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ORIGINAL ARTICLE

Napkin Dermatitis: Skin Hydration Levels and Skin Care Practices amongst Children at Urban Comprehensive Health Centre, Ile-Ife, Nigeria

Dermatite de la Serviette : Niveaux d'Hydratation de la Peau et Pratiques de Soins de la Peau chez les Enfants du Urban Comprehensive Health Centre, Ile-Ife, Nigeria

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ABSTRACT

INTRODUCTION: Napkin Dermatitis (ND) means skin inflammation occurring within the napkin area. Skin care practices and skin hydration levels (SHL) are parameters of interest in the pathogenesis of ND.

AIM AND OBJECTIVES: To compare napkin area skin care practices and levels of skin hydration in children with ND and those without ND and to determine the predictors of ND in children.

METHODS: This was a case-control study of 60 participants with ND and 60 age and sex matched controls without ND, aged below 12 months that used napkins. Information on napkin area skin care practices were obtained from parents and diagnosis of ND was made clinically. Skin hydration levels were measured using a Corneometer®.

RESULTS: The median age of children was 16 ± 17.1 weeks (range 2–48 weeks). Controls were more likely to use appropriate barrier agents compared with participants with ND (71.7% vs. 33.3%; p<0.001). There was no significant difference in the mean SHL ± SD of participants with ND and controls on the non-lesional (buttock) area (42.00 ± 19.71 vs. 43.46 ± 21.68; t = –0.384, p= 0.702). Controls who always used a barrier agent were 83% less likely to have ND than those who did sometimes and those who never used a barrier agent (OR: 0.168, CI: 0.064–0.445, p< 0.001).

CONCLUSION: Consistent use of an appropriate barrier agent could be protective against ND. **WAJM 2023; 40(2): 203–208.**

Keywords: Napkin Dermatitis, Skin Hydration, Skin Care.

RÉSUMÉ

INTRODUCTION: La dermatite de la serviette (DN) désigne une inflammation cutanée survenant dans la zone de la serviette. Les pratiques de soins de la peau et les niveaux d'hydratation de la peau (SHL) sont des paramètres d'intérêt dans la pathogenèse de la DN.

BUT ET OBJECTIFS: Comparer les pratiques de soins de la peau de la zone de la serviette et les niveaux d'hydratation de la peau chez les enfants atteints de MN et ceux qui ne le sont pas, et déterminer les facteurs prédictifs de la MN chez les enfants.

MÉTHODES: Il s'agit d'une étude cas-témoins portant sur 60 participants atteints de MN et 60 témoins non atteints de MN, appariés selon l'âge et le sexe, âgés de moins de 12 mois et utilisant des serviettes. Les parents ont fourni des informations sur les pratiques de soins de la peau sur les serviettes et le diagnostic de la MN a été posé cliniquement. Les niveaux d'hydratation de la peau ont été mesurés à l'aide d'un Cornéomètre®.

RÉSULTATS: L'âge médian des enfants était de 16 ± 17,1 semaines (intervalle 2-48 semaines). Les témoins étaient plus susceptibles d'utiliser des agents de barrière appropriés que les participants atteints de MN (71,7 % contre 33,3 % ; p<0,001). Il n'y a pas de différence significative entre la moyenne des SHL ± SD des participants atteints de MN et des témoins sur la zone non-lésionnelle (fesse) (42,00 ± 19,71 vs. 43,46 ± 21,68 ; t= -0,384, p= 0,702). Les témoins qui utilisaient toujours un agent barrière étaient 83 % moins susceptibles de souffrir de MN que ceux qui le faisaient parfois et ceux qui n'utilisaient jamais d'agent barrière (OR : 0,168, IC : 0,064 - 0,445, p< 0,001).

CONCLUSION: L'utilisation systématique d'un agent barrière approprié pourrait être un facteur de protection contre la MN. **WAJM 2023; 40(2): 203–208.**

Mots clés: Dermatite de la Nappe, Hydratation de la Peau et Soins de la Peau.

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Abbreviations: ANOVA, Analysis of Variance; **ASHL,** Average Skin Hydration Levels; **CI,** Confidence Interval; **ND,** Napkin Dermatitis; **OR,** Odds Ratio; **SD,** Standard Deviation; **SHL,** Skin Hydration Levels; **TEWL,** Trans-Epidermal Water Loss.

