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Frequency of Diaper Dermatitis Using Disposable Diaper Versus Traditional Cloth Diaper in Children Admitted in Pediatric Unit MTI Mardan

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ABSTRACT

Background: Diaper dermatitis is a frequent inflammatory skin problem in infants and young children and it commonly occur due to prolonged exposure of skin to moisture, urine and stool. Type of diaper may influence the occurrence of dermatitis because of differences in absorbency and skin protection. **Objective:** To determine the frequency of diaper dermatitis using disposable diaper versus traditional cloth diaper in children admitted in pediatric unit of Mardan Medical Complex. **Study Design:** Cross sectional study. **Duration and Place of Study:** This study was conducted from 01 November 2024 to 01 May 2025 at the Department of Pediatrics, Mardan Medical Complex, Mardan. **Methodology:** A total of 181 children aged 3 months to 3 years using disposable or cloth diapers were included in the study. Detailed clinical examination of diaper area was carried out by trained paediatrician for erythema, papules, erosions, oozing and crusting. Data was analysed by using IBM Statistical Package for Social Sciences version 26. **Results:** The mean age was 1.47 ± 0.78 years and mean weight was 9.89 ± 2.50 kg. Diaper dermatitis was present in 82 (45.3%) children. Dermatitis was more common in cloth diaper users 36 (57.1%) compared to disposable diaper users 46 (39.0%) with significant association (p=0.019). Higher weight and prolonged diaper use were also significantly associated with dermatitis (p=0.001 and p<0.001 respectively). **Conclusion:** Diaper dermatitis was commonly found among young children and was significantly higher in cloth diaper users compared to disposable diaper users.

INTRODUCTION

Diaper dermatitis is one of the most common inflammatory skin condition seen in infants and young children, especially during the first two years of life.[1] It usually develops in the diaper area because the skin remain exposed to moisture, urine, stool, friction and irritation for long period of time.[2] The affected skin become red, painful and sometimes swollen with appearance of small papules or peeling of skin. In severe cases, secondary bacterial or fungal infection may also occur, particularly due to Candida species.[2] Many factors contribute in development of diaper dermatitis including poor hygiene, infrequent diaper changing, diarrhoea, use of antibiotics and sensitive skin.[3] The immature skin barrier in children make them more vulnerable to irritation and inflammation.

The application of disposable diapers is widespread in modern healthcare because of their convenience, high capacity, and overall usefulness to parents or caregivers.[4] According to a large number of studies, disposable diapers can reduce the risk of having wet skin due to the absorbent gels contained within.[5] On the other hand, diaper rash can still be a complication arising from the use of disposable diapers, especially in situations where diapering is done less often and during episodes of diarrhea.[6] The presence of various chemicals, fragrances, and plastics in some types of disposable diapers can cause irritation and even trigger allergic reactions in some children. The high humidity level and temperature in disposable diaper use can lead to inflammation and fungal growth.[7]

Traditional cloth diapers are still commonly used in many low income and rural populations because they are reusable, economical and easily available.[8] Cloth diapers are usually made from cotton or soft fabric materials and are considered more breathable compared to disposable diapers.[9] Despite this advantage, the frequency of diaper dermatitis is often reported higher among children using traditional cloth diapers because these diapers absorb less moisture and remain wet for longer periods.[10] Continuous contact of urine and stool with skin can damage the skin barrier and increase risk of irritation and infection. Inadequate washing methods, use of harsh detergents and poor drying of cloth diapers may further aggravate skin inflammation in children. Parents may also delay changing

cloth diapers due to repeated washing burden which increase exposure of skin to wetness and friction.[11]

Diaper dermatitis is one of the common problems found among babies and toddlers, which can have adverse effects on comfort, sleeping habits, and feeding behavior. The choice of the diaper can influence the incidence rate of diaper dermatitis because of its moisture-retention capacity, skin-breathing quality, and hygienic measures. In many developing countries, both types of diapers disposable and cloth are commonly used, but evidence in relation to diaper dermatitis is scarce in those areas. This study will help in identifying the frequency of diaper dermatitis among children using disposable diapers versus traditional cloth diapers and may provide useful information for parents and healthcare professionals regarding better diaper care practices. The objective of this study is to determine the frequency of diaper dermatitis using disposable diaper versus traditional cloth diaper in children.

