

Behind the diaper: Unveiling prevalence and associated factors of diaper rash among infants

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ABSTRACT

Introduction: Commonly termed diaper rash (DR), diaper dermatitis is an inflammatory condition affecting the perineal area of infants. Given its frequent occurrence, understanding its epidemiology is crucial. This study aims to determine the prevalence of DR and identify its associated factors among infants attending immunization clinics in the Bope-Poddala Medical Officer of Health (MOH) area.

Methods: A descriptive cross-sectional study was conducted using systematic sampling to select infants from immunization clinics in the Bope-Poddala MOH area. Data on demographic details, DR symptoms over the past six weeks, and potential associated factors were collected via a pretested, interviewer-administered questionnaire describing the specific symptomatology of the diaper dermatitis. Data analysis was performed using SPSS software (version 25).

Results: Of 254 infants, 57.5% were female, with a median age of 6 months (IQR 3-8). A total of 57.1% were exclusively breastfed. Regarding diaper usage, 80% used either cloth or disposable diapers, with specific usage at 4% for cloth and 16% for disposable alone. The median frequency of diaper changes was 10 times per day (IQR 4-13). DR was observed in 24 infants (9.4%), with significant associations found between its occurrence and both concomitant diarrhoeal illness ($\chi^2=28.496$, $p<0.05$) and infrequent daytime diaper changes ($\chi^2=12.129$, $p<0.05$). No significant correlations were noted with age, gender, weight, type of diaper, nighttime changes, family income, or caregiver education level.

Conclusions: DR affects approximately one-tenth of infants, with less frequent daytime diaper changes and concurrent diarrhoeal illnesses being significant risk factors. These findings highlight the importance of improving caregiver awareness and diaper hygiene practices to potentially reduce DR prevalence.

Keywords: *Associated factors, Diaper rash, Prevalence.*

Introduction

Diaper rash (DR) is one of the commonest skin problems among infants. It is an inflammatory reaction of the skin covered by diaper as a result of progressive compromise of skin barrier which is characterised by dryness, scaling and erythema (1).

Increase moisture around diaper area; prolong contact with faeces, and other irritants including skin care products, detergents can lead to mechanical skin damage (2). Thus, promoting the skin is susceptible to increase friction and maceration and finally

damaging the barrier of the skin. The damaged skin favours the environment for the microorganisms to colonize further damaging the skin barrier.

Skin pH also plays an important role in the occurrence of DR (3). The skin pH is increased by production of ammonia due to prolonged exposure to urea. In addition, activation of faecal enzyme protease and lipase cause further damage to the area of skin under the diaper (4). DR is often complicated by infections, predominantly fungal infections and is frequently caused by *Candida albicans*. Bacterial infections by *Staphylococcus aureus* with DR are also reported (2).

The risk factors for DR are multifaceted and include age, diet, frequency of defaecation; duration of skin exposed to urine and feces and the type of diaper (5). The relationship between DR and gender is controversial. While some studies suggest that DR affects infants indiscriminately regardless of gender (6), others have observed a higher incidence of DR among females (7). The prematurely born infants are more prone to get DR due to immaturity of the skin with the highest incidence was reported to be among 9-12 age groups (8).

The contact of faeces and urine gradually decreases with infant's age, bowel and 'potty' training and maturity. Infants who are on solid food more likely to get DR than those who are breastfed due to lower stool pH, differences in the intestinal flora and components of the faeces and urine (9, 10). Furthermore, the frequency of diaper changes plays a crucial role. Infants who change diapers less than six times per day are at higher risk of developing the DR (6). Additional risk factors for DR include, use of topical applications on diaper area, use of oral antibiotic, diarrhoea and atopic conditions (11, 12).

Differential diagnoses for DR include conditions like seborrhoeic dermatitis, atopic eczema, candidiasis, perianal dermatitis, miliaria and infantile psoriasis, which may complicate or coexist with DR (5). The presence of DR can cause discomfort for infants and create stressful situations for parents. Therefore, to develop preventive measures, it is critical to identify the relevant factors of DR. Despite literature demonstrating nearly half of infants among populations experiencing DR at given time (13), there is a lack of comprehensive data worldwide and in Sri Lanka there is no published data on DR

in infants. In this study we aimed to fill the gap by assessing the prevalence and associated factors of diaper dermatitis among infants attending immunization clinic at Bope-Poddala MOH area.

Methods

This descriptive cross-sectional study was conducted across six immunization clinics within the Bope-Poddala MOH area. A total of 254 infants attending these clinics were recruited based on a calculated sample size to ensure statistical relevance.

A systematic sampling technique was employed, selecting every other infant listed in the immunization clinic registers. The inclusion criteria were infants accompanied by mothers or caregivers who consented to participate in the study. Exclusion criteria included non-consenting mothers or caregivers, infants with congenital malformations leading to urinary or bowel incontinence, and illiterate mothers or caregivers.

Data were collected through a pretested, interviewer administered questionnaire to mothers or caregivers. The questionnaire was designed to capture specific symptoms typically associated with DR, such as erythema, irritability, and rash confined to the diaper area. Given other dermatological conditions that can present with overlapping symptoms, the questionnaire focused on common and distinguishing features reported by carers, including psoriasis, seborrhoeic dermatitis, and candidiasis. The data collection was conducted by trained interviewers who adhered to a structured protocol to ensure consistency and accuracy. Any ambiguous cases or symptoms not typical of diaper rash were flagged for further evaluation by a dermatologist. Data on demographic information of the infant and caregiver, presence of DR during the last 6 weeks, details of any previous episodes of DR, current and birth weight of infants, recent diarrhoeal episodes, feeding patterns, diaper change frequency, diaper type, and products applied to the diaper area were collected. Participants were specifically questioned on DR during the last six weeks, and they were clearly explained nature of DR to confirm its occurrence.

