An Observational Study of Neonatal Skin Care in Rural and Urban Communities in Southwest Nigeria and Possible Relevance to the Prevalence of Atopic Dermatitis

AJOSE FO FRCP[1], **COLE-ADEIFE OM** FMCP[1], **KATIBI OS** FWACPaed[2]

[1]Dermatology Unit, Department of Medicine, Lagos State University Teaching Hospital, Ikeja, Lagos, Nigeria.

[2]Paediatric Dermatology Unit, Department of Paediatrics, College of Health Sciences, University of Ilorin

Corresponding Author: Dr Olufolakemi Cole-Adeife,

Address: Dermatology Unit, Department of Medicine, Lagos State University Teaching Hospital, Ikeja, Lagos, Nigeria:

E-mail address: fomcole@yahoo.com, ocole@lasuth.org.ng **Phone numbers**: +2348037133139

ABSTRACT

Background: Atopic dermatitis (AD) is the most common chronic inflammatory dermatosis in children, with increasing global prevalence. Modes of birth and skincare practices in early life are postulated to influence the development of AD and other atopic conditions. This study sought to explore neonatal skin care practices and the prevalence of AD in rural and urban communities in Southwest Nigeria.

Methods: This exploratory observational study was conducted over six months (Jan – June 2017) in Southwest Nigeria. Birth processes and postpartum skin care products were compared between 50 parturient women at six government-licensed traditional birth attendant (TBA) centres in 3 rural communities and 50 parturient women in 3 urban government maternity centres. The frequency of AD in under-five clinic records of these communities was also compared.

Results: All births were vaginal at the TBA centres, while 44% were via caesarean section at the urban maternity hospitals. The neonatal skin care regimen at the TBA centres comprised herb-infused water, traditional black soap, and vegetable oil moisturizers, all pH 5-7. The skin care regimen in urban centres included tap water, olive oil, baby soaps, and proprietary moisturizers, all pH 8-10. The frequency of AD in under-5 children at rural community clinics was 0.08%, and 6% at the urban health facilities (p=0.001).

Conclusion: In rural communities in Southwest Nigeria, vaginal deliveries were the norm, and the skin care regimen during the neonatal period comprised early skin-to-skin contact and pH-neutral or acidic skin care products, while in urban areas, caesarean section births were common, skin-to-skin contact was often delayed, and skin care products were mostly alkaline. The prevalence of atopic dermatitis was much lower in rural communities than in urban communities, but further studies are needed to determine if there is a direct relationship between neonatal skin care practices, modes of birth, and AD prevalence.

Keywords – Atopic dermatitis, neonatal skincare, traditional skin care, skin microbiota, emollients

Une Étude Observationnelle des Soins de la Peau Néonatals dans les Communautés Rurales et Urbaines du Sud-Ouest du Nigeria et leur Pertinence Possible pour la Prévalence le la Dermatite Atopique

ABSTRAIT

Contexte: La dermatite atopique (DA) est la dermatose inflammatoire chronique la plus courante chez les enfants, avec une prévalence mondiale croissante. Les modes de naissance et les pratiques de soins de la peau au début de la vie sont supposés influencer le développement de la MA et d'autres conditions atopiques. Cette étude visait à explorer les pratiques néonatales de soins de la peau et la prévalence de la MA dans les communautés rurales et urbaines du sud-ouest du Nigeria.

Méthodes: Cette étude observationnelle exploratoire a été menée sur six mois (janvier - juin 2017) dans le sud-ouest du Nigeria. Les processus d'accouchement et les produits de soins de la peau post-partum ont été comparés entre 50 femmes parturientes dans six centres d'accoucheuses traditionnelles (AT) agréés par le gouvernement dans 3 communautés rurales et 50 femmes parturientes dans 3 maternités publiques urbaines. La fréquence de la MA dans les dossiers cliniques des moins de cinq ans de ces communautés a également été comparée.

Résultats: Toutes les naissances ont été vaginales dans les centres AT, tandis que 44 % ont eu lieu par césarienne dans les maternités urbaines. Le régime néonatal de soins de la peau dans les centres TBA comprenait de l'eau infusée aux herbes, du savon noir traditionnel et des hydratants à l'huile végétale, tous pH 5-7. Le régime de soins de la peau dans les centres urbains comprenait de l'eau du robinet, de l'huile d'olive, des savons pour bébés et des hydratants exclusifs, tous à pH 8-10. La fréquence de la MA chez les enfants de moins de 5 ans dans les cliniques communautaires rurales était de 0,08 % et de 6 % dans les établissements de santé urbains (p = 0,001).