METHODOLOGY

This cross-sectional study was conducted from 01 November 2024 to 01 May 2025 at the Department of Pediatrics Mardan Medical Complex. Ethical approval for the study was obtained from hospital ethical committee before commencement of study. The 181 sample size was calculated by using WHO sample size software with 95% confidence interval, 7% margin of error and expected frequency of diaper dermatitis as 36.1%.[12]

Inclusion Criteria

Children were included aged from 3 months to 3 years of both genders and using disposable diaper or cloth diaper.

Exclusion Criteria

Children were excluded with history of skin disorders such as eczema or psoriasis, concurrent antibiotics or steroids use, chronic diarrhea, low birth weight less than 2500 grams or major congenital anomalies.

After obtaining informed consent from parents or guardians, demographic information was collected including age, gender, weight, duration of using diapers, type of diaper, educational level, socioeconomic status and residential status. Detailed clinical examination was performed in all children. The diaper area was thoroughly examined by trained pediatrician for presence of erythema, papules, erosions, oozing and crusting. The examiner also documented extent of lesions present in diaper region. Cloth diaper was considered as reusable diaper having inner absorbent layer made from natural fibres such as cotton with more than 80% cotton content and absorptive capacity of at least 200 mL. Disposable diaper was considered as single-use diaper having cellulose fluff pulp absorbent core greater than 10 grams with minimum absorption capacity of 300 mL, non-woven polypropylene topsheet greater than 15 gsm and polyethylene backsheet less than 25 µm thickness making it liquid impermeable. Diaper dermatitis was considered when erythema involved 25% or more of diaper area and/or presence of any two or more lesions including papule erosions, oozing or crusting in diaper region.

Data analysis was conducted by using IBM SPSS version 26. Quantitative variables including age, weight, duration of diaper use were expressed as mean ± standard deviation. Categorical variables including gender, type of diaper, educational level, socioeconomic status, residential status and diaper dermatitis were represented as frequencies and percentages. Comparison of diaper dermatitis between disposable diaper and cloth diaper was carried out by chi-square test or Fisher exact test where applicable. Stratification of diaper dermatitis was performed for age, gender, weight, educational level, socioeconomic status, duration of diaper use and residential status. Post-stratification chi-square test or Fisher exact test was applied and p value ≤0.05 was considered statistically significant.

RESULTS

The study enrolled 181 children with a mean age of 1.47 ± 0.78 years and mean weight of 9.89 ± 2.50 kg. Among the participants, 105 (58.0%) were male and 76 (42.0%) were female. Regarding parental education, 47 (26.0%) parents were uneducated, 57 (31.5%) had primary level education, 63 (34.8%) had secondary education, and only 14 (7.7%) had higher education. In terms of socioeconomic status, both poor and middle class groups were equally represented with 80 (44.2%) each, whilst high socioeconomic status was seen in 21 (11.6%) families. Most of the children were from rural areas, 116 (64.1%), compared to urban areas, 65 (35.9%). Majority of children were using disposable diapers 118 (65.2%) whilst 63 (34.8%) were using cloth diapers (Table-I).

Table I

Patient Demographics

Demographics	Mean ± SD / n (%)
Age (Years)	1.47 ± 0.78
Weight (Kg)	9.89 ± 2.50
Gender	
Male n (%)	105 (58.0%)
Female n (%)	76 (42.0%)
Parents' Educational Level	
Uneducated n (%)	47 (26.0%)
Primary n (%)	57 (31.5%)
Secondary n (%)	63 (34.8%)
Higher n (%)	14 (7.7%)
Socioeconomic Status	
Poor n (%)	80 (44.2%)
Middle n (%)	80 (44.2%)
High n (%)	21 (11.6%)
Residential Status	
Rural n (%)	116 (64.1%)
Urban n (%)	65 (35.9%)
Type of Diaper	
Cloth n (%)	63 (34.8%)
Disposable n (%)	118 (65.2%)

Overall, diaper dermatitis was found present in 82 (45.3%) children whereas 99 (54.7%) children had no dermatitis. When comparison was made between diaper types, dermatitis was more frequently observe in children using cloth diapers 36 (57.1%) as compare to those using disposable diapers 46 (39.0%), and this difference was found to be statistically significant (p = 0.019) (Table-II).

