

THE ROLE OF FEEDING IN THE ETIOLOGY OF NEONATAL DIAPER DERMATITIS

Vedat Sezer, M.D.*

Neonatal diaper dermatitis (perianal dermatitis) is commonly seen during the first week of life. It is localized in the anal and gluteal areas, probably because these areas are in most direct and persistent contact with the feces. The lesions are characterized by erythema, papules, and sometimes by exudation. Ulceration may occur, but does so only rarely.

Although the condition is fairly common, its etiology is still unknown. There is, furthermore, a wide variation in the reported incidence of the condition, ranging from 6.7 per cent to 35 per cent.¹⁻⁷

This article is a report of the results of a study of neonatal diaper dermatitis and a discussion of the possible rôle of feeding in its etiology.

Material and Method

Nine hundred full term newborns were studied at the Ankara Maternity Hospital during the first four days of life in regard to the incidence and development of neonatal diaper dermatitis. All of the babies were breast-fed, all wore the same kind of diaper and were kept in the prone position. None was bathed during the four day period. Each baby was examined by the author on each of the four mornings.

Samples of fecal matter were collected once a day for the entire four day period, and urine samples were collected on the third and fourth days, from 40 of the 900 infants. The samples were frozen until all had been collected, and the pH of each sample was determined. Thirty of the fecal samples were tested by two different methods: nitrazine paper to determine the approximate pH, then

From Ankara University Hacettepe Medical Center and Ankara Maternity Hospital.

* Pediatric dermatologist.

the pHydrion control paper method to find the exact pH. Another investigator used the Beckman expanded scale zeromatic pH meter. There was no statistically significant difference between the results obtained by the two methods, and we therefore used only the pHydrion control paper method in all subsequent tests (Figure 1).

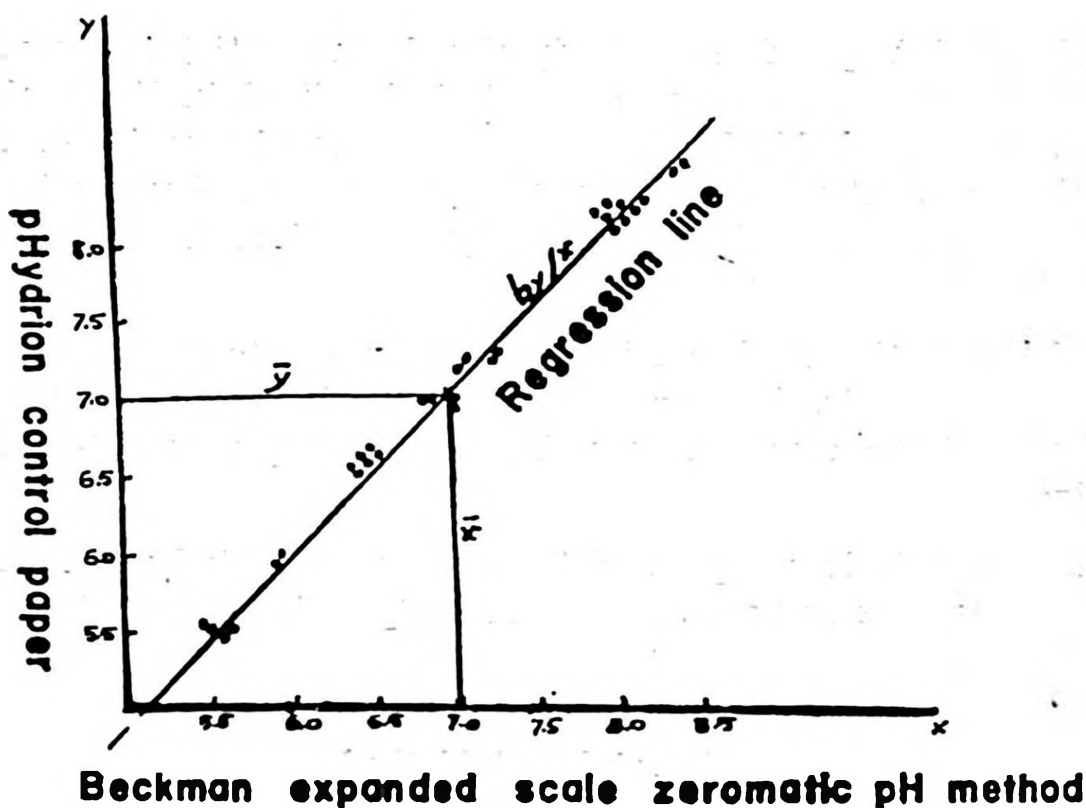


Figure 1. pH determinations by the Beckman expanded scale zeromatic method and the pHydrion control paper method.

