

Analysis of Risk Factors for Infant Diaper Dermatitis

Fadilah Oliv Khairina^{1*}, Nelva Karmila Jusuf²

¹Faculty of Medicine, Universitas Sumatera Utara, Dr. Mansyur st. 5, Medan, Indonesia,

²Department of Dermatology and Venereology, Universitas Sumatera Utara, Medan, Indonesia

Abstract. Infants have skin that is easy to get irritated and infected by microorganisms. The use of diapers in infants often causes diaper dermatitis and disturbs the comfort. The diaper dermatitis incidence is quite high in infants aged 0-24 months. This study purposes to determine the factors that influence the infant diaper dermatitis and assess the relationship between these factors and the diaper dermatitis. The study design is an analytical observational with a cross sectional study design. Data retrieval using interview method on respondents use a structured questionnaire to obtain risk factors which are associated with the diaper dermatitis incidence. Bivariate analysis was used to examine the relationship between the diaper dermatitis incidence and contributing factors. The study result is 27 infants (36%) of 75 infants had diaper dermatitis. It was obtained p value ≤ 0.05 for solid food (fishes, $p = 0,018$) and diarrhea ($p = 0,021$). The value of $p > 0.05$ for the variables of age, sex, maternal education level, neighborhood, solid foods (cereals, eggs and fruits), frequency of diaper changes, frequency of bathing, and the use of protective skin cream. The conclusion is there is a correlation between diaper dermatitis and the solid food (fishes) and diarrhea.

Keyword: Diaper Dermatitis, Infant, Risk Factors.

Received date month year. | Revised date month year | Accepted date month year

1 Introduction

Based on data released by the World Health Organization (WHO) in 2009, the prevalence of skin irritation in infants is quite high, ie 25% of all babies born in the world suffer from skin irritation caused by diaper use [1].

Skin areas covered by diapers are often warm, moist and often contaminated by impurities loaded with microorganisms, which causes diaper dermatitis to be one of the most common skin disorders in infants and early childhood [2]. Diaper dermatitis appears with erythema and often with papulovesicular or bullous lesions, fissures, and patchy or confluent patterns of erosion. Chronic hypertrophy, flat papules and infiltrative nodules can be found [3]. This disease is characterized by inflammation of acute skin eruptions in the baby's diaper area [4].

*Corresponding author at: Faculty of Medicine, Universitas Sumatera Utara, Dr. Mansyur st. 5, Medan, Indonesia

E-mail address: fadilaholiv@gmail.com

The National Survey of Medicine has determined the incidence of dermatitis in the world, accounting for 97 visits to doctors per year per 1000 children in the age group 0 - 2 years. Infant whose mother's last education was elementary school 4.2 times more at risk with the incidence of diaper dermatitis compared to the mother who was last educated in high school [5].

Diaper dermatitis often occurs due to the response of parents' actions in infant caring so that some infants tend to be at risk of suffering diaper dermatitis and the management of the tendencies tends to be difficult. The effects of excessive skin hydration and prolongation of contact with feces and urine can be avoided by frequent diaper replacements and periods of "resting" infants free from diaper use [3]. Therefore, researchers chose to conduct a study on infants to analyze the risk factors for the incidence of diaper dermatitis in infants of suspected factors and see the correlation between these risk factors and diaper dermatitis in infants.

2 Method

The type of research used is analytical research with cross sectional design. The sampling technique in this study used consecutive sampling. The samples in the study were all infant patients who came to the University of North Sumatra Hospital, Badrul Aini Mother and Child Hospital, Medan Selatan Health Center, and Sukaramai Health Center in September - October 2018 that met the inclusion and exclusion criteria. The inclusion criteria, namely infants aged 0-24 months, were willing to sign an informed consent sheet with a complete questionnaire. The selection criteria specifically excluded infants that had at least one of the following: (i) low birth weight (<2500 g); (ii) <37 weeks gestation; (iii) congenital malformations; (iv) long-term medication use. The ethical clearance approval number is 50/TGL/KEPK FK USU-RSUP HAM/2018.