Table II

Frequency of Diaper Dermatitis and its Comparison by Type of Diaper

Variables	Yes n (%)	No n (%)	Total n (%)
Diaper Dermatitis	82 (45.3%)	99 (54.7%)	181 (100%)

Type of Diaper				P value
Cloth	36 (57.1%)	27 (42.9%)	63 (100%)	
Disposable	46 (39.0%)	72 (61.0%)	118 (100%)	0.019
Total	82 (45.3%)	99 (54.7%)	181 (100%)	

Among the demographic and clinical factors which was analysed, weight and duration of diaper use were come out as the most significant predictors of diaper dermatitis. Children with weight more than 10 kg had considerably higher frequency of dermatitis 48 (58.5%) as compared to those weighing 10 kg or less 34 (34.3%), with a statistically significant p-value of 0.001. Similarly, duration of diaper use was also shown strong association, where children who used diapers for more than 12 months had much higher rate of dermatitis 47 (68.1%) in comparison to those who used it for 12 months or less 35 (31.3%), and this was highly significant (p < 0.001) (Table-III).

Table III

Association of Diaper Dermatitis with Demographic and Clinical Factors

Factors	Subgroup	Diaper Dermatitis		p-value
		Yes n (%)	No n (%)	
Age (Years)	≤2	56 (41.2%)	80 (58.8%)	0.052
	>2	26 (57.8%)	19 (42.2%)	
Gender	Male	47 (44.8%)	58 (55.2%)	0.863
	Female	35 (46.1%)	41 (53.9%)	
Weight (Kg)	≤10	34 (34.3%)	65 (65.7%)	0.001
	>10	48 (58.5%)	34 (41.5%)	
Parents' Educational Level	Uneducated	20 (42.6%)	27 (57.4%)	0.712
	Primary	29 (50.9%)	28 (49.1%)	
	Secondary	28 (44.4%)	35 (55.6%)	
	Higher	5 (35.7%)	9 (64.3%)	
Socioeconomic Status	Poor	33 (41.3%)	47 (58.8%)	0.417
	Middle	37 (46.3%)	43 (53.8%)	
	High	12 (57.1%)	9 (42.9%)	
Residential Status	Rural	55 (47.4%)	61 (52.6%)	0.446
	Urban	27 (41.5%)	38 (58.5%)	
Duration of Diaper Use (Months)	≤12	35 (31.3%)	77 (68.8%)	<0.001
	>12	47 (68.1%)	22 (31.9%)	

DISCUSSION

Total 181 children was enrolled and overall frequency of diaper dermatitis was found to be 45.3%. These findings was suggesting that diaper dermatitis remain a common skin problem in young children and its occurrence is influence by several factors including type of diaper used, weight of child, and duration of diaper use. Regarding type of diaper, dermatitis was more frequently seen in children who was using cloth diapers 36 (57.1%) as compare to disposable diapers 46 (39.0%), and this difference was statistically significant (p = 0.019). The possible scientific reason for this finding is that cloth diapers has poor absorbency and tend to keep moisture in contact with skin for longer period. Persistence of moisture causes maceration of the stratum corneum and makes the skin more vulnerable to friction and irritation from chemicals, as well as infection with microorganisms, such as C. albicans and fecal flora. The duration of diaper use was found to be strongly related to the development of dermatitis, as more than 47 children (68.1%) who had used diapers for more than 12 months had experienced dermatitis compared to only 35 cases (31.3%) who used diapers for 12 months or less, p < 0.001. Extended contact of the skin with urine and feces causes cumulative effects on its barrier function. Urea-splitting bacteria produce ammonia that increases the skin's pH value and activates fecal proteases and lipases, whose action is harmful to the skin.