Conclusion: Dans les communautés rurales du sud-ouest du Nigeria, les accouchements par voie basse étaient la norme et le régime de soins de la peau pendant la période néonatale comprenait un contact peau à peau précoce et des produits de soins de la peau au pH neutre ou acide, tandis que dans les zones urbaines, les naissances par césarienne étaient courants, le contact peau à peau était souvent retardé et les produits de soins de la peau étaient principalement alcalins. La prévalence de la dermatite atopique était beaucoup plus faible dans les communautés rurales que dans les communautés urbaines, mais d'autres études sont nécessaires pour déterminer s'il existe une relation directe entre les pratiques néonatales de soins de la peau, les modes d'accouchement et la prévalence de la MA.

Mots-clés – Dermatite atopique, soins néonatals, soins traditionnels, microbiote cutané, émollients

Introduction

Neonatal skincare and post-natal practices vary among cultures and environments; some are postulated as beneficial, while others may be harmful.[1,2] The use of emollients postpartum, for example, is a common traditional skincare practice across Africa.[1] Modern obstetric facilities also have varying routines for post-natal care, including skin care practices which constantly evolve along with available scientific evidence.[2,3] Some studies have highlighted the role that the mode of birth, neonatal exposure, and skin care practices may play in immune system development and function and the propensity for atopy or immune hyperactivity.[4] Recent research has provided insight into the role of perinatal microbial exposure in the development of atopy.[4] Neonatal skincare practices such as bathing frequency, soap use, moisturizer application, and early skin-to-skin contact have also been proposed as potential factors influencing the development and severity of atopic conditions like asthma, food allergies, and atopic dermatitis [5].

Atopic dermatitis (AD) is a chronic inflammatory skin disease that typically starts in early childhood and follows a chronic and relapsing course. [6–8] It is a pruritic, inflammatory dermatosis associated with cutaneous hyperreactivity to environmental triggers, usually innocuous to non-atopic individuals.[6,7] (Fig 1) AD is a part of the atopic march, which also consists of asthma, allergic rhinitis, and allergic conjunctivitis, and up to 80% of people with AD have a personal or family history of these other atopic conditions.[6,8] AD has a global prevalence of 15-25% in children and 3-4% in adults.[6–8] About 50% of AD cases present within the first year of life and about 95% by age five.[7,8] AD is associated with a high socioeconomic and psychosocial burden, negatively impacting the quality of life.[9–11]

The exact aetiology of AD remains unclear, but the pathogenesis is a complex interaction of genetic and environmental factors with self-perpetuating epidermal barrier dysfunction, dysregulated immune responses, and TH2 and interleukin-driven inflammation.[6,7,12] Genetic factors play a major role in AD aetiology, but the lack of complete concordance between monozygotic twins implies that environmental factors are also involved.[13,14] Global prevalence of AD is on the rise, and an 8-10 fold increase in AD prevalence has been reported in Nigeria over the last five decades.[15,16] The escalating prevalence of AD comes with unmet needs for safe and effective treatment, particularly in resource-poor countries where novel targeted therapies like biologics remain unavailable and unaffordable.[12,17] This increasing global prevalence has also led to growing interest in identifying modifiable risk factors that may contribute to its development.

Studies worldwide show disparities in AD prevalence in rural and urban areas.[8,10,15] Lower AD prevalence in rural settings has been reported in both developed[7,18] and developing countries, including Nigeria[10,15]. A common anecdotal opinion in Nigeria is that babies born in rural settings, specifically in traditional birth attendant (TBA) homes, have fewer allergic problems

like atopic dermatitis and food allergies than those born in hospitals or health centres. (Fig 2) There is also a lack of established, acceptable, uniform guidelines for neonatal skin care worldwide.[3]

This study aimed to explore the differences in neonatal skin care practices in rural and urban settings in Southwest Nigeria, the prevalence of AD in children in these communities and relate it with the current evidence on the influence of certain neonatal care practices on the development of atopy and AD.

Methods

Study Design and Setting: This exploratory observational study was conducted over six months (January to June 2017) in the Lagos and Ogun states of Southwest Nigeria. These states have 20 local government areas each, which may be considered urban, rural, or semi-urban based on industrial development, infrastructure, and social amenities or the predominance of farmlands in the rural areas. The study was conducted in one urban local government in Lagos (Lagos Island) and two (one urban and one rural) in Ogun state – Ijebu ode and Odogbolu.

Study population: The study population was parturient females in these communities.

