30 and 40 years old (78/139, 56.1%). The majority of caregivers (95/139, 68.3%) worked in health care-related fields, that is, doctors, dentists, nurses, and faculty staff.

Prevalence of Diaper Dermatitis Among the Daycare Population

Half of the study population (77/139, 55.4%) had experienced at least 1 previous episode of diaper dermatitis; however, only 17.2% (24/139) of the children had documented occurrences of diaper dermatitis within the previous 6 weeks (at the time filling out the questionnaires). Children with previous episodes of diaper dermatitis were more likely to have diaper dermatitis at the time of data

collection (odds ratio [OR] = 2.84, 95% CI = 1.05-7.80, *P* = .035).

Analysis of Associated Factors

There are many variables that have been proposed as being associated with the occurrence of diaper dermatitis among children in this age group, all of which were included in the structured questionnaires. Table 1 shows factors associated with diaper dermatitis in the study population. The 2 factors found to be significantly correlated with diaper dermatitis were diarrhea and the use of oral antibiotics. One factor that demonstrated significant preventive correlation was beginning toilet training before 2 years of age. Although atopic background and diaper-dependent status have been proposed as factors that may contribute to the occurrence of diaper dermatitis, no statistically significant correlation with diaper dermatitis was found in this study. The major factors proposed as being associated with diaper dermatitis factors are described next

Onset of Toilet Training Before 2 Years of Age. Eighty-seven (62.5%) of the children in this study started the toilet training before the age of 2 years, and 52 children (37.4%) started later. There were 10 cases of diaper dermatitis reported in the former group and 14 cases in the latter. Initiating toilet training before 2 years of age decreased the occurrence of diaper dermatitis, exhibiting a significant preventive correlation (OR = 2.84, 95% CI = 1.17-6.86, *P* = .02).

Diarrhea. There were 16 documented cases of diarrhea in the study population. In 15 of these cases, the children had diaper rashes concurrent with the diarrhea. There was only 1 case in which the child did not have a diaper rash at the