3 Results and Discussion

From the 75 samples, the distribution of respondents was based on age, sex, maternal education level, home setting, exclusive breastfeeding, type of solid food consumed, type of nappy worn, frequency of nappy changing, frequency of bathing, barrier cream use, and diarrhea that we can see in Table 1.

Table 1. Frequency distribution of subject characteristics.

Variable	Frequency (n)	Percentage (%)
Age		
0-12 months	64	85,3
13-24 months	11	14,7
Gender		
Male	39	52
Female	36	48
Maternal education level		
Primary	1	1,3
Junior high school	6	8

Senior high school	40	53,3
Bachelor	28	37,3
Home setting		
Urban	59	78,7
Rural	16	21,3
Exclusive breastfeeding		
Yes	42	56
No	33	44
Solid food		
Cereal		
Yes	39	52
No	36	48
Egg		
Yes	23	30,7
No	52	69,3
Fish		
Yes	27	36
No	48	64
Fruits		
Yes	30	40
No	45	60
Type of nappy worn		
Disposable only	46	61,3
Cloth only	29	38,7
Frequency of nappy changing		
<6 times/day	35	46,7
≥6 times/day	40	53,3
Frequency of bathing		
<2 times/day	19	25,3
≥2 times/day	56	74,7
Barrier cream use		
Yes	21	28
No	54	72
Diarrhea		
Yes	19	25,3
No	56	74,7
Diaper dermatitis		
Yes	27	36
No	48	54
Total	75	100

Bivariate analysis was performed to see the correlation between the characteristics of infants and the incidence of diaper dermatitis using the chi square statistical test that we can see in Table 2 and Table 3.

Table 2. Frequency distribution of subject's characteristics with the incidence of diaper dermatitis.

Variable	Diaper Dermatitis			
	Yes		No	
	n	%	n	%
Age				
0-12 months	25	33,3%	39	52%
13-24 months	2	2,7%	9	12%
Gender				

Male	16	21,3%	23	30,7%
Female	11	14,7%	25	33,3%
Maternal education level				
Low (<Senior high school)	4	5,3%	3	4%
High (\geq Senior high school)	23	30,7%	45	60%
Home setting				
Rural	9	12%	7	9,3%
Urban	18	24%	41	54,7%
Exclusive breastfeeding				
No	13	17,3%	20	26,7%
Yes	14	18,7%	28	37,3%
Solid food				
Cereal				
Yes	11	14,7%	28	37,3%
No	16	21,3%	20	26,7%
Egg				
Yes	5	6,7%	18	24%
No	22	29,3%	30	40%
Fish				
Yes	5	6,7%	22	29,3%
No	22	29,3%	26	34,7%
Fruits				
Yes	7	9,3%	23	30,7%
No	20	26,7%	25	33,3%
Type of nappy worn				
Disposable only	18	24%	28	37,3%
Cloth only	9	12%	20	26,7%
Frequency of nappy changing				
<6 times/day	15	20%	20	26,7%
\geq 6 times/day	12	16%	28	37,3%
Frequency of bathing				
<2 times/day	10	13,3%	9	12%
\geq 2 times/day	17	22,7%	39	52%
Barrier cream use				
Yes	5	6,7%	16	21,3%
No	22	29,3%	32	42,7%
Diarrhea				
Yes	11	14,7%	8	10,7%
No	16	21,3%	40	53,3%

Table 3. The prevalence ratio of diaper dermatitis risk factors.

