

Factors Influencing Diaper Dermatitis Among Jordanian Children Younger Than 24 Months

Eman S. Al-Satari¹, Nihaya A. Al-sheyab², Huda Gharaibeh³, Audai A. Hayajneh⁴

¹ MSc, Faculty of Nursing, King Saud University, Riyadh 11451, Saudi Arabia, ward.eo_86@yahoo.com. The corresponding author.

² Ph.D, Associate Professor, Faculty of Applied Medical Sciences, Faculty of Nursing, Jordan University of Science and Technology, Irbid 22110, Jordan, Phone: 009622 720100, Fax: 009622 7095123, Email: Nasheyab@just.edu.jo.

³ Ph.D, Associate Professor, Faculty of Nursing, Jordan University of Science and Technology, Irbid 22110, hgharaibeh@just.edu.jo

⁴ Audai A. Hayajneh, PhD, RN, CPT, Assistant professor, Adult health-nursing department

Faculty of Nursing, Jordan University of Science and Technology, P.O. Box: 3030, Irbid, Jordan, 22110, aahayajneh@just.edu.jo

This study was approved by ethics committee [IRB] in Jordan. All authors are aware of the *International Journal of Nursing Practice* conflict of interest policy and are in compliance with this policy. There is no conflict of interest related to this research, and no financial support was obtained during the preparation of this manuscript. The work in this manuscript is original conducted by the authors. The content of the manuscript has not been previously published, either in part or in full, and it has not been submitted to any other journal. Nihaya A. Al-sheyab, Huda Gharaibeh, Audai A. Hayajneh are aware that the manuscript is being submitted to *International Journal of Nursing Practice* and approved the final draft.

Abstract

Aim: The current study aims to explore the factors influencing DD among children aged between 0-24 months in Jordan. **Methods:** This study utilized a descriptive cross-sectional design with a convenient sample of 140 children diagnosed with DD. Structured face-to face interviews were used to collect data from the parents of the children included in the study. Univariate and multivariate logistic regression analyses were used to test the association between diaper dermatitis and its related medical factors. **Results:** The prevalence of DD was found to be 98.6% among the participants. The median of the duration of the most recent DD episode in days was 3 days (Inter Quartile Range= 2 to 4 days). The factors influencing DD were the use of barrier cream (OR=.35, 95% CI = .18-.72, p=.004), and bathing frequency of ≤ 1 time per week (OR=1.15, 95% CI = .65-2.10, p=.002). **Conclusion:** The identified factors should be paid significant attention in order to reduce the prevalence of DD among children aged 24 months or under. **Clinical implications:** Prevention-focused programs which encourage the frequent application of appropriate barrier creams and frequent bathing of more than once a week are needed. Moreover, there is a need to raise awareness among parents and the community through educational plans related to the prevention of DD and diaper hygiene care

Keywords: Diaper Dermatitis; Jordanian; Children; Factors; Younger Than 24 Months

Trial Registration: NCT04210674

WHAT'S KNOWN?

- Diaper dermatitis (DD) is a highly common condition among neonates, infants, and toddlers.
- Many risk factors which may increase the occurrence of DD, including gastrointestinal tract infection, the type of diaper used, diaper changing of fewer than three times/night, and the topical application of baby talcum powder to the diaper area.
- In the case of infants, DD may cause restlessness, interruption in feeding, crying, and sleeplessness due to the annoying pain and redness in the affected part.
- The DD symptoms may increase the need for frequent pediatrician visits, which increases parents' guilt, anxiety, and financial burden.

WHAT'S NEW?

- The prevalence of DD was found to be 98.6% among the participants.
- The identified factors which are the use of barrier cream and bathing frequency of ≤ 1 time per week should be paid significant attention in order to reduce the prevalence of DD among children aged 24 months or under.
- There is a need to raise awareness among parents and the community through educational plans related to the prevention of DD and diaper hygiene care

Introduction

Diaper dermatitis (DD) is a highly common condition among neonates, infants, and toddlers (1) and can be described as an acute inflammatory skin eruption and irritation which is observed in areas such as the buttocks, thighs, scrotum, and mons pubis (2). It has been reported by pediatricians and parents that DD affects almost all infants aged between 9-12 months (2, 3). The prevalence of DD has been reported to range from 7% to 50% (4, 6) and to be equal among children of both sexes and of different racial backgrounds (4, 5, 2). The prevalence of DD in infants has been reported to be 75% in the United States (US), 15% in Italy, 43.8% in China, 16% in the United Kingdom (UK), 87% in Japan, and 34.9% in Iran (7, 8, 9, 10, 11, 12). However, the actual prevalence of DD among the pediatric population may be higher than what has been reported, as most cases of DD resolve within a few days without the need to seek a pediatrician or intensive medical treatment (4,5).