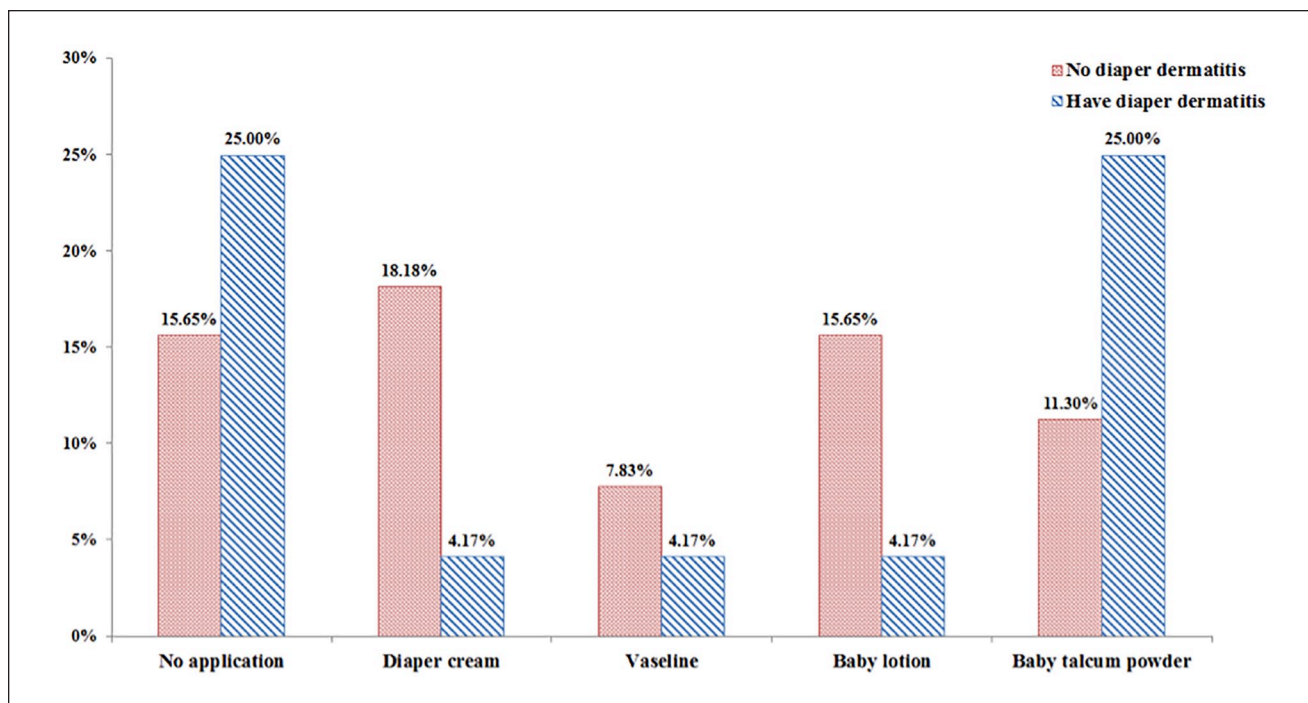


Figure 1. The distribution of participants who had and did not have diaper dermatitis by topical treatment. No statistical correlation was found between topical treatment and the occurrence of diaper dermatitis.

time the diarrhea occurred. There was a statistically significant correlation between diarrhea and diaper dermatitis (OR = 1.90, 95% CI = 22.47-1606.85, $P < .001$).

The Use of Oral Antibiotics. The overall antibiotics use in the study population was 69/139 cases (49.65%), and that among the children with diaper dermatitis was 15/24 cases (62.5%). There was a statistically significant correlation between the use of oral antibiotics and the occurrence of diaper dermatitis (OR = 15.92, 95% CI = 3.57-70.94, $P < .001$).

Diaper Dependency. Diaper dependency was defined as the need for diapering at any time during the 6 weeks prior to data collection. A total of 28 of 139 cases (20.1%) were reported as being diaper dependent, of which 7 were noted to have diaper dermatitis. A chi-square test revealed some correlation between diaper dependency and diaper dermatitis, but this was not statistically significant (OR = 1.84, 95% CI = 0.70-4.91, $P = .264$).

Atopic Conditions. There were 57 of 139 cases in which the child was documented as having a history of at least one atopic condition (atopic dermatitis/allergic rhinitis and asthma/cow's milk protein allergy). The children in only 9 of these cases had diaper dermatitis at the time of data collection. A chi-square test revealed a nonsignificant correlation between atopic conditions and the occurrence of diaper

dermatitis (OR = 1.19, 95% CI = 0.49-2.89, $P = .821$). The sample size was too small to conduct subgroup analysis to test for correlations between each individual atopic condition and diaper dermatitis.

Topical Application to the Diaper Area in the Study Population

Diaper cream, petroleum jelly, baby lotion, and baby powder were recorded as being applied on the diaper area. Figure 1 shows the distribution of the participants who had and did not have diaper dermatitis by topical treatment. There was no correlation found between the presence of diaper dermatitis and topical treatment (Table 2).

Discussion

The prevalence of diaper dermatitis among children aged 2 to 4 years in 2 Khon Kaen University daycare centers was 17.2%. This number is apparently low compared with that found in a previous study in children < 2 years old. This can be explained by the fact that most children achieve diaper independence by the age of 2 years,⁷⁻⁹ making diaper dermatitis less common in that group.

Although diaper dependency has been reported as the main factor leading to diaper dermatitis in this age group, no statistically significant correlation was found in our study (OR = 1.84, $P = .246$). Diaper dependency was

Table 2. Comparison Between Each Topical Application on Diaper Area and the Occurrence of Diaper Dermatitis by Using Fisher's Exact Test.