The overall frequency of diaper dermatitis in present study was found to be 45.3%, which is somewhat comparable to findings reported by Negera *et al.* [13] who noted that approximately 70% of infants and young children experience diaper dermatitis during diaper wearing years. Similarly, Wanjiku *et al.* [14] reported variable global prevalence ranging from 15% in Italy to 87% in Japan, which is suggesting that frequency of diaper dermatitis differ considerably across different populations and settings. The relatively lower frequency observed in present study as compare to some international figures may be because of differences in study design, sample size, diaper changing practices, and hygiene habits among the study population.

Regarding type of diaper, cloth diaper users in present study showed higher frequency of dermatitis 36 (57.1%) as compare to disposable diaper users 46 (39.0%), with statistically significant difference (p=0.019). This finding is in agreement with Arthur D. Little Inc. [15] who reported that disposable diapers provided better protection against diaper dermatitis as compare to reusable diapers, and also with Song *et al.* [16] who explained that introduction of absorbent gelling material in disposable diapers reduced skin hydration and improved pH stability, resulting in lower dermatitis rates compared with cloth diapers. The scientific basis for this observation is that cloth diapers has poor moisture absorbency and keep skin in prolonged contact with wetness, which is cause maceration of stratum corneum and increase vulnerability to microbial colonisation. However, this finding is in contrast with Uber *et al.* [17] who reported no significant difference in diaper dermatitis frequency between cloth 47.5% and disposable diaper users 47.0% (p=0.47), and also contradicts Kanchanamala *et al.* [18] who found no significant association between diaper type and diaper rash. These differences may possibly be explained by variation in diaper changing frequency, hygiene practices, and climate conditions across different study settings.

Duration of diaper use was found to be highly significant factor in present study, where children using diapers for more than 12 months had considerably higher

rate of dermatitis 47 (68.1%) as compared to those using it for 12 months or less 35 (31.3%), with p-value less than 0.001. This is well supported by Safitri *et al.* [19] who also demonstrated a significant relationship between diaper usage duration and severity of dermatitis (p=0.000), concluding that prolonged diaper use is increase severity of condition. Song *et al.* [16] also provided scientific explanation that prolonged skin wetness and faecal enzyme activity contribute significantly to skin barrier damage over time. Urease producing bacteria break down urea into ammonia which raise skin pH and activate faecal proteases and lipases that directly damage epidermal barrier with repeated and cumulative exposure.

Children with weight more than 10 kg in present study showed significantly higher frequency of dermatitis 48 (58.5%) compared to lighter children 34 (34.3%), with p-value of 0.001. This finding was not directly compared in most reviewed studies. However, Kanchanamala *et al.* [18] found no significant association between infant weight and diaper rash, which is contradicting the present finding. The difference may be because heavier children tend to have more prominent skin folds in nappy region that is creating warm and moist microenvironment favouring microbial growth, and also producing higher urine output which is increase skin exposure to irritants. Gender was not found to be significantly associated with diaper dermatitis in present study (p=0.863), which is consistent with Kanchanamala *et al.* [18] and Uber *et al.* [17] who similarly reported no significant gender based difference in dermatitis frequency.

Several weaknesses exist in the current study. One limitation is that the study was performed at only one facility. The sample used in the current research was relatively small with only 181 patients involved in the analysis. Recollection bias may have occurred since information regarding types of diapers, duration, and personal hygiene practices were collected retrospectively by parents and caregivers who did not remember specific details well enough.

CONCLUSION

The current research demonstrates that diaper dermatitis is a common problem in dermatology in children during their early years of life. In addition, it was established that the incidence of the disease depends on the type of diapers used, the time spent wearing them, and the body weight of the child. More cases of the disease were recorded among cloth diapers than disposable ones due to the high moisture absorbency of the latter type of diapers.

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