Correlation coefficient : $r(xy) = + 0.99 \pm 0.27$

Regression coefficient : $by/x = + 1.02$

Regression balance : $y = 1.02 x - 0.2$

Results

Among the 900 newborns, we saw no neonatal diaper dermatitis on the first day of life. On the second day, the condition was seen in 1.8 per cent of the infants; on the third day the percentage increased to 2.5 per cent, and on the fourth day it was 2.0 per cent (Table 1).

The results of the pH determinations of stool and urine of the group of 40 newborns are given in Table 2. On the first day, the stool pH varied between 5.0 and 6.3. On the second day, the

TABLE I
INCIDENCE OF NEONATAL DIAPER DERMATITIS AMONG 900
NEWBORNS AT ANKARA MATERNITY HOSPITAL DURING THE
FIRST FOUR DAYS OF LIFE

D A Y S							
1		2		3		4	
No. of cases	Per cent	No. of cases	Per cent	No. of cases	Per cent	No. of cases	Per cent
0	0	16	1.8	23	2.5	18	2

values were between 4.5 and 6.6; on the third day, between 4.0 and 6.3; on the fourth day, between 4.0 and 6.0. Most of the samples had a pH of 5.9 (Figure 2). Urine samples taken from this same group on the third and fourth days had pH values ranging from 4.7 to 6.5.

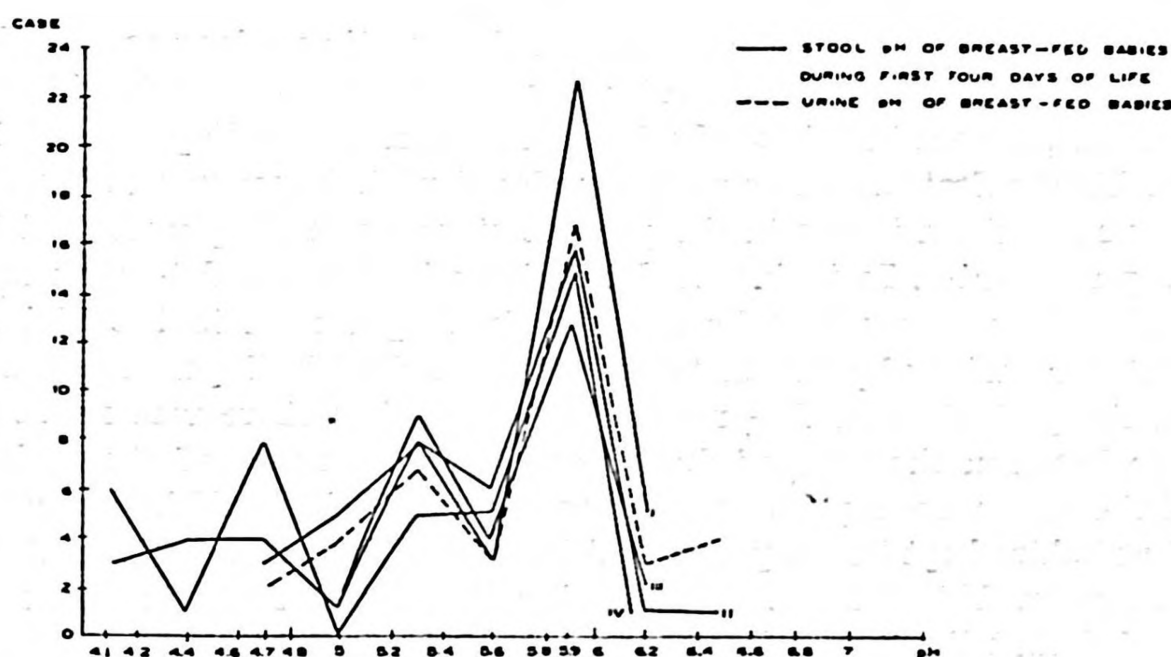


Figure 2. Graph showing stool and urine pH values of breast-fed infants during the first four days of life.

