

# The Severity of Diaper Dermatitis and the Effects of Caregivers' Habits on Infants' Behaviors

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## Abstract

**Objectives:** To investigate the behavioral characteristics of infants with diaper dermatitis as well as the habits of their caregivers and the effects of those habits on infants with diaper dermatitis. **Methods:** The participants' demographic features, the infants' behavior, and the caregivers' habits were evaluated using a questionnaire. The severity of diaper dermatitis was scored using the Cincinnati Children's Hospital Diaper Dermatitis Grading Scale. **Results:** A statistically significant difference in terms of the infants' behavioral changes was found in relation to the different maternal education level groups ( $P < 0.001$ ). Three well-known discomfort behaviors, namely easy crying, changes in eating habits, and changes in sleeping patterns, were observed in infants with diaper dermatitis who were being raised by uneducated caregivers. **Conclusions:** The growth and development of babies with recurrent diaper dermatitis may be affected over time if adequate protection methods are not applied to prevent diaper dermatitis. Both diaper dermatitis and recurrent attacks can be prevented by adequate training of the caregivers of babies prone to diaper dermatitis. Babies who are not restless and whose sleeping and eating patterns are not disturbed may develop healthier growth.

**Keywords:** Behavior, breastfeeding, development, growth, habit

## INTRODUCTION

Diaper dermatitis is a form of inflammatory dermatitis that is caused by skin immaturity in newborns and infants. Perianal and inguinal involvement can sometimes be seen in cases of diaper dermatitis.<sup>[1]</sup> Diaper dermatitis develops as a result of multiple factors that cause irritation to the skin, including increased moisture, prolonged exposure to urine and feces, and contact with detergents.<sup>[2]</sup> It is most commonly seen in infants aged 9–12 months, and it occurs in around 50% of infants.<sup>[3]</sup>

Diaper dermatitis can cause significant discomfort in infants as well as anxiety in their caregivers.<sup>[2,4]</sup> In fact, 25% of caregivers consult their primary care physicians with complaints related to diaper dermatitis during the first year of their infant's life.<sup>[5]</sup>

A number of prior studies have investigated the etiology of diaper dermatitis, in addition to the associated prevention and treatment methods.<sup>[6,7]</sup> Some such studies have focused on parents' education.<sup>[8,9]</sup> For example, a recent global study

investigated the effects of caregivers' behavior in relation to diaper dermatitis.<sup>[8]</sup> However, the effects of caregivers' habits and the impact of those habits on the discomfort behaviors of infants with diaper dermatitis, including changes in their eating and sleeping patterns, have not yet been investigated.

The present study sought to examine the behavioral characteristics of infants with diaper dermatitis as well as the habits of their caregivers and the effects of those habits on infants with diaper dermatitis.

## METHODS

This cross-sectional study was conducted from January 2017 to October 2017 in a tertiary hospital. Some 106 healthy infants aged from 0 to 24 months who were full-time diaper users and their caregivers were enrolled in the study.

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In the diaper area; infants with erythematous papules starting with bright erythematous lesions and presenting with edema and desquamation over time were evaluated as diaper dermatitis. Affected hip, thighs, lower abdomen and groin area, labia major, and scrotum were interpreted in favor of diaper dermatitis. Infants were excluded if they had any chronic skin disease, infection, autoimmune or metabolic disease, or candida infection in the diaper area. The required data were collected by asking the caregivers to evaluate the demographic features of themselves and their infants, the infants' behavior, and the caregivers' habits. If a candida infection was suspected, a potassium hydroxide examination was performed. The degree of the infants' diaper dermatitis was scored using the Cincinnati Children's Hospital Diaper Dermatitis Grading Scale and are shown in Table 1 and Figure 1.<sup>[10]</sup> Written informed consent was provided by all the caregivers before the study commencing. The tertiary hospital's ethics committee approved the study (diary number: 16.12.14, date: December 08, 2016).

**Statistical analysis**

The SPSS software (version 15.0 for Windows; SPSS Inc, Chicago, IL, USA) for Windows was used for all the statistical analyses in the present study. In terms of descriptive statistics, the categorical variables were given as numbers and percentages, while the numerical variables were given as the mean, standard deviation, minimum, and maximum. The group comparisons of those numerical variable >2 were performed using the Kruskal–Wallis test because the normal distribution condition was not met in the groups. The subgroup analyzes were performed using the Mann–Whitney U-test and then interpreted using the Bonferroni correction. The rates in the groups were compared via a Chi-square analysis. The alpha significance level was accepted as  $P < 0.05$ .