INTRODUCTION

Napkin dermatitis (ND) refers to an inflammatory process occurring within the napkin area. It is one of the most common dermatological disorders occurring in young children[1] with a prevalence of between 7% and 67.3%.[2–5] Napkin dermatitis could be primary or secondary.[6] Primary ND occurs due to napkin use with inflammation occurring in the napkin area due to contact with irritants such as urine and feces, occlusion by the napkin or any other form of irritants to the napkin area. Secondary ND occurs when there is inflammation in the napkin area with a definite cause not necessarily associated with napkin use as found in infantile seborrheic dermatitis, napkin psoriasis and scabies.[2,6]

Primary napkin dermatitis is a prototype of irritant contact dermatitis and the most typical cause of napkin dermatitis.[7] Numerous factors such as the impact of urine, feces, increased skin pH, friction, increased hydration, and micro-organisms have been implicated in the pathogenesis of irritant napkin dermatitis.[7,8]

Skin with an intact layer, low hydration, low pH, reduced trans-epidermal water loss (TEWL), normal body flora, antimicrobial surface-deposited free fatty acids and sphingosine all play a role in maintaining the integrity of the skin barrier function.[9]

Protective emollients provide a thin film of lipid on the skin, preventing the direct impact of irritants like urine and feces on the skin.[10–12] It also supplies lipid, which is beneficial to repairing the stratum corneum.[6,13]

This study is the first to compare the skin hydration levels of the napkin area of cases with ND and controls without ND in Nigeria. The predictors and consequent prevention of ND have become clearer because of this study.

SUBJECTS, MATERIALS, AND METHODS

This case-control study included 120 children aged below 12 months. Consecutive consented recruitment of sixty (60) children with ND and sixty (60) age-and sex-matched children without ND who met the study's inclusion criteria was carried out using a purposive strategy. Parental written informed consent and permission for clinical photographs and their use were obtained before recruitment. The study excluded infants with generalized rashes with a clinical history suggestive of non-primary napkin dermatitis, e.g., napkin psoriasis, scabies, seborrheic dermatitis, fever, or other severe conditions. Children who received phototherapy in the previous one month, those with non-traumatic impairment of epidermal integrity like epidermolysis bullosa, infants who had napkins on only at nighttime were all excluded from the study.

The protocol including the informed consent forms were approved by the Ethics and Research Committee, Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Osun State, Nigeria. Information obtained from the caregivers included sociodemographic data, napkin area skin care practices – type of napkins used; towel cloth, fabric cloth with or without plastic pants or disposable napkin, type of disposable napkin; breathable or non-breathable was assessed. Breathable napkins are napkins with the presence of pores in the outer layer of the napkins. Frequency of napkin change in a day, type of cleansing agent (water, wipes, soap with water and others), barrier agent (none, Vaseline, shea butter, olive oil and others) were also documented. Observation and duration of napkin free period as well as daytime and nighttime frequency of napkin change, occurrence, and duration of diarrhea within the last month, previous occurrence of ND, treatment given in the past for napkin rash, impact the rashes had on the child's behaviour, feeding practices and place of childcare were all noted using the study proforma. The study participants were classified into different social classes using the socio-economic classification scheme by Oyedeji *et al.*[14] This classification uses occupation and education which are each graded into 5 (Class I–V).

Skin hydration levels were measured after acclimatization for at least 20 minutes in a temperature-controlled room with an ambient temperature between 20–22^{O}C and relative humidity between 40% and 60% according to the European Group for Efficacy Measurement on Cosmetics and other Topical products (EEMCO) guideline for assessment of stratum corneum hydration.[15] Model HTC-1 digital thermometer and hygrometer was used to ensure the temperature and the relative humidity ranges were maintained between the intended range. This device digitally displayed the room temperature and humidity as the study was ongoing which could have suggested the need to regulate the air conditioning system upwards or downwards to ensure the expected temperature and humidity range were maintained as stated above.

Skin hydration was measured using Corneometer^{R} CM 825-Courage and Khazaka electronic GmbH, a noninvasive bioengineered device that measures the electrical capacitance of the skin surface.[16] The outer thigh was used as an internal control in both participants with ND and controls.