Discussion

Parrott, in 1877, wrote the first detailed description of neonatal diaper dermatitis. Subsequently, several investigators suggested several different possible causes of the condition: Jacquet,⁸ mechanical irritation; Marfan,⁹ yeast; Burgoon,¹⁰ predisposing and activating factors; Zahorsky,¹¹ ammonia; Robinson,¹² *Candida albicans*; Rapp,¹³ ammonia and skin toxins caused by the decatabolism of amino acids; Kaessler,¹⁴ and Benson,¹⁵ sensitive skin and feeding.

Pratt and Read³ maintained that the condition was directly related to feeding : those babies who are breast-fed have much less diaper dermatitis than those fed on formula milk.

Sezer and Keitel¹⁰ have shown that neither ammonia nor the decatabolism of amino acids by skin toxins is a cause of neonatal diaper dermatitis. In a study made by Keitel et al,³ half of a group of newborns was kept in the supine position for the first four days of life, while the other half was kept in the prone position. In the first group, the incidence of diaper rash was 9.4 per cent on the third day and 28.1 per cent on the fourth day. In the prone group, the incidence was 0.8 per cent on the third day, and 10.3 per cent on the fourth day. The investigators concluded that the more persistent contact between feces and the skin of the gluteal area in the supine group was the cause of the higher incidence of diaper rash in that group, and that contact with fecal matter was the probable cause of diaper dermatitis.

The incidence of neonatal diaper dermatitis varies greatly (25 to 35 per cent has been reported in studies made in the United States and 2.5 per cent in this study done in Ankara). The diapers used in the United States studies were laundered with detergents and antiseptic solutions. Those in the present study were simply washed in soap and water. In trying to determine whether the detergent and antiseptic agents might be a factor in diaper rash in the United States, a series of patch tests was performed with diaper fragments on the gluteal area. The results indicated that there was no relation between the type of diaper and the occurrence of the rash.¹⁰ If the rash were a primary contact dermatitis, it would be expected that babies kept in the prone position would develop a rash on their stomachs. This did not occur during the study. Thus, it was concluded that the diaper itself was not the cause of the rash.

As for the differences in feeding, babies in this study were all breast-fed, while those in the United States studies were mostly formula-fed. We know that breast-fed babies have acid feces and formula-fed babies have alkaline feces. All the babies in this present study had strongly acid feces (Table 2). Diaper rash occurs only in an alkaline medium,³ and it would thus be expected that breast-fed babies will be more or less immune to the condition.

Our conclusion is that feeding, which directly effects the pH of the feces, is an important etiological factor in neonatal diaper dermatitis.

TABLE 2
RESULTS OF STOOL AND URINE pH STUDIES OF 40 BREAST-FED
NEWBORNS DURING THE FIRST FOUR DAYS OF LIFE

Case number	Stool pH				Urine pH 3rd and 4th days
	Day 1	Day 2	Day 3	Day 4	
1	5.9	5.3	4.2	4.0	5.8
2	5.3	5.8	5.3	4.6	6.0
3	6.2	5.9	5.8	4.0	5.5
4	5.9	5.3	5.3	4.5	6.0
5	6.3	5.9	5.9	6.0	5.3
6	6.3	6.2	6.0	5.3	6.0
7	5.3	5.6	5.5	5.8	5.3
8	5.9	5.8	5.3	5.6	5.0
9	5.3	5.8	5.8	5.9	5.8
10	5.9	5.0	4.5	6.0	6.4
11	5.3	5.9	5.8	4.8	6.0
12	5.0	5.6	5.6	5.8	6.0
13	5.9	5.0	4.8	5.9	6.4
14	5.3	5.0	5.3	5.8	5.8
15	5.9	4.5	4.2	4.8	6.0
16	5.9	5.6	5.3	5.9	5.8
17	6.0	5.6	5.8	5.9	4.8
18	5.9	4.8	4.5	4.8	5.3
19	5.9	5.3	4.8	5.3	4.7
20	6.0	5.3	5.8	4.6	4.7
21	5.9	5.8	5.5	6.0	5.0
22	5.9	5.8	5.3	4.0	5.5
23	5.3	5.8	5.3	5.5	5.8
24	5.9	6.6	6.3	4.2	6.0
25	6.0	5.8	5.6	6.0	6.2
26	5.8	5.3	4.5	4.0	5.3
27	5.8	5.3	4.8	5.5	5.0
28	5.6	5.9	4.8	4.2	5.3
29	5.3	5.9	6.3	4.8	5.8
30	5.6	6.0	5.9	5.3	6.0
31	5.6	5.0	4.5	4.6	6.2
32	6.2	5.8	5.3	6.0	6.4
33	6.0	5.0	4.8	5.8	6.3
34	5.9	5.3	5.9	5.6	6.5
35	5.3	4.8	4.0	4.8	5.3
36	5.8	5.5	5.0	5.6	5.8
37	6.0	5.3	5.9	5.3	5.0
38	6.3	5.8	6.0	6.0	5.5
39	5.8	5.9	5.3	5.3	5.3
40	6.0	5.6	5.8	5.9	5.8
Average	5.78	5.53	5.3	5.24	5.69