Topical Application on Diaper Area	No Diaper Dermatitis (n = 115)	Have Diaper Dermatitis (n = 24)	P
No application	18 (15.65)	6 (25.00)	.371
Diaper cream	22 (18.18)	1 (4.17)	.125
Vaseline	9 (7.83)	1 (4.17)	>.999
Baby lotion	18 (15.65)	1 (4.17)	.196
Baby talcum powder	13 (11.30)	6 (25.00)	.100

defined as the need for diapering at any time during the 6 weeks prior to data collection but the duration of diapering, which varied among children in this study was not considered. Some children wore diapers only at night, while some were documented as only wearing diaper when going outside of the house. Not accounting for this variation may have influenced the study results. A future study that considers the exact duration of diapering may be useful in discovering the correlation between the duration of diaper contact and occurrence of diaper dermatitis.

Another factor proposed to be associated with the occurrence of diaper dermatitis is the timing of toilet training. Children in this study were older than 2 years and had already undergone toilet training, which means they spent less time in diapers.^{7,10-12} Thus, the occurrence of diaper dermatitis should be substantially lower in this group. The authors explored the onset when the study population started their toilet training by the cutoff age of 2 years.¹³ We found that toilet training before 2 years of age showed a preventive correlation with the occurrence of diaper dermatitis. This finding should encourage caregivers to attempt early toilet training in order to prevent the occurrence of diaper dermatitis in the future.

The other 2 main factors that had a statistically significant correlation with diaper dermatitis were diarrhea ($P < .001$) and the use of oral antibiotics ($P < .001$). Diarrhea is a significant factor in the occurrence of diaper dermatitis¹⁴ in that it increases contact with stool.^{15,16} Stool is a major irritant and contains many gastrointestinal enzymes, including protease, lipase, and urease.^{1,2,4,5} Having diarrhea increases the frequency of defecation, which can subsequently cause significant irritation to the skin on the diaper area. The authors explored a possible correlation between diarrhea and oral antibiotics use in the study population; however, no statistically significant correlation was found ($P = .082$). This may be due to oral antibiotics being used to treat other conditions, such as respiratory tract infection. In addition, the use of oral antibiotics may have been unnecessary in some cases.

Previous studies have shown that the use of oral antibiotics in daycare populations is significantly higher than in children who stay at home.^{17,18} This can be explained by the greater amount of contact among children in the

daycare setting, which allows for various contagious infections to break out and spread more easily than in the home setting, thus increasing the necessity of oral antibiotics. However, most of these infections are viral and do not necessitate the use of antibiotics. Previous studies have shown the overuse of antibiotics to be harmful to children in daycare centers.¹⁸ The overuse of antibiotics has been shown to lead to community-acquired antimicrobial resistance, even among outpatients in primary care centers.¹⁹ The present study showed a statistically significant correlation between the use of oral antibiotics and diaper dermatitis (OR = 15.92, 95% CI = 3.57-70.94, $P < .001$). This correlation can be explained by antibiotic-associated diarrhea, which a previous study conducted in a pediatric ambulatory care setting found in up to 6.2%.²⁰ Thus, it is important to promote to limit antibiotic use among children in daycares to only cases in which they are necessary, which will help prevent diaper dermatitis in this population.

There were several potential limitations to the present study. The questionnaire was only structured to examine possible risk factors for diaper dermatitis. However, there may be other unknown factors that have an impact on diaper dermatitis and were not included in the analyses. In addition, there were some parents/caregivers who did not return the questionnaires, making response bias a possible attributing factor.

Conclusion

Implementing early toilet training (before 2 years of age) and decreasing the use of unnecessary oral antibiotics can help prevent diaper dermatitis in children in daycare centers. In addition to lowering the potential occurrence of diaper dermatitis, early toilet training has been shown to help children develop healthy habits, increase their learning opportunities, and give them confidence in the developmental milestone.

Author Contributions

P.S. contributed to the study design and analysis, drafted the manuscript, gave final approval, and agrees to be accountable for all aspects of work ensuring the integrity and accuracy of this work.

J.C. contributed to analysis and interpretation, gave final approval, and agrees to be accountable for all aspects of ensuring integrity and accuracy of this work.

L.T. contributed to the study design, analysis, and interpretation, critically revised manuscript, gave final approval, and agrees to be accountable for ensuring the integrity and accuracy of this work.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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