Measurements were taken in at least three anatomical sites for all the participants as follows:

i. Over the lateral condyle of the right femur for cases and controls as internal controls.
ii. Over the buttock non-lesional area taken on the upper inner quadrant of the right side of the buttock for both cases and controls.
iii. Over the lesional area measured on the adjacent intact skin of the inflamed area of cases with napkin dermatitis.

At least two readings were obtained on the outer thighs and the napkin areas, and their averages were noted in the proforma. Repeated measurements on the same spot were avoided to prevent abnormal readings due to occlusion of the skin pores during the first measurement.

Statistical Analysis

Data analysis was performed using Statistical Package for Social Sciences Version 21.0 for windows. Chi-square and multivariate logistic regression analysis were used to measure the association between skin care practices and napkin dermatitis. Paired t-test was used to compare skin hydration levels between the buttock area and outer thigh of controls, Analysis of Variance (ANOVA)

was used to compare the skin hydration levels of lesional buttock area, non-lesional area and outer thigh of cases, and an Independent – t-test was used to compare skin hydration levels of the non-lesional area between cases and controls. The level of statistical significance was set at 0.05.

RESULTS

A total of 120 participants aged below 12 months were studied. There was no significant difference in the median age of the participants and controls 16 ± 17.1 weeks, with an age range of 2–48weeks. There were 26 (43.4%) males and 34 (56.7%) females in each group, with a male to female ratio of 1 to 1.3. Sixty-five percent (39) and 35% (21) of participants and control belonged to age group < 6months and 7–12 months, respectively. There were no significant differences in the mother's level of education (p=0.503) and social stratification (p=0.757), Table 1.

Figure 1 shows the comparison between the barrier agents for the participants. Overall, the subjects with ND mostly used nothing (28% vs. 5%), powder (25% vs. 18%), steroid containing cream (13% vs 5%), and Zinc oxide/ Coconut oil/Sulphur ointment (10% vs.5%) as barrier agents compared to the control. Meanwhile, the control population was more likely to use shea butter (60% vs 20%) than the subjects with napkin dermatitis.

Table 2 shows the comparison of napkin area skin care practices and other risk factors for ND between the participants and the controls. The control population used appropriate barrier agents more than the participants with ND(p<0.001) and their response was "always" in the use of barriers compared to the participants with napkin rash (48.3% vs.11.7%, p<0.001). There were no significant differences in the use of cleansing agents after urinating (p=0.205); and after defecating (p=0.792). There was no significant difference in children with ND and controls who used perfumed-type wipes and those that did not use them (p=0.547). Amongst the subjects with ND, history of diarrhea one month preceding the time of the study was significant compared to the controls (16.7% vs. 5.0%, p=0.040). There was no significant difference between children with ND and controls who used oral antibiotics within one month preceeding the study (p=0.076), had the previous history of ND (p=0.838), were exclusively breastfed for six months (p=0.224) and place of care (p=0.846).

Table 3 shows there was no significant difference in the overall mean skin hydration levels of children with ND and controls on the buttock non-lesional area (42.00 ± 19.71 vs. 43.46 ± 21.68, p=

Table 1: The Sociodemographic Characteristics of Participants

Variables	Cases Frequency (%) N= 60	Controls Frequency (%) N= 60	Statistical Test Chi-square	p-value
Age		0.000	1.000	
Median ± SD (weeks)	16 ± 17.1	16 ± 17.1		
Range (weeks)	2 – 48	2 – 48		
Age Group (Months)			0.000	1.000
<6	39(65)	39(65)		
7–12	21(35)	21(35)		
Sex		0.000	1.000	
Males	26 (43.4)	26 (43.4)		
Females	34 (56.7)	34 (56.7)		
Mother's Level of Education			1.373*	0.503
Tertiary	36 (60.0)	40 (66.7)		
Secondary	18 (30.0)	17 (28.3)		
Primary	6 (10.0)	3 (5.0)		
Social Stratification			0.556	0.757
Upper class	20 (33.3)	17 (28.3)		
Middle class	34 (56.7)	38 (63.3)		
Lower class	6 (10.0)	5 (8.3)		