Variable	PR
Age	
0-12 months	2,148
13-24 months	
Gender	
Male	1,343
Female	
Maternal education level	
Low (<Senior high school)	1,689
High (\geq Senior high school)	
Home setting	
Rural	1,845
Urban	
Exclusive breastfeeding	
No	1,182

Yes	
Solid food	
Cereal	
Yes	0,635
No	
Egg	
Yes	0,514
No	
Fish	
Yes	0,404
No	
Fruits	
Yes	0,525
No	
Type of nappy worn	
Disposable only	1,261
Cloth only	
Frequency of nappy changing	
<6 times/day	1,429
≥6 times/day	
Frequency of bathing	
<2 times/day	1,734
≥2 times/day	
Barrier cream use	
Yes	1,286
No	
Diarrhea	
Yes	2,026
No	

According to Table 3, the prevalence ratio analysis showed that the probability of infant age between the groups was significantly higher in the infant's aged 0 – 12 months compared to the age 13 – 24 months (PR = 2,148). The probability of diaper dermatitis in male infant group is higher compared to the female (PR = 1,343). Maternal educational level is taken apart to incidence of diaper dermatitis too, the probability of mother's educational level which had not taken part to senior high school risks 1,689 times compared to the mother with higher educational level.

In the present study, the probability of living environment between the groups was higher in the family lives in rural than in urban dwellings (PR = 1.845). Infant who was not getting exclusive breastfeeding has greater probability compared to the infant that getting exclusive breastfeeding (PR = 1,182). The prevalence ratio of consumption of cereals, eggs, fish and fruits to diaper dermatitis was respectively 0.635, 0.514, 0.404, 0.525 (PR <1) so consumption of cereals, eggs, fish and fruits for diaper dermatitis was a protective factor against diaper dermatitis in infants.

In the present study, infant with disposable diapers has higher probability of incidence of diaper dermatitis, compare to infant with cloth disposable (PR = 1,261). The probability of frequency of nappy changing between groups was significantly higher in infant whose nappy changing less than 6 times a day compared to the infant whose nappy changing more than 6 times a day (PR = 1,429) It is suspected that older infants change diapers less than younger infants [11]. Infants who

take a bath less than 2 times a day also have greater probability in incidence of diaper dermatitis than infants who often take a bath in a day (PR = 1,734)

In the present study, the probability of barrier cream used between groups has higher probability in infants who were used barrier cream compared to infants who were not (PR = 1,286). Infants with diarrhea have significantly higher probability than infants without diarrhea (PR = 2,026). When an infant experiences diarrhea, the stool produced will be more fluid so that it will lead to faster transit times in the intestine and increase the amount of gastric enzymes in the stool, which will irritate the infant's skin [7].

The proportion of diaper dermatitis in this study was greater among infants aged 0-12 months, the male was found to be higher compared to female. The present study showed that most infants with diaper dermatitis wore a disposable diaper, had a diaper changed <6 times a day, and did not use any diaper cream. The same results were obtained as study by Cana et al. [13].

Table 4. The correlation between subject's characteristics with the incidence of diaper dermatitis

Variable	<i>p</i>
Age	0,321
0-12 months	
13-24 months	
Gender	0,345
Male	
Female	
Maternal education level	0,244
Low (<Senior high school)	
High (≥Senior high school)	
Home setting	0,057
Rural	
Urban	
Exclusive breastfeeding	0,587
No	
Yes	
Solid food	
Cereal	0,143
Yes	
No	
Egg	0,087
Yes	
No	
Fish	0,018*
Yes	
No	
Fruits	0,062
Yes	
No	
Type of nappy worn	0,477
Disposable only	
Cloth only	
Frequency of nappy changing	0,247
<6 times/day	
≥6 times/day	

Frequency of bathing	0,080
<2 times/day	
≥2 times/day	
Barrier cream use	0,170
Yes	
No	
Diarrhea	0,021*
Yes	
No	

The correlation between subject's characteristics with the incidence of diaper dermatitis can be shown in the Table 4. Based on the statistical test the value of $p = 0.321$ was obtained so that it was concluded that the age group was not correlated to the incidence of diaper dermatitis. The results obtained are the same as the research conducted by Bartels et al. in [6] which the age of the infant is not correlated to diaper dermatitis ($p \text{ value} > 0.05$).