The signs and symptoms of DD reported in recent studies have varied according to differences in cultural beliefs regarding care for the diaper area and the prevention and management of DD (13). The signs and symptoms of DD may include erythema, papules, pustules, scaling, itching, maceration, burning, and skin breakdown with open areas (14). Consequently, these symptoms cause irritation, which can be diagnosed through patch testing (15, 16). Most cases of skin inflammation in the diaper area are considered to be cases of irritation, which may be caused by changes in the skin pH, lack of zinc and exposure to fresh air, the inadequate use of certain topical barrier creams, low frequency of diaper changing, the type of feeding (i.e. breast or bottle), diarrhea, infant maturity, age, and the prolonged exposure to various enzymes in feces and urine (3, 17, 18, 19, 20). In addition, the presence of bacteria and candida is the most common and frequent cause of the development of irritations and diaper dermatitis (21).

Studies in the literature have reported many risk factors which may increase the occurrence of DD, including gastrointestinal tract infection, the type of diaper used, diaper changing of fewer than three times/night, and the topical application of baby talcum powder to the diaper area (21,22). If untreated, acute cases of diaper dermatitis may result in the formation of surface wounds in the diaper area, which may lead to the formation of sores on the genitals, pain during urination, vesicoureteral reflux, and the appearance of blood spots on the infant's diaper. These negative impacts can also extend to the appearance of blood in urine, which may ultimately cause anemia, amongst other problems (4).

In the case of infants, DD may cause restlessness, interruption in feeding, crying, and sleeplessness due to the annoying pain and redness in the affected part. These symptoms in infants may impact parents' peace of mind and cause them stress. Further, these symptoms may increase the need for frequent pediatrician visits, which increases parents' guilt, anxiety, and financial burden (5, 23). In Jordan, there is a lack of published information on DD, including its causes, predictors, prevalence, and prevention methods. Therefore, this study aimed to identify the prevalence of DD and its associated medical factors among children aged 24 months or under in Jordan.

Methods

Study Design and Participants

This descriptive cross-sectional study was conducted on a sample of 160 children aged 24 months or under. The children were selected from pediatric outpatient clinics at university affiliated and governmental hospitals, as well as primary health care centers, in Irbid, Jordan. The recruitment period lasted from February 2018 to May 2018. The required sample size of 160

participants was based on a power calculation with a power of 80% and a significance level of 0.05, after assuming a dropout rate of 20% and a poor compliance rate of 15%. The eligibility criteria included being a child diagnosed with DD by a pediatrician and attending clinical pediatric settings. Children with history of co-morbidities, including kidney disorders, malignance, oral or genital thrush, psoriasis, and mineral deficiencies such as zinc deficiency, children on a high protein diet, and children who were on oral antibiotics were excluded from this study.

Data Collection

Prior to the completion of the checklist and the examination of each child, full informed consent was obtained from the child's caregiver. Based on the literature, the researcher developed a structured checklist which included 27 variables that were identified as being medical factors associated with DD. These factors were: the characteristics of the infants (i.e. age, gender, and weight) and the characteristics of the mother or caregiver (i.e. age, parity, educational level, employment status, income, nationality, and type of area of residence), type of feeding, introduction of solid foods, general health status of the child, recent antibiotic use before the episode, type of diaper, number of diaper changes per day, type of wipes, skin cleansing agents used, barrier cream used, frequency of bathing, bowel frequency, and history of DD (i.e. severity level, medication used in the previous episodes, duration of episode, and frequency of DD episodes per month). Diaper dermatitis diagnosis was conducted by trained nurses through physical examinations and using a checklist. Furthermore, the children's privacy was protected by ensuring that all consultations took place in private consultation pediatrician rooms.