Summary

Nine hundred babies born at Ankara Maternity Hospital were studied for neonatal diaper dermatitis during the first four days of life. None was seen on the first day, but on the second day the incidence was 1.8 per cent, on the third day, 2.5 per cent, and on the fourth day, 2.0 per cent. All the babies were breast-fed, and stool and urine pH values of 40 babies, tested over the four day period, were consistently acid. The author concludes that feeding is an important etiological factor in neonatal diaper dermatitis because of its effect on feces pH.

REFERENCES

1. Saraçlı, T., Kenney, J. A. Jr. and Scott, R. B.: Common skin disorders in the newborn Negro infant. Observations based on the examination of 1,000 babies, *J. Pediat.* 62: 359, 1963.
2. Tanino, J., Steiner, M. and Benjamin, B.: The relationship of perianal dermatitis to fecal pH, *J. Pediat.* 54: 793, 1959.
3. Pratt, A. G. and Read, W. T. Jr.: Influence of type of feeding on pH of stool, pH of skin, and incidence of perianal dermatitis in newborn infant, *J. Pediat.* 46: 539, 1955.
4. Pratt, A. G.: Perianal dermatitis of newborn, *A. M. A. J. Dis. Child.* 82: 429, 1951.
5. Keitel, H. G., Cohn, R. and Harnish, D.: Diaper rash, self-inflicted excoriations, and crying in full-term newborn infants kept in the prone or supine position, *J. Pediat.* 57: 884, 1960.
6. Sezer, V. and Keitel, H. G.: Studies in neonatal diaper dermatitis. I. The use of hydroxyquinoline, *Turkish J. Pediat.* 6: 156, 1964.
7. Sezer, V. and Keitel, H. G.: Studies in neonatal diaper dermatitis. II. Use of a powder containing undecylenate, *Turkish J. Pediat.* 6: 160, 1964.
8. Jacquet, L.: Des érythèmes papuleux fessiers posterosif, *Rev. Mens de Mal. de L'enf.* 4: 201, 1886.
9. Marfan, A. B.: Les erythèmes fessiers des nourissons, *Nourisson* 14: 65, 1926.
10. Burgoon, C. F. Jr., Urbach, F. and Grover, W. D.: Diaper dermatitis, *Pediat. Clin. N. Amer.* 8: 835, 1961.
11. Zahorsky, J.: The ammoniacal diaper in infants and young children, *Am. J. Dis. Childh.* 10: 436, 1915.
12. Robinson, R. C. V.: Cutaneous monilliasis in infants, *J. Pediat.* 50: 721, 1957.
13. Rapp, G. W.: Etiology of urine diaper rash, *Arch. Pediat.* 72: 113, 1955.
14. Kaessler, H. W.: Dermatitis of diaper region. A new remedy for an old affliction, *Arch. Pediat.* 74: 47, 1957.
15. Benson, R. A., Slobody, L. B., Lillick, L., Maffia, A. and Sullivan, N.: Treatment of ammonia dermatitis with diaperene; report on 500 cases, *J. Pediat.* 34: 49, 1949.
16. Sezer, V. and Keitel, H. G.: Clinical investigation of neonatal diaper dermatoses, *Turkish J. Pediat.* 6: 148, 1964.