Data were analysed using the *Statistical Package for the Social Sciences (SPSS)* version 25.0. Ethical approval for this study was granted by the Ethical

Review Committee of the Faculty of Allied Health Sciences, University of Ruhuna (Ref no:72.11.2021)

Results

A total of 254 mothers of infants participated in the survey. The median (IQR) age was 6 (3-8) months. Majority of the infants were females ($n=146$, 57.5%). The mean (SD) birth weight was 2878 (348) g while mean (SD) current weight was 6345.39 (1664) g. Only 3.6% of infants had a reported history of atopy.

Thirty-one infants (12.2%) had experienced DR at some point in their lifetime, with 9.4% (24/254) experiencing DR within the last 6 weeks. Among these, 17 (6.7%) had experienced at least one episode, while 7 (2.7%) had experienced more than one episode during the past 6 weeks.

When analysing factors associated with DR (Table 1), a statistically significant association was observed between diarrhoeal illness during the past six weeks and the frequency of daytime diaper changes. The risk of DR was significantly higher in infants with diarrhoeal illness compared to those without (odds ratio [OR] = 9.55, $p < 0.05$), and infants who were changed fewer than 6 times during the day were also significantly more likely to experience DR (OR = 4.42, $p < 0.05$).

No significant associations were found between DR during the past six weeks and other factors, including gender, birth weight, maternal age, maternal education level, family monthly income, frequency of night time diaper changes, feeding pattern of the infant, or diaper type. Additionally, no significant associations were identified between DR and the age of the infant or current weight when analysed using independent t-tests ($p > 0.05$).

Discussion

This is the first study to determine prevalence and associated factors of DR among infants in Sri Lanka. The overall prevalence of DR within the past six weeks in our sample was relatively low, reported at 9.4% (24/254), compared to similar research studies. A study conducted in China showed a much higher prevalence of DR among children aged 1-24 months, at 43.8% (6), while in Thailand, it was reported as 36.1% (13). Despite previous findings

indicating a higher prevalence among older children, our study failed to detect a significant association between age and DR (6).

Although there was a difference in the prevalence of DR between boys and girls in our study, no significant association was found between DR and gender. This is consistent with findings from previous studies (9).

Contrary to some previous research, we found no significant association between the level of maternal education and the incidence of DR (6, 14, 15). Similarly, family income was not significantly associated with DR occurrence in our study population. This suggests that factors beyond socioeconomic status may play a more significant role in the development of DR in infants in Sri Lanka.

While our study did not find a significant association between birth weight and DR, some researchers have suggested that prematurely born infants may be more prone to DR due to the immaturity of their skin (8).

Frequency of diaper change is the one of the major factors that influences the prevalence of DR, due to prolonged contact of urine and faeces with the skin. Previous studies have recommended changing diapers every three to four hours based on the frequency of urination in infants (13). Our findings support this recommendation, as frequent diaper changes were associated with a lower risk of DR. Specifically, changing diapers fewer than six times during the daytime significantly increased the risk of DR compared to more frequent changing (OR=4.42). However, fewer than four changes during nighttime did not lead to significant increases in DR occurrence.

Frequent liquid stools, which contain a higher amount of residual digestive enzymes, have been identified as a risk factor for DR. The present study revealed a significant association between DR and concomitant diarrhoeal conditions, consistent with previous research findings (6).

Similarly, previous studies have reported our study did not find a significant association between DR and feeding patterns, including exclusive breastfeeding versus other feeding methods, despite differences in stool composition between breastfed and formula-fed infants (6). In contrast to the findings from China, the type of diaper used did not significantly influence the occurrence of DR in our study population.

Table 1: Diaper Rash and Associated Factors

Factor	Presence of diaper rash during past six weeks			Chi value	P value
	Present n (%)	Absent n (%)			
Gender	Female	17 (11.6%)	129 (88.4)	1.943	0.164
	Male	7 (6.5%)	101 (93.5%)		
Birth weight	Low birth weight	4 (9.8%)	37 (90.2%)	0.005	0.941
	Normal birth weight	20 (9.4%)	193 (90.6%)		
Mother's age	Teenage mothers	1 (14.3%)	6 (85.7%)	0.197	0.657
	Non training mothers	23 (9.3%)	224 (90.7%)		
Educational level of mothers	Below secondary education	3 (9.7%)	28 (90.3%)	0.002	0.963
	Above secondary education	21 (9.4%)	202 (90.6%)		
Income	Below mean income	14 (9.2%)	139 (90.8%)	0.040	0.841
	Above mean income	10 (41.7%)	91 (39.6%)		
Presence of Diarrheal illness during last 6 weeks	Yes	10 (38.5%)	16 (61.5%)	28.496	0.000
	No	14 (6.1%)	214 (93.9%)		
Frequency of diaper changing during daytime	Below 6 times	10 (23.8%)	32 (76.2%)	12.129	0.000
	Above 6 times	14 (6.6%)	198 (93.4%)		
Frequency of diaper changing during nighttime	Below 4 times	17 (11.0%)	137 (89%)	1.156	0.282
	Above 4 times	7 (7%)	93 (93%)		
Feeding pattern	Exclusive breast feeding	12 (8.3%)	133 (91.7%)	0.543	0.461
	Other feeding pattern	12 (11.0%)	97 (89.0%)		
Diaper type	Cloths only	2 (5.1%)	37 (94.9%)		
	Disposable only	4 (36.4%)	7 (63.6%)	10.257	2
	Both	18 (8.8%)	186 (91.2%)		

Conclusions

The prevalence of DR among infants is reported to be lower than the studies in literature. Less frequent diaper change during daytime and presence of concomitant diarrhoeal illness increased the risk of DR among infants.

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