Measures

The checklist used for DD diagnosis was a 5-point grading scale which is used to measure the severity level of skin breakdown and diaper dermatitis (Davis et al., 1986). A grade-0 indicates healthy, normal skin, with no rash or erythema; grade-1 indicates slight erythema of the entire diaper area or in patchy, localized areas, with mild irritation or rash; grade-2 indicates definite erythema of the diaper area totally or in localized areas, with erythematous papules and moderate irritation or rash; grade-3 indicates moderate to severe erythema, with or without oozing, in a generalized pattern, with papules, pustules, or superficial ulceration and extreme irritation or rash; grade-4 indicates severe erythema involving the entire diaper area and includes oozing papules, pustules, and erosion (24). In order to test the checklist, a pilot study was conducted among 20 caregivers of children who were included in the main study. In total, one hundred and sixty (160) participants were recruited and (160) checklists were completed by the researcher through structured interviews, leading to an overall response rate of 87.5%.

Statistical Analysis

Descriptive statistics (proportions, percentages, median, interquartile range (IQR), and means) were used to describe the group of measurements. Univariate logistic regression analysis was performed to predict the medical factors associated with DD by calculating the odds ratios (OR) and 95% confidence intervals (CI). Multivariate logistic regression analysis (a backward elimination model) was performed to identify the final significant predictors and medical factors associated with DD, controlling for potential confounders. All analyses were conducted using the SPSS software (SPSS Statistics for Windows, Version 25.0, IBM Corp., Armonk, NY, USA), with the significance level set at 0.05.

Ethical Considerations

Prior to conducting the research study, ethical approval was obtained from Jordan University of Science and Technology (Ref#20170528), the Jordanian Ministry of Health (MOH REC 180026), and the selected hospitals. After explaining the study purpose and procedures, the researchers obtained signed consent forms from the children's caregivers. Data were kept on a secured, password-protected computer, and all identifying data were removed after the completion of the study.

Results

The median age among the participating 140 mothers was 28 years (IQR= 23 to 33 years). The majority of the mothers (95%) were of Jordanian nationality, and 70% were residents of urban areas. Almost two thirds of the mothers (72.9%) lived within nuclear families. Most of the mothers (64.3%) were educated to high school level or above. About one-fifth of the mothers (20%) were primipara mothers, whilst most (83.6%) had previous experience in caring for children with DD. One-fifth of the mothers (22.1%) were employed and earning income. As with regards to total household monthly income, 44.3% had income \leq 300 Jordanian Dinar (JOD), 33.6% had income between 301-500 JOD, and 22.1% had income \geq 501 JOD. As with regards to the main source of information related to the prevention and management of DD, 44.3% of the mothers received information mainly from a family member, 38.6% from health professionals, 7.9% from the media, and 9.3% from previous experience (see Table 1).

One hundred and forty infants and toddlers were included in the study, with equal numbers of females and males. The median age of the children was 14 months (IQR= 6 to 18 months), and the median weight was 10 kilograms (IQR=7.3 to 12 kilograms). Fifty-eight children (41.4%) were

breastfed children at the time of data collection. In total, 138 (98.6%) children were diagnosed with DD, and disposable diapers were used for all of these 138 children. The median of the duration of the most recent DD episode in days was 3 days (IQR= 2 to 4 days), and the median stool frequency was 2 times per day (IQR= 1 to 3 times). For cleaning the diaper area, 51 mothers (36.4 %) used water-soaked wipes with their children, 49 (35%) used alcohol wipes, and 40 (28.6%) had never used any type of wipes. Also, half of the mothers (55%) used soap to clean the diaper area. In addition, most of the mothers (n=113; 80.7%) reported changing their child's diaper < 6 times per day, and 88 (62.9%) mothers reported bathing their child ≤ 1 time per week. Furthermore, about 63 (54%) of the children who were diagnosed with DD were usually exposed to air on a daily basis. Aeration is normally carried out by leaving the child without a diaper for at least 10 minutes. A total of 46 (32.9%) mothers applied cream barriers to prevent the occurrence of DD. Finally, none of the children had diarrhea or were receiving antibiotics at the time of data collection (see Table 1).