A study conducted in America by Ward et al. in [8] that the prevalence of diaper dermatitis in infants has no difference in gender or race. Based on the statistical test in this current study, the value of $p = 0.345$ was obtained so that it was concluded that gender was not correlated to the incidence of diaper dermatitis. Thus, in the maternal education level variable, the value of $p = 0.244$ was obtained so that it was concluded that the maternal education level was not correlated to the incidence of diaper dermatitis. The same results were obtained as research in China by Li et al. in [7]. Many other factors that can influence the occurrence of diaper dermatitis are thought to influence the level of maternal education is not significant.

There is no correlation between infant's living environment with the incidence of diaper dermatitis based on the statistical test the value of $p = 0.057$ was obtained. This result is contrary to the research conducted by Li et al. in [7] where the living environment is associated with diaper dermatitis ($p \text{ value} < 0.05$).

The p values for the exclusive breastfeeding in infants was 0.587, so that it was concluded that exclusive breastfeeding was not correlated to the incidence of diaper dermatitis. The same results were obtained by Li et al. in [7] where the exclusive breastfeeding is not associated with diaper dermatitis ($p \text{ value} > 0.05$).

Based on statistical tests, the p values for consumption of cereals, eggs, fish and fruits are respectively 0.143, 0.087, 0.018 and 0.062 so that the consumption of cereals, eggs, and fruits is not related to the incidence of diaper dermatitis. The consumption of fish is associated with the incidence of diaper dermatitis. This result is contrary to the research conducted by Li et al. in [7] where the solid food in the form of cereals, fish and eggs that the infant has consumed is correlated with diaper dermatitis ($p \text{ value} < 0.05$). It is said that solid food can cause diaper dermatitis because the composition of faeces, pH and digestive enzyme activity will change

during the introduction of new foods. In children with multiple food allergies, the course of diaper dermatitis was more severe, and the condition did not respond to topical treatment [9].

The p value of the type of nappy worn was 0.477, so that it was concluded that the type of nappy worn was not correlated to the incidence of diaper dermatitis. According to the literature, cloth diapers and disposable diapers have the same tendency for diaper dermatitis [10]. Thus, the p value of the frequency of nappy changing was 0.247, so that it was concluded that the frequency of nappy changing was not correlated to the incidence of diaper dermatitis. This result is contrary to the research conducted by Li et al. in [7], where the frequency of nappy changing is correlated with diaper dermatitis (p value <0.05). It is suspected that there is a relationship between the frequency of nappy changing and the age of the infant; older infants change diapers less than younger infants [11]. From the research conducted, there is a possibility that the sample experiencing diarrhea causes an increase in the frequency of infant diaper changes, so that it can affect the occurrence of diaper dermatitis as an effect. Urine can also increase the pH of the diaper environment by breaking up urea when there is urease in the stool [12].

Based on the statistical test, the p value of the frequency of bathing was 0.080 so that it was concluded that the frequency of bathing was not correlated to the incidence of diaper dermatitis. This result is contrary to the research conducted by Li et al. in [7], where the frequency of infant bathing is a correlation with diaper dermatitis (p value <0.05). However, the p value of barrier cream used was 0.170, so that the use of barrier cream is not related to the incidence of dermatitis diaper. The same results were obtained by Li et al. in [7], where the barrier cream used is not associated with diaper dermatitis (p value > 0.05).

In diarrhea, the infant's skin can get irritated because of the increasing of the amount of gastric enzymes in the stool and the stool produced that will be more fluid, so that it will lead to faster transit times in the intestine. Based on the statistical test the value of $p = 0.021$ was obtained so that it was concluded that diarrhea was associated with the incidence of diaper dermatitis. This result is similar to a study in China where there is a relationship between diarrhea and diaper dermatitis (p value <0.05)[7].