*SD, Standard Deviation, Significant p-value < 0.05; *, Likelihood-ratio;*

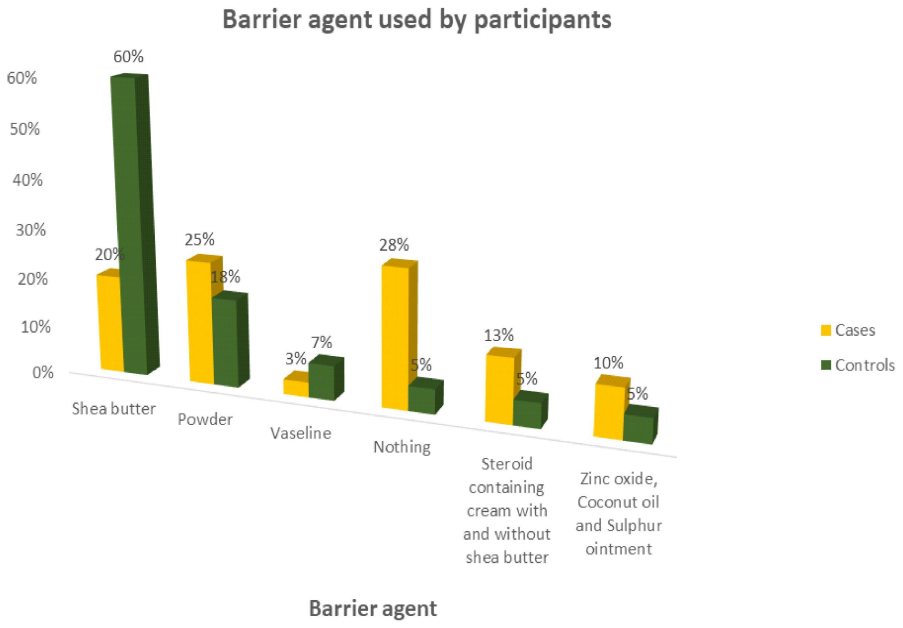

Fig. 1: Clustered Bar Chart comparing specific Barrier Agents used by Cases and Controls.

Table 2: Comparison of Napkin Area Skin Care Practices and Risk Factors For Napkin Dermatitis between Cases and Controls

Variables	CasesN (%)	Control N (%)	Chi- square	p-value
Napkin Type Used			5.497*	0.064
Disposable only	47 (78.0)	39 (65.0)		
Disposable and re-useable	12 (20.0)	21 (35.0)		
Re-useable only	1 (1.7)	0 (0.0)		
Barrier Agent Used			20.386	<0.001
Appropriate#	20 (33.3)	43 (71.7)		
Inappropriate##	23 (38.3)	14 (23.3)		
Nothing	17 (28.3)	3 (5.0)		
Frequency of use of Barrier Agent			22.780	<0.001
Always	7 (11.7)	29 (48.3)		
Sometimes	36 (60.0)	28 (46.7)		
Never	17 (28.3)	3(5.0)		
Cleansing Agent after Urinating			5.928*	0.205
Don't clean up	2 (3.3)	–		
Wipes only	20 (33.3)	18 (30.0)		
Water only	22 (36.7)	18 (30.0)		
Wipes and water	16 (26.7)	23 (38.3)		
Soap and water	–	1 (1.7)		
Cleansing Agent after Defecating			1.036*	0.792
Wipes only	13 (21.7)	11 (18.3)		
Water only	23 (38.3)	20 (33.3)		
Wipes and water	23 (38.3)	27 (45.0)		
Soap and water	1 (1.7)	2 (3.3)		
Diarrhea in the last 1 month			4.227	0.040
Yes	10 (16.7)	3 (5.0)		
No	50 (83.3)	57 (95.0)		
Antibiotic use in the last one month			3.142	0.076
Yes	17 (28.3)	9 (15.0)		
No	43 (71.7)	51 (85.0)		
Place of Care			0.334	0.846
Home	40 (66.7)	42 (70.0)		
Day care	8 (13.3)	6 (10.0)		
Child taken to work	12 (20.0)	12 (20.0)		

*Significant p value < 0.05; *, Likelihood-ratio; #, Petroleum Jelly; Shea Butter; Zinc Oxide Cream,; Coconut Oil and Sulphur containing Ointment; ##, Shea Butter mixed with potent steroid containing cream, potent steroid containing cream and powder.*