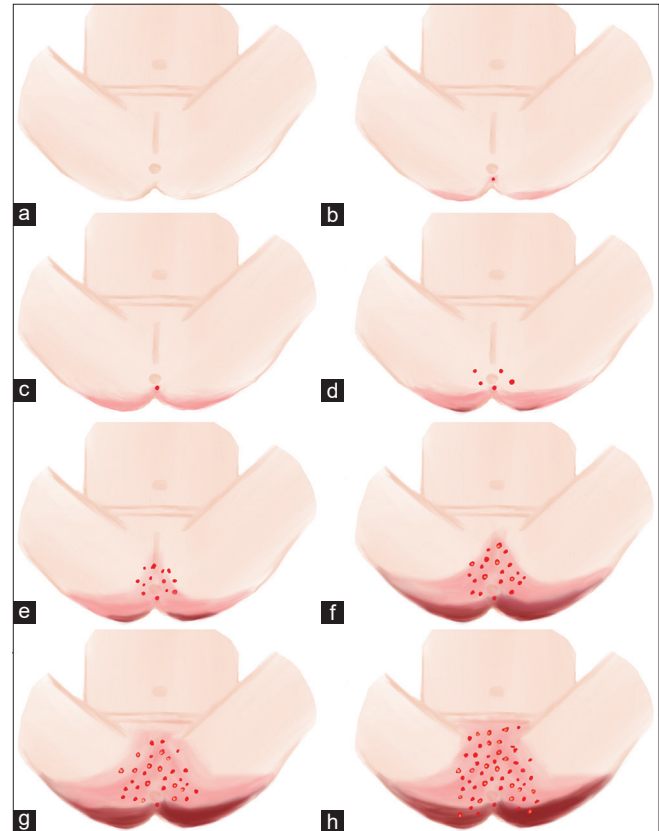
**RESULTS**

Of the 106 infants, 75 (70.8%) were female. The mean duration of the participating infants' diaper dermatitis was  $2.20 \pm 2.10$  months (range: 1–10 months). The mean grade of their diaper dermatitis was  $2.16 \pm 0.57$  (range: 0.5–3). The general characteristics of the infants and their caregivers are summarized in Table 2.

**Caregivers' habits, hygiene practices, and education levels**

The clinical features of the infants with diaper dermatitis and the habits of their caregivers are presented in Table 3.

The rate of exclusive breastfeeding among the uneducated caregivers was found to be high in those who had graduated from high school and university. Moreover, among the infants, the rate of being fed via breastfeeding and complementary foods was also found to be high. The use of solid foods by the uneducated mothers was high, while the use of mixed foods was high for those who had graduated from high school



**Figure 1:** The diagram shows the severity of the diaper dermatitis. According to the areas of involvement and the color of erythema and the presence of papule-pustules, 0 (none), 0.5 (slight), 1 (mild), 1.5 (mild to moderate), 2 (moderate), 2.5 (moderate to severe), 3 (severe) respectively (a-h)

**Table 1: Cincinnati Children's Hospital Diaper Dermatitis Grading Scale<sup>[11]</sup>**

Grade	Erythema	Rash	Severity
0	None	Papule one	-
0.5	Faint-definitely pink, <2%	Papule one	Slight
1.0	Faint-definitely pink, 2%-10% or definitely red <2%	Papules 2-5 scattered	Mild
1.5	Faint-definitely pink >10%, definitely red 10%-50%, or very intense red 2%	Papules slightly scattered over ≥1 areas, <10%	Mild to moderate
2.0	Faint-definitely pink >50%, definitely red 10%-50%, or very intense red 2%	Papules ≥1 areas 10%-50%, pustules 0-5	Moderate
2.5	Definitely red >50% or very intense red with edema 2%-10%	Papules: multiple >50% or pustules numerous or both	Moderate to severe
3.0	Very intense red with edema >10%	Papules large areas, numerous, confluent	Severe

**Table 2: The general characteristics of infants and caregivers**

	<i>n</i> (%)
Age of infants, mean±SD (minimum-maximum) (months)	10.1±5.5 (2-24)
Age of caregivers, mean±SD (minimum-maximum) (years)	30.8±7.4 (18-43)
Gender	
Girl	75 (70.8)
Boy	31 (29.2)
Range of ages (months)	
0-6	25 (23.6)
7-12	51 (48.1)
13-24	30 (28.3)
Presence of atopy	52 (49.1)
Presence of allergy	12 (11.3)
Fitzpatrick skin type	
2	13 (12.3)
3	40 (37.7)
4	42 (39.6)
5	11 (10.4)
Localization	
Urban	90 (84.9)
Rural	16 (15.1)
Socioeconomic status*	
Low	69 (65.1)
Medium	25 (23.6)
High	12 (11.3)
Education level of caregivers	
No education	46 (43.4)
Primary school	52 (49.1)
High school	5 (4.7)
University	3 (2.8)

\*Low (<300 dolar) medium (300-1000 dolar) high (>1000 dolar).  
SD: Standard deviation

and university. The diaper change frequency was found to be 1–4 times per day among those caregivers who were uneducated and who had graduated from primary school, while it was 5–8 times per day among those caregivers who had graduated from high school and university graduates. The use of wet wipes and antibiotics was higher among the caregivers who were high school and university graduates.