4 Conclusion and Suggestion

There is a correlation between the types of solid foods that have been consumed (fish) and diarrhea with the occurrence of diaper dermatitis in infants. But, there is no correlation between infant's age, gender, mother's education level, living environment, exclusive breastfeeding, type of solid food consumed (cereals, eggs and fruits), type of nappy worn, frequency of diaper changes, frequency of bathing, and the use of protective creams with the occurrence of diaper dermatitis in infants.

Hopefully, the mothers who have infants, are more active in perianal care to prevent the occurrence of diaper dermatitis in infants; health workers are expected to increase the provision of education and knowledge regarding the incidence of diaper dermatitis in infants to mothers who visit health services; this study can be continued by looking at the effect of factors that are considered to be at risk for diaper dermatitis in infants simultaneously.

REFERENCES

- [1] H. L Ramba, "Skin irritation (diaper rash) in infants aged 0-12 months," *Journal of Pediatric Nursing STIKES Nani Hasanuddin Makassar*, vol. 1, no. 2, pp.87-92. 2014.
- [2] B. J. Zitelli, S. C. McIntire, A. J. Nowalk, *Zitelli and Davis' Atlas of Pediatric Physical Diagnosis*. Elsevier Health Sciences. 2018.
- [3] B. Z. Dickey, Y. E. Chiu, *Eczematous disorders' in Nelson Textbook of Pediatrics*, 20th edn, Elsevier, Philadelphia. 2016.
- [4] B. Seifi, Jalali, S., Heidari, M., "Assessment effect of breast milk on diaper dermatitis," *Dermatology reports*, 9(1). 2017.
- [5] A. Wanjiku, "Socio-Demographic and Economic Determinants of Diaper Dermatitis among Children Aged 0-24 Months at Mbaghati District Hospital, Kenya: A Cross Sectional Study." *International Journal of Health Sciences and Research (IJHSR)*, vol. 6 no. 5, pp.239-247. 2016.
- [6] N. G. Bartels, L. Lünemann, A. Stroux, J. Kottner, J. Serrano, & U. P. Blume-, "Effect of diaper cream and wet wipes on skin barrier properties in infants: a prospective randomized controlled trial," *Pediatric dermatology*, vol. 31, no. 6, pp.683-691. 2014.
- [7] C. H. Li, Z. H. Zhu, Y. H. Dai, "Diaper dermatitis: a survey of risk factors for children aged 1-24 months in China," *Journal of International Medical Research*, vol. 40, no. 5, pp.1752-1760. 2012.
- [8] D. B. Ward, A. B. Fleischer, F. Jr., R. Steven, Krowchuk and P. Daniel, "Characterization of diaper dermatitis in the United States," *Archives of Pediatric Adolescent Medicine*, vol. 154, no. 9, pp. 943-946. 2000.
- [9] M. H. Celiksoy, E. Topal, O. Z. Hazıroglu, C. Alataş and M. S. Demirtas, "Characteristics of persistent diaper dermatitis in children with food allergy," *Pediatric dermatology*, vol. 36, no. 5, pp.602-606. 2019.
- [10] W. D. James, T. G. Berger, D. M. Elston, *Andrews' Diseases of the Skin 12th Ed*. Elsevier Health Sciences. 2016.
- [11] D. Yaduwanshi and C. Kumari, "Frequency and prevalence of nappy rash in indian infant's population". *IJPE*, vol. 1, no. 4, pp.25-32. 2012.
- [12] H. T. Shin, "Diagnosis and management of diaper dermatitis," *Pediatr Clin North Am*, vol. 61, no. 2, pp.367-82. 2014.
- [13] R. S. Cana, N. K. Jusuf, I. B. Putra, T. Widyawati, and N. K. Arrasyid," The profile of diaper dermatitis in infants," *Proceedings of the 2nd International Conference on Tropical Medicine and Infectious Disease - ICTROMI*, pp.44-51. 2020.