Table 3: Comparison of the Average Skin Hydration Levels of the) Area And Outer Thighs of Cases and Controls. Buttock (Lesion-Free

Variables	Cases (N=60) Mean ± SD	Controls (N=60) Mean ± SD	t	p- value
Skin hydration – Buttock area	42.00 ± 19.71	43.46 ± 21.68	-0.384	0.702
Skin hydration – Outer thigh	27.29 ± 20.27	28.63 ± 18.93	-0.374	0.648

SD, Standard Deviation; t-, Independent sample t-test; Significant p< 0.05

0.702) and the thighs (27.29 ± 20.27 vs. 28.63 ± 18.93, p= 0.648).

In Table 4, children with ND had their mean skin hydration level significantly higher in the lesional areas than the non-lesional buttock and the outer thighs (53.63 ± 27.91 vs 42.00 ± 19.71 vs 27.29 ± 20.27: F– 19.88, p < 0.001). Scheffe post-hoc analysis done to assess for intergroup differences demonstrated a significant difference between lesional area vs. buttock area (53.63 ± 27.91 vs. 42.00 ± 19.71, p=0.017), buttock area vs. outer thigh (42.00 ± 19.71 vs. 27.29 ± 20.27, p=0.002) and lesional area vs. outer thigh (53.63 ± 27.91 vs. 27.29 ± 20.27, p< 0.001) Table 5 shows the logistic regression of the predictors of ND in the multivariate analysis. Those who used barrier agents always were 83% less likely to have ND compared to those who did sometimes and those who never used a barrier agent (OR: 0.168, CI: 0.064–0.445, p< 0.001).

DISCUSSION

This present study showed no significant association between the napkin type and the occurrence of ND. Napkin type appeared to be of less importance in our study because most of the infants with mild to moderate ND used breathable napkins that could have been protective against ND. Similarly, Andrew *et al*[17] in a multinational study, described the use of mainly disposable napkins and found no association of napkin use with a reduced prevalence of ND. However, like the findings in this study, the prevalence of ND was noticeably lower amongst infants in China, the country with the highest prevalence of protective barrier cream use. However, in contrast to the present study, Owa *et al*[4] documented a significant association between napkin type, predominantly non-breathable napkins, and ND. The use of non-breathable napkins in their study might have been a risk factor for heat and moisture generation, which predisposed to ND as opposed to the majority's use of breathable napkins in the current study. Over two-thirds of both infants with ND and controls changed their napkins at least three (3) times a day in this study. We found no significant association between the frequency of change of napkins and ND as shown in other studies.[4,5,18] Chiabi *et al*[19] reported that infants with napkin change less than six (6) times a day had more ND than those with napkins changed more often. Majority of participants in their study used re-useable cloth napkins with reduced capacity to retain moisture and needed to be changed more often.

Table 4: Comparison of Average Skin Hydration Levels of the Lesional Area, Buttock (Lesion-Free Area) and Outer Thigh of Cases Only and the Scheffe Post-Hoc Analysis

Skin Area of Cases measured	Skin Hydration Mean ± SD	F-test	*p*-value
Lesional area	53.63 ± 27.91	19.88	**< 0.001**
Buttock area	42.00 ± 19.71		
Outer thigh	27.29 ± 20.27		
Scheffe Post-Hoc Analysis for Intergroup Differences			
	Skin Hydration Mean ± SD	***p*- value**	
Lesional area vs. buttock area	53.63 ± 27.91 vs. 42.00 ± 19.71	0.017	
Buttock area vs. outer thigh	42.00 ± 19.71 vs. 27.29 ± 20.27	0.002	
Lesional area vs. outer thigh	53.63 ± 27.91 vs. 27.29 ± 20.27	< 0.001	

SD, Standard Deviation; F, One-way ANOVA; Significant p <0.05.

Table 5: Logistic Regression of the Predictors of Napkin Dermatitis

Variables	Odds Ratio (OR)	95% CI Lower	95% CI Upper	p-value
Barrier Agent Used				
(Ref-inappropriate & nothing)Appropriate	0.661	0.099	4.422	0.669
Frequency of Barrier Agent Used				
(Ref-sometimes & never)Always	0.168	0.064	0.445	<0.001
Diarrhea in the last one month (Ref. No)				
Yes	2.014	0.500	8.112	0.325
Antibiotic use in the last one month (Ref. No)				
Yes	1.338	0.497	3.601	0.564

CI, Confidence Interval; OR, Odds Ratio; Significant p <0.005.