The univariate analysis showed that DD was significantly associated with two of the 17 factors considered: the use of barrier creams and bathing frequency of ≤ 1 time per week ($P < 0.05$ for all comparisons; see Table 2). The use of barrier creams (OR=.52, 95% CI = .27-.99, $p=.047$) is a protective factor against the development of DD. The results indicated that children who had barrier creams applied to their diaper area were about .52 times less likely to develop DD than children who did not have barrier creams applied (see Table 2).

Moreover, bathing frequency of ≤ 1 time per week (OR=2.01, 95% CI = 1.07-3.75, $p=.029$) was associated with the increased risk of developing DD. The results indicated that children who are bathed ≤ 1 time per week are about 2.01 times more likely to develop DD than children who are bathed ≥ 1 time per week. However, upon fitting these factors using multiple ordinal logistic

regression and by specifying 'backward conditional' method with removal at correlated $p < 0.05$. The two factors, which were the use of barrier creams and bathing frequency of ≤ 1 time per week, were tested. However, the use of barrier creams (OR=.35, 95% CI = .18-.72, $p=.004$) and bathing frequency of ≤ 1 time per week (OR=1.15, 95% CI = .65-2.10, $p=.002$) remained significantly associated with diaper dermatitis (see Table 2).

Discussion

Diaper dermatitis is a common condition among infants and toddlers. The present study aimed to determine the medical factors that may contribute to or influence the development of DD among infants and toddlers in Jordan. Our study results indicated that the incidence of DD was not statistically associated with nationality, educational status, type of area of residence, type of family, employment status, income, parity, child's sex, child's age, type of feeding, type of wipes, previous experience caring for a child with DD, the use of soap, exposure of the diaper area to air, or diaper changing frequency of fewer than six times per day.

Sukhneewat1 et al. (2019) conducted a study on 1153 Thai children aged between 1–24 months using structural questionnaires to identify the prevalence of DD and its associated risk factors. The children were classified into four age groups (i.e. 1–6, 7–12, 13–18, and 19–24 months), and the results showed the prevalence of DD to be the highest among the 1–6 months age group as compared to the other three age groups ($P<0.001$). Additionally, diaper changing frequency of fewer than three times/night, previous episodes of diaper rash, the use of cloth diapers, and the application of topical talcum powder on the diaper area were found to be the major factors influencing the prevalence of diaper dermatitis (22).

Moreover, in a retrospective chart review study that was conducted on 157 children diagnosed with persistent diaper dermatitis, the results showed that neonates who had been breastfed for less than 6 months were at risk of developing multiple food allergies. The results also indicated that having multiple food allergies increased children's risk of developing DD and of the DD covering the whole perineum (25).

Goldman & Lodhi conducted a retrospective study related to care practices among a sample of over 1800 infants. Data were collected using an online questionnaire which included Likert-type scales and which was distributed through email and social media platforms in the US. The results showed lower rates of diaper dermatitis to be associated with increased frequency of diaper changes and longer diaper-free time (26).

In an index study conducted in Mauritius, Semra et al. found a correlation between educational level of the mother and the prevalence of DD, whereby children of parents who had no formal school education had statistically significantly higher prevalence of diaper dermatitis than children of parents who had received formal school education. Moreover, age, supplementary food intake, and lack of cream use were associated with the incidence of DD, whereas breastfeeding neonates was found to decrease the incidence of DD (27)

The multivariate analysis conducted in the present study identified two potential factors as being independently associated with the incidence of DD: the use of barrier creams and bathing frequency of ≤ 1 time per week. Therefore, children who had barrier creams applied to their diaper area were less likely to develop DD than children who did not have barrier creams applied. These findings are consistent with the findings of Alonso and colleagues, which evidenced petrolatum jelly as being more effective than usual care (not applying anything after cleansing) for the prevention of diaper rash (28). Further, Gozen and colleagues studied the topical application of

human milk and barrier creams which consist of 40% zinc oxide with cod liver oil formulation. The study included 63 term and preterm newborns of both sexes who had developed diaper rash during the hospital admission period. The results indicated that barrier creams were more effective than treatment with human breast milk in the healing process of moderate to severe DD (29).