### Infants' behavioral changes

The behavioral changes exhibited by the infants with diaper dermatitis are presented in Figure 2.

A statistically significant difference in terms of the infants' behavioral changes was found in relation to the different maternal education level groups ( $P < 0.001$ ). The uneducated mothers and the primary school graduate mothers had infants who exhibited a high degree of easily crying, changes in sleeping patterns and eating disorders. A statistically significant difference was also found with regard to the infants' behavioral changes based on the utilized feeding methods ( $P = 0.003$ ). Those caregivers who exclusively breastfeed their infants reported a high degree of easily crying,

**Table 3: Clinical features of infants with diaper dermatitis and habits of caregivers**

	<i>n</i> (%)
Frequency of feeding, mean±SD (minimum-maximum)	6.13±3.41 (2-15)
Frequency of defecation, mean±SD (minimum-maximum)	3.9±1.58 (1-8)
Grading scale of DD, mean±SD (minimum-maximum)	2.16±0.57 (0.5-3)
Feeding methods	
Exclusive breastfeeding	26 (24.5)
Breastfeeding and complementary feeding	37 (34.9)
Only complementary feeding	43 (40.6)
Complementary foods	
Liquids	32 (40.5)
Solids	25 (31.6)
Mix	22 (27.8)
Frequency of diaper changes (times/day)	
1-4	48 (45.3)
5-8	41 (38.7)
>8	17 (16.0)
Use of topical cream	93 (87.7)
Types of topical cream	
Barrier	27 (28.4)
Antifungal	2 (2.1)
Corticosteroid	11 (11.6)
Antifungal + corticosteroid	50 (52.6)
All of them	5 (5.3)
Air the diaper area out	69 (65.1)
Diarrhea	27 (25.5)
Use of wet wipes	45 (42.5)
Types of wet wipes	
Alcohol based	22 (48.9)
Alcohol free	23 (51.1)
Skin cleansing agents	
Water soaked wipe	23 (30.3)
Soap soaked wipe	28 (36.8)
Only water	25 (32.9)
Use of antibiotics (last 1 month)	46 (43.4)

\*Only complementary feeding: Foods other than breast milk or infant formula, \*\*Liquids: Juice, cow milk, soup etc., \*\*\*Solids: Meats, poultry, cereal, vegetables, fruits and eggs etc. Presence of diarrhea in last 1 week, use of antibiotics in last one month was questioned. DD: Diaper dermatitis, SD: Standart deviation

changes in sleeping patterns, and eating disorders among their babies [Figure 2].

There was a statistically significant difference found in the mean of the grade of the infants' diaper dermatitis in relation to the different feeding methods ( $P < 0.001$ ). The mean grade of the diaper dermatitis seen in the infants who were exclusively breastfed was statistically significantly higher than that seen in those who were fed via breastfeeding and complementary food and those who were fed with only complementary food ( $P < 0.001$  for both). No significant difference was found in the mean grade of the diaper dermatitis seen in the infants who were fed via breastfeeding and complementary

foods and those who were fed with only complementary foods ( $P = 0.061$ ) [Figure 3].

A statistically significant difference was found in the infants' behavioral changes based on the caregivers' use of cream ( $P < 0.001$ ). The rate of the change in sleeping and eating habits was lower in those infants who were treated with cream when compared with those whose caregivers did not use cream. In terms of the cleaning of the diaper area, the change in sleeping habits was high in the infants who were cleaned with only water ( $P < 0.001$ ). The rate of easily crying, changes in sleeping patterns, and eating disorders was high in those infants who were cleaned with wet wipes ( $P < 0.001$ ), while the rate of easily crying was significantly higher in those who were cleaned using alcohol wipes ( $P = 0.004$ ). The rate of easily crying and changes in sleeping patterns was significantly lower in the infants whose caregivers allowed the diaper area to air out.