Fig. 2: Typical Irritant Napkin Dermatitis Sparing the Skin Folds (Erythema and Crusting).

Fig. 3: Napkin Dermatitis Complicated by Superficial Ulcers.

Shea butter was the most used barrier agent in this study. Owa *et al*[4] also reported similar findings. Petroleum jelly was reported by Eke *et al*[20] and Palm kernel oil by Chiabi *et al.*[19] Destin ointment and Eucerin cream were the most common barrier agents reported by Andrew *et al.*[17] The pattern of barrier use could be related to prevalent local practices. Shea butter is produced from the shea tree (Vitellaria paradoxa) and has been a common agent used in Africa for body creams, hair creams, balms and cooking oil and has been reported for its emollient, moisturizing, sunscreen, anti-aging, anti-inflammatory, and hypo-cholesterolemia properties amidst several other benefits.[21,22] It was the most popular barrier agent in this study and Owa *et al's* study probably because of its availability, affordability, efficacy and popularity.

Among the non-ND controls, shea butter was the preferred barrier agent. This finding is consistent with the findings of other authors[5,7,23] who found a significantly lower ND prevalence among infants who used prophylactic barrier agents. Studies have shown that the appropriate use of barrier creams forms the backbone for the prevention of ND by forming a protective lipid layer on the infant's skin against irritants and allowing the underlying skin to heal if already inflamed.[7,24] The consistent, "always" use of an appropriate barrier agent as opposed to "sometimes" or "never" was the only significant predictor of ND on the logistic regression model in this study.

Similar to reports by other authors,[5,18,25–27] there was no discernable difference in the type of cleansing agent used after urinating and defecating in relation to ND. All the participants in the studied population used wipes that had a fragrance. The active ingredients in the wipes were unknown, and the type of fragrance used was beyond the scope of this study. To minimize the irritation of napkin area, studies have shown that wipes made of absorbent materials with acid pH buffers, emollients and minimal preservatives, alcohol and fragrance is encouraged.[25,28]

Concerning the skin's hydration status, this study showed that the average skin hydration levels (ASHL) of the buttock area without any lesion was slightly lower in participants with ND than controls. The reverse was the case in the reports by Stamata *et al*[28] who documented a slightly higher ASHL amongst cases than controls. However, both studies reported no significant difference in the ASHL of cases and controls. Frequent use of emollient as a barrier agent by controls can be moisturizing in the napkin area over time, while an increased powder use amongst the cases could be the reason for the insignificantly higher ASHL amongst the controls in the present study.

The average skin hydration level of the lesional area was significantly higher than the non-lesional areas (buttock) amongst participants with ND in this study. This is similar to the report by Stamata and his colleagues.[28] This finding corroborates other documentation in literature, the role of maceration, irritation, inflammation, and wetness in the pathogenesis of irritant napkin rash.[7] This study documented a significantly higher ASHL in the non-lesional (buttock area) than the non-diapered area (outer thigh) amongst both cases and controls, corroborating the reports by Bartels *et al,*[27] Stamata *et al,*[28] and Visscher *et al*.[8] This finding also implies that the napkin area is more prone to maceration and irritation by having significantly higher skin hydration levels than other body parts.

The study has some limitations. The sample size was the smallest that could be analyzed. The study was conducted at an immunization center, limiting the participants to age below 12 months as most children in the National Immunization Program are under this age limit. Therefore, the findings of this study cannot be generalized to older children or to the general population who wear napkins. These limitations notwithstanding, to the best of the researchers' knowledge, this study is the first to compare skin hydration levels of the napkin area of babies with and without napkin dermatitis in Nigeria.

In conclusion, this study found that ND is common in the first six months of infancy, regardless of parents' socioeconomic status or level of education. The use of an appropriate barrier agent on the napkin areas in children aged below 12 months on a regular basis for skin care is one of the ways to reduce the burden of ND and its complications.

We declare no conflict of interest.

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