Additionally, studies have shown that the presence of a protective lipid film covering the diaper area and/or penetrating the intercellular spaces of the stratum corneum helps in keeping the skin moisturized, maintaining normal skin Ph, preventing excessive water loss, and preventing exposure to irritants such as ammonia from urine and active digestive enzymes from feces (30 & 31). Ideally, a barrier preparation contains long-lasting lipids, such as ceramides, cholesterol, and free fatty acids, which are similar to the lasting lipids naturally present in the stratum corneum (32). Therefore, a thick coat of appropriate barrier cream should be applied with each diaper change for infants and toddlers who are at risk of developing diaper dermatitis. Hence, the application of barrier creams is considered a preventive measure and first-line treatment (33, 34). Application of barrier cream should be carried out at least twice weekly for healthy baby skin (35).

The results of the current study have also indicated an association between frequency of bathing and incidence of DD, whereby children who are bathed ≤ 1 time per week were found to be more likely to develop DD compared to children who are bathed ≥ 1 time per week. These findings are consistent with those reported in the study of Atherton, who reported that children should be bathed at least once daily, and twice daily in the case of the presence of a rash, with water and bath oil (17). Numerous randomized control trials (RCTs) in the literature have supported that routine bathing with water alone or with the addition of a cleanser that has a neutral pH does not have an association with physiological changes in skin barrier function, skin scaling, skin erythema, or microbial colonization (36, 37, 38). In a study conducted in Nigeria by Owa and

colleagues, it was reported that children with DD had higher skin pH in the diaper area as compared to children without DD (39). Keeping children clean and maintaining good skin hygiene is essential for maintaining the overall health of children, and regular bathing helps in removing unwanted irritants such as saliva, sweat, urine, feces, fecal enzymes, and transient microbes and dirt (40).

There were several limitations to the present study. First, the use of a cross-sectional design does not allow for testing the causal relationships between the study variables. Second, the use of convenience sampling and the small sample size may mean that the sample is not representative of all children younger than 24 months in Jordan. Third, the study setting included three hospitals (with their affiliated clinics) and Jordanian Ministry of Health (JMOH) health care centers in the same region, thus decreasing the generalizability of the results to different settings in Jordan. Fourth, there may be other unknown factors which may impact the incidence of DD but which were not included in this study due to practicality reasons. Finally, the fact that the study was conducted during winter may have affected the results, as skin pH is likely to vary between seasons.

Conclusion

There is a need to place more focus on developing and implementing strategies aimed at preventing the incidence of DD among children aged 24 months or under. Further, there is a need for prevention-focused programs which encourage the frequent application of appropriate barrier creams and frequent bathing of more than once a week. It is also essential that nurses and midwives are made aware of the pathophysiology and etiological causes of DD and preventive methods based on recent and evidence-based publications. Also, there is a need to raise awareness among parents and the community through educational plans related to the prevention of DD and diaper

hygiene care. Finally, parents and caregivers need to be given access to useful and reliable sources of information which may enhance their awareness of and compliance with DD prevention methods.

Acknowledgments

Thanks to the Jordan University of Science and Technology for funding this study. We want to thank all participating children and their families, and acknowledge to my beautiful shining lovely friends that are part of my soul Esraa' Al-Nsor.

Conflict of Interest

All authors declare no interest

Funding

A grant (Ref# 20180008) was obtained from the Jordan University of Science and Technology.