## DISCUSSION

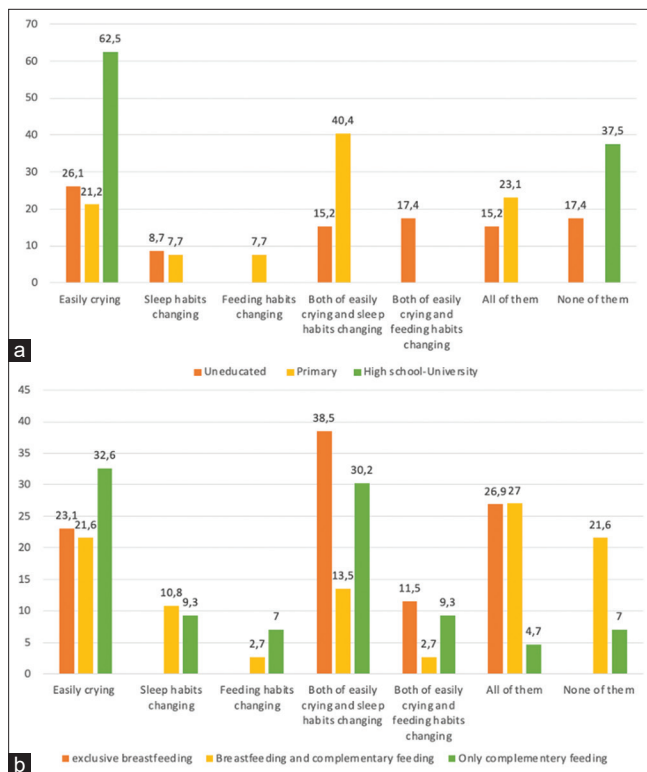
Diaper dermatitis is a preventable form of dermatitis. However, if caregivers have insufficient diaper hygiene training to adequately deal with, it can turn into a chronic condition with recurrent episodes.<sup>[9]</sup> Due to causing discomfort among

infants, diaper dermatitis can cause anxiety among caregivers. In addition, recurrent episodes of diaper dermatitis are likely to result in frequent referrals to healthcare professionals, which leads to a burden on the healthcare system.<sup>[11]</sup>

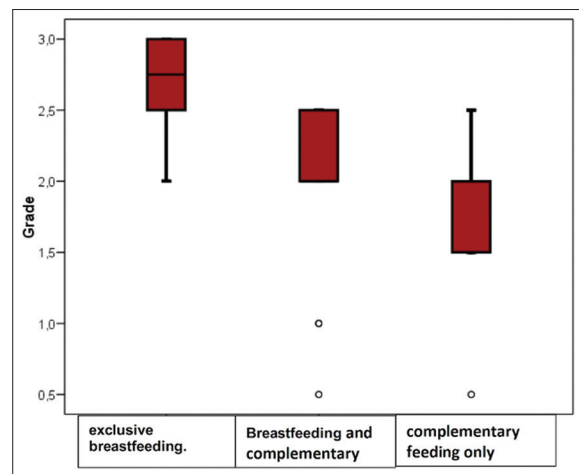
In our study, as the education level of caregivers increases, exclusive breastfeeding decreases; while the frequency of diaper change, use of wet wipes, and antibiotic use increase in infants. As the education level of caregivers decreases, the severity of diaper dermatitis and in relation to this, the effects of infants' behavior (easily crying, changes in sleeping patterns, and eating disorders) are increasing.

Previous studies have shown that breastfeeding is effective in terms of preventing diaper dermatitis.<sup>[12,13]</sup> It is thought that the feces of infants who are fed via breastfeeding exhibits a lower pH as well as less protease and lipase activity than the feces of infants who are fed via other methods, resulting in it being less of an irritant in the diaper area.<sup>[14]</sup> When it comes to its ability to heal diaper dermatitis, Farahani *et al.* reported that human milk with a high anti-inflammatory content is as effective as hydrocortisone 1% ointment when applied to the diaper area.<sup>[15]</sup> However, in a study conducted among 1036 infants in China, no relation was found between breastfeeding and the severity of diaper dermatitis.<sup>[16]</sup>

In the present study, the severity of diaper dermatitis was found to be higher in the breastfed infants. This may be due to the highest breastfeeding levels being seen among the uneducated caregivers. At the same time, the uneducated caregivers were found to more frequently combine the addition of solid foods to their infants' diet with breastfeeding. Moreover, the uneducated caregivers were found to less frequently change their infants and allow the diaper area to air out. This finding may suggest that the severity of diaper dermatitis is high among the infants of those caregivers who do not have sufficient knowledge of the condition. Most of the infants in our study were girl babies. It is thought that girls may be more susceptible to diaper dermatitis since their diaper areas are wider and more



**Figure 2:** (a) Infants behavioral changes according to caregivers education level: The uneducated mothers and the primary school graduate mothers had infants who exhibited a high degree of easily crying, changes in sleeping patterns, and eating disorders ( $P < 0.001$ ). (b) Infants behavioral changes according to feeding methods: Those caregivers who exclusively breastfeed their infants reported a high degree of easily crying, changes in sleeping patterns, and eating disorders among their babies ( $P = 0.003$ )



**Figure 3:** Grade minimum, maximum, 25%–75% percentile, median levels in the feeding methods of infants

open to mucous membranes. Because of these features, baby girls may have been more exposed to irritants (urea, feces), as diaper changes are performed less frequently (1–4 times/day) at 45.3% according to the results of our study.

The causes of diaper dermatitis have been found to differ in various studies. While, Li *et al.* recently reported that diarrhea is the most important factor in relation to diaper dermatitis,<sup>[16]</sup> they previously stated that its occurrence can be prevented by the use of barrier cream and increasing the frequency of diaper changes.<sup>[8,11]</sup> Similarly, in a large-scale study conducted in the United States, more frequent diaper changes and longer periods of non-diapered time were shown to decrease diaper dermatitis.<sup>[17]</sup> With regard to the results of the present study, the uneducated caregivers were likely unaware of the severity of diaper dermatitis, which indicates the need to increase their knowledge of the associated prevention methods.

To the best of our knowledge, although caregivers' habits have been investigated in previous studies, this study is the first to examine the discomfort behaviors of infants in relation to diaper dermatitis.

In the present study, the change in sleep and/or eating behaviors seen among the infants with diaper dermatitis whose caregivers used cream (barrier, topical antifungal, corticosteroid, antifungal + corticosteroid) and aired the diaper area out was significantly lower. In prior studies, it has been found that keeping moisture and irritants away from the diaper area through the use of barrier creams and breathable diaper technologies is important in relation to protecting infants from diaper dermatitis.<sup>[7,18]</sup> In a global study, it was observed that the severity of diaper dermatitis was lower in the infants of caregivers who kept their babies out of diapers for a long time during the night.<sup>[8]</sup>

When the caregivers' diaper area hygiene practice involved the use of alcohol-based wet wipes, it was observed that the rate of easy crying among the infants was high. Wet wipes for babies contain approximately 75% isopropyl alcohol (IPA), and IPA is a known skin irritant.<sup>[19]</sup> A small amount of IPA on the skin is generally not dangerous, although repeated exposure can cause itching, redness, rash, drying, and cracking. The sensation of discomfort associated with diaper dermatitis may increase in infants due to the irritation caused by IPA. Thus, caregivers should take care to use alcohol-free wet wipes in their diaper area hygiene practice.

In the present study, the most striking finding was that all the investigated discomfort behaviors, namely easily crying, changes in sleeping patterns, and eating disorders, were observed in infants with diaper dermatitis who were being raised by uneducated caregivers.

It is believed that caregivers who do not receive sufficient diaper hygiene training will be unable to adequately protect their infants from developing diaper dermatitis. A study conducted in 2001 found that, as a result of neonatal skincare practice that involved new literature being given to nurses in

neonatal intensive care units, significant improvements were observed in the skin of newborns due to the increase in the knowledge of nurse.<sup>[20]</sup>

### Limitations

Since our study is a cross-sectional study, the evaluation of the resulting cause-effect relationship is not as valuable as in cohort studies. Therefore; Epidemiological criteria (relative risk, odds ratio, attributed risk, preservation speed) were not obtained to evaluate the cause-effect relationship. Sufficient information could not be obtained from some immigrant caregivers who had language problems. Although all babies with diaper dermatitis admitted to our outpatient clinic were taken in order, the number of girl babies was higher than boys. It would be preferable if there was no significant difference between the genders.

### CONCLUSIONS

In many countries; there is breastfeeding (breastfeeding) counseling that solves the problems mothers experience while breastfeeding. However, very few countries have counseling or any unit that provides training for caregivers regarding the care of the diaper area. Whereas; considering the education level of the caregivers, the care of the diaper area should be explained in detail. Complications from diaper dermatitis are rare; but, if prevention methods are not adequately explained to caregivers and adequate treatment is not applied, in addition to the bacterial and fungal superinfections that occur, an increase in the severity of the skin shedding and discomfort behavior in babies are observed. Over time, changes in eating and sleeping behaviors can cause babies to experience more distress.

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### Conflicts of interest

There are no conflicts of interest.

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