References

- 1- Hayden GF. Skin Diseases Encountered in Pediatric Clinic. Contact dermatitis. 1985 Jan 1;11:5.
- 2- Ward DB, Fleischer AB, Feldman SR, Krowchuk DP. Characterization of diaper dermatitis in the United States. Archives of pediatrics & adolescent medicine. 2000 Sep 1;154(9):943-6.
- 3- Stamatas, G. N., & Tierney, N. K. (2014). Diaper dermatitis: etiology, manifestations, prevention, and management. *Pediatric dermatology*, 31(1), 1-7.
- 4- Emdadi M, Bazmamoun H. The frequency of diaper dermatitis in 0-2 years old children at nursing homes in Hamadan on 2000-2001. Scientific Journal of Hamadan University of Medical Sciences. 2004 Jan 1;11(1):44-6.
- 5- Adalat S, Wall D, Goodyear H. Diaper Dermatitis-Frequency and Contributory Factors in Hospital Attending Children. *Pediatric dermatology*. 2007 Sep 1;24(5):483-8.
- 6- Wolf R, Wolf D, Tüzün B, Tüzün Y. Diaper dermatitis1. Clinics in Dermatology. 2000 Nov 1;18(6):657-60.
- 7- Önder M, Adışen E, Velagiç Z. Diaper dermatit. Çocuk Sağlığı ve Hastalıkları Dergisi. 2007;50:129-35.treatment with 0.25% miconazole nitrate ointment in neonates and infants with moderate to severe diaper dermatitis complicated by cutaneous candidiasis. *Pediatr Dermatol*. 2013;30(6):717–24. doi: 10.1111/pde.12107. [PubMed: 23675632].
- 8- Shin HT. Diaper dermatitis that does not quit. *Dermatologic Therapy*. 2005 Mar 1;18(2):124-35.
- 9- Al-Faraidy NA, Al-Natour SH. A forgotten complication of diaper dermatitis: Granuloma gluteale infantum. *Journal of Family and Community Medicine*. 2010 May;17(2):107.
- 10- Coondoo A, Chattopadhyay C. Use and abuse of topical corticosteroids in children. *Indian Journal of Paediatric Dermatology*. 2014 Jan 1;15(1):1.
- 11- Coughlin CC, Eichenfield LF, Frieden IJ. Diaper dermatitis: clinical characteristics and differential diagnosis. *Pediatric dermatology*. 2014 Nov 1; 31(s1):19-24.
- 12- Bonifaz A, Tirado-Sánchez A, Graniel MJ, Mena C, Valencia A, Ponce-Olivera RM. The efficacy and safety of sertaconazole cream (2%) in diaper dermatitis candidiasis. *Mycopathologia*. 2013 Apr 1;175(3-4):249-54.
- 13- Gupta AK, Skinner AR. Management of diaper dermatitis. *International Journal of Dermatology*. 2004 Nov 1;43(11):830-4.
- 14- Shin HT. Diagnosis and management of diaper dermatitis. *Pediatr Clin North Am*. 2014 Apr 1; 61(2):367-82.
- 15- Hauser M, Lünemann L, Blume-Peytavi U, Stamatas GN, Kottner J, Garcia Bartels N. Prevention of diaper dermatitis in infants—A literature review. *Pediatric dermatology*. 2014 Jul 1; 31(4):413-29.
- 16- Coughlin CC, Eichenfield LF, Frieden IJ. Diaper dermatitis: clinical characteristics and differential diagnosis. *Pediatric dermatology*. 2014 Nov 1; 31(s1):19-24.
- 17- Atherton DJ. A review of the pathophysiology, prevention and treatment of irritant diaper dermatitis. *Current medical research and opinion*. 2004 May 1;20(5):645-9.

- 18- Pigatto P, Martelli A, Marsili C, Fiocchi A. Contact dermatitis in children. Italian journal of pediatrics. 2010 Dec;36(1):2.Chosidow O, Lebrun-Vignes B, Bourgault-Villada I. Local corticosteroid therapy in dermatology. 28. Paris, France: Presse medicale; 1999.
- 19- Bonifaz A, Tirado-Sánchez A, Graniel MJ, Mena C, Valencia A, Ponce-Olivera RM. The efficacy and safety of sertaconazole cream (2%) in diaper dermatitis candidiasis. Mycopathologia. 2013 Apr 1;175(3-4):249-54.
- 20- Li, C.H., Zhu, Z.H. and Dai, Y.H., 2012. Diaper dermatitis: a survey of risk factors for children aged 1-24 months in China. Journal of International Medical Research, 40(5), pp.1752-1760.
- 21- Kliegman RM, Behrman RE, Jenson HB, Stanton B..Nelson text book of pediatrics. Germany: ElsevierHealthSciences; 2011.
- 22- Sukhneewat, C., Chaiyarit, J., & Techasatian, L. (2019). Diaper dermatitis: a survey of risk factors in Thai children aged under 24 months. *BMC dermatology*, 19(1), 7.
- 23- Rouhi Boroujeni, H., Noorbakhsh, M. K., Mobasheri, M., & Masoudi, R. (2015). magnasium cream tratment in diaper rash inpediatric. *Journal of Clinical Nursing and Midwifery*, 4(3).
- 24- Davis JA, Leyden JJ, Grove GL, Raynor WJ. Comparison of disposable diapers with fluff absorbent and fluff plus absorbent polymers: effects on skin hydration, skin pH, and diaper dermatitis. *Pediatric dermatology*. 1989 Jun 1; 6(2):102-8.
- 25- Celiksoy, M. H., Topal, E., Hazıroglu Okmen, Z., Alataş, C., & Demirtaş, M. S. (2019). Characteristics of persistent diaper dermatitis in children with food allergy. *Pediatric dermatology*, 36(5), 602-606.
- 26- Goldman, M., & Lodhi, I. (2016). A real-world evidence study evaluating a treatment for nappy rash. *British Journal of Nursing*, 25(8), 432-439.
- 27- Kayaoglu, S., Kivanc-Altunay, I., & Sarikaya, S. (2015). Diaper dermatitis in infants admitted to social pediatrics health center: role of socio-demographic factors and infant care. *The Indian Journal of Pediatrics*, 82(10), 904-908.
- 28- Alonso C, Larburu I, Bon E, González MM, Iglesias MT, Urreta I, Emparanza JI. Efficacy of petrolatum jelly for the prevention of diaper rash: a randomized clinical trial. *Journal for Specialists in Pediatric Nursing*. 2013 Apr 1; 18(2):123-32.
- 29- Gozen D, Caglar S, Bayraktar S, Atici F. Diaper dermatitis care of newborns human breast milk or barrier cream. *Journal of clinical nursing*. 2014 Feb 1; 23(3-4):515-23.
- 30- Stamatas GN, Tierney NK. Diaper dermatitis: etiology, manifestations, prevention, and management. *Pediatric dermatology*. 2014 Jan 1; 31(1):1-7.
- 31- Fernandes JD, Machado MC, Oliveira ZN. Clinical presentation and treatment of diaper dermatitis: part II. *Anais brasileiros de dermatologia*. 2009 Feb; 84(1):47-54.
- 32- Darmstadt GL, Dinulos JG. Neonatal skin care. *Pediatric Clinics*. 2000 Aug 1; 47(4):757-82.
- 33- Taquino LT. Promoting wound healing in the neonatal setting: process versus protocol. *The Journal of perinatal & neonatal nursing*. 2000 Jun 1; 14(1):104-18.
- 34- Noonan C, Quigley S, Curley MA. Skin integrity in hospitalized infants and children: a prevalence survey. *Journal of pediatric nursing*. 2006 Dec 1; 21(6):445-53.

- 35- Blume-Peytavi U, Lavender T, Jenerowicz D, Ryumina I, Stalder JF, Torrelo A, Cork MJ. Recommendations from a European roundtable meeting on best practice healthy infant skin care. *Pediatric dermatology*. 2016 May 1; 33(3):311-21.
- 36- Dizon MV, Galzote C, Estanislao R, Mathew N, Sarkar R. Tolerance of baby cleansers in infants: a randomized controlled trial. *Indian pediatrics*. 2010 Nov 1; 47(11):959-63.
- 37- Garcia Bartels N, Scheufele R, Prosch F, Schink T, Proquitté H, Wauer RR, Blume-Peytavi U. Effect of standardized skin care regimens on neonatal skin barrier function in different body areas. *Pediatric dermatology*. 2010 Jan 1; 27(1):1-8.
- 38- Lavender T, Bedwell C, O'Brien E, Cork MJ, Turner M, Hart A. Infant skin-cleansing product versus water: A pilot randomized, assessor-blinded controlled trial. *BMC pediatrics*. 2011 Dec; 11(1):35.
- 39- Owa A, Oladokun R, Osinusi K. Skin pH and Transepidermal Water Loss Values in Children with Diaper Dermatitis in Ibadan, Nigeria. *Pediatric dermatology*. 2017 May 1; 34(3):303-7.
- 40- Telofski LS, Morello AP, Mack Correa MC, Stamatas GN. The infant skin barrier: can we preserve, protect, and enhance the barrier?. *Dermatology research and practice*. 2012; 2012.

Table 1: Demographic characteristics of the study child-mother pairs by study groups on baseline day

Characteristics	Total (N=140) %
Socio-demographics of the mother-child pairs	
Mothers	
Median age in years (IQR)	28 (23,33)
Nationality (Jordanian) (n) %	(133) 95%
Type of area of residence (urban) (n) %	(98) 70%
Type of family (nuclear) (n) %	(102) 72.9%
Educational status (high school or higher) (n) %	(90) 64.3%
Employment (yes) (n) %	(31) 22.1%
Income (in Jordanian Dinar) (n) %	
≤ 300	(62) 44.3%
301-500	(47) 33.6%
≥ 501	(31) 22.1%
Parity (primiparous) (n) %	(28) 20%
Child	
Sex (male) (n) %	(70) 50%
Age in months (median) (IQR)	14 (6,18)
Weight in kilograms (median) (IQR)	10 (7.3,12)
Factors associated with the incidence of DD	
Breastfeeding (yes) (n) %	(58) 41.4%
Type of diaper (disposable diapers) (n) %	(138) 98.6%
Type of wipes (n) %	
Wet wipes	(51) 36.4%
Alcohol wipes	(49) 35%
Never used	(40) 28.6%

Characteristics	Total (N=140) %
Previous experience (yes) (n) %	(117) 83.6%
Frequency of diaper changes (n) %	
< 6 times per day	(113) 80.7%
≥6 times per day	(27) 19.4%
Barrier cream (yes) (n) %	(46) 32.9%
Soap (multiple times per day) (n) %	(77) 55%
Exposure to air (yes) (n) %	(63) 45%
**Stool frequency in times per day (median) (IQR)	2 (1,3)
Bathing frequency (n) %	
≤ 1 time per week	(88) 62.9%
> 1 time per week	(52) 37.1%
Duration of the current DD episode in days (median in days) (IQR)	3 (2,4)
Source of information (n) %	
Family member	(62) 44.3%
Health professional	38.6 (54)
Media	(11) 7.9%
Others	(13) 9.3%

Table 2: Summary of the factors that were identified through the univariate and multivariate logistic regression analyses as being significantly associated with diaper dermatitis

Characteristics	Univariate			Multivariate		
	OR	95% CI	p-value	OR	95% CI	p-value
Socio-demographics of the mother-child pairs						
Mother						
Age (years)	1.01	.97-1.07	.58			
Nationality (Jordanian)	1.09	.28-4.29	.90			
Educational level (high school or higher)	.60	.32-1.12	.11			
Type of area of residence (urban)	.72	.38-1.39	.33			
Type of family (nuclear)	.68	.32-1.43	.31			
Employment status (employed)	1.01	.49-2.07	.98			
Income (in Jordanian Dinar)						
≤ 300	1.12	.51-2.43	.78			
301-500	.75	.33-1.69	.49			
≥ 501						
Parity (primiparous)	.63	.30-1.34	.23			
Child						
Sex (male)	1.18	.65-2.15	.58			
Age						
≤ one-year age						
Factors associated with the incidence of DD						
Breastfeeding (yes)	1.62	.88-2.98	.12			
Type of wipes						
Wet wipes	.60	.28-1.27	.18			
Alcohol wipes	1.08	.51-2.28	.85			
Never used						
Previous experience (yes)	.78	.35-1.75	.55			

Characteristics	Univariate			Multivariate		
	OR	95% CI	p-value	OR	95% CI	p-value
Frequency of diaper changes						
< 6 times per day	.81	.38-1.73	.59			
Barrier cream (yes)	.52	.27-.99	.047	.35	.18-.72	.004
Soap (multiple times per day)	1.24	.68-2.25	.49			
Exposure to air (yes)	1.01	.56-1.85	.97			
Bathing frequency						
≤ 1 time per week	2.01	1.07-3.75	.029	1.15	.18-.69	.002

Dependent variable: diaper dermatitis score on the assessment day. OR: odds ratio; CI: confidence interval.