Sample size calculation: $N=z2p(1-p)/d2$, where p is the average prevalence of AD in Southwest Nigeria [9,15,16] (7%), z = 1.96 for a 95% confidence interval, and d is precision (0.05). N = 100. Thus, a total of 100 parturient females were recruited.

Inclusion criteria: Parturient women in the early stage of labour who consented to be observed

Exclusion criteria: Pregnant women attending who were not in labour or did not give consent

Sampling method: Random sampling was employed in this study. Fifty participants were recruited at six government-licensed traditional birth centres in three rural communities run by skilled traditional birth attendants (TBAs), while 50 participants were recruited at three urban maternity centres serviced by state obstetricians and registered nurses and midwives.

All study participants were observed from the onset of labour until 24 hours postpartum by a consultant dermatologist (first author) and a senior registrar in dermatology who visited each centre 4-6 times during the study period. The birth mode, birth process, and postpartum skincare regimen that all study participants and their newborns were subjected to were observed and compared. The pH of water and skincare products used for the newborns was measured with a pH strip. The frequency of atopic dermatitis in children under five in the available clinic records of hospitals and primary health centres over one year in these communities was documented.

Data analysis: The results were documented, and simple descriptive statistics and tables were used for mean and standard deviation. Chi-square was used to determine the relationship between mode of birth and AD prevalence. Statistical significance was set at less than <0.05.

Ethical considerations: Ethical approval for the study was obtained from the Lagos State University Teaching Hospital Research and Ethics Committee. Permission was obtained from hospital and clinic management, and verbal and written informed consent was obtained from clinical personnel, birth attendants and study participants. Confidentiality was maintained by deidentifying the data provided.

Results

One hundred parturient females were recruited – fifty from 6 rural traditional birth attendant centres and 50 from 3 urban maternity hospitals. The mean age of the study participants was 24.8+/- 6.4 years. At the rural TBA centres, 98% (49) of the women delivered vaginally. One woman was referred to a general hospital due to obstructed labour. At the urban maternity hospitals, 42% (21) of the women had a caesarean section, while 58% (29) delivered vaginally.

Birth Processes

At the Rural TBA centres - In the first hour postpartum, the neonate is placed on the mother's chest (skin-to-skin) while the placenta is birthed. The cord is clamped and cut, and suckling is initiated. In the second hour postpartum, initial cleansing of the skin and the vernix caseosa with vegetable oils like palm oil or coconut oil (pH 5-6) is done. (Figure 2) In

the third hour postpartum, further skin cleansing is done with a boiled plant infusion (camwood leaves and other herbs), traditional black soap (pH 6-7), and a plant fibre sponge (Figure 4). This is followed by moisturization with tropical vegetable oils like coconut oil (pH 6) or shea butter (pH 5-6). Four to six hours postpartum, the newborn is returned to the mother's chest for suckling and bonding, either naked or wrapped loosely in the mother's wrapper (Figure 3a).

At the Urban Maternity Centres – In the first hour postpartum, while the cord is clamped and cut and the placenta is birthed, the neonate is placed on hospital drapes and taken to a resuscitation tray for weighing, suctioning, and cleaning (Figure 3b). By the second and third hour, postpartum, initial cleaning of the skin and the vernix caseosa is done with olive oil, followed by bathing with municipal tap water (pH 7-8), conventional tablet or liquid soaps (pH 9-10) and plastic sponges (Figure 5). Sometimes, antiseptic soaps or liquids are used. This is followed by moisturization with modern baby lotions (pH 7-9). By 3-6 hours postpartum, the newborn is clothed and placed on the mother's chest for suckling or in a cot. Table 1 compares the components of the skincare routines in rural and urban centres.

Under-five clinic records in the health centres and clinics affiliated with the urban maternity centres showed an average prevalence of atopic dermatitis in these communities of 6%. Clinic records showed that most children attending these health centres were born in urban maternity health centres. In the primary health centres of the rural areas where the TBA centres were more commonly patronized for childbirth, the prevalence of atopic dermatitis in clinic records was 0.08%. However, the diagnosis of AD in both urban and rural health facilities was made by non-specialist medical officers. The diagnostic criteria for AD used by the medical officers were dry, recurrently itchy skin and flexural dermatitis in a child with a history of asthma or allergies, which is in keeping with the UK working party criteria.

Table 1 – Newborn skincare regimen in Rural centres Vs. Urban centres

Traditional Birth Attendant Centres	Conventional Maternity Centres
Imosan (13 women) – palm oil, warm camwood leaf water, traditional black soap, and coconut oil **Odogbolu (9 women)** – palm oil, warm water infused with herbs, traditional black soap, and shea butter **Ijebu Ode (28 women) - p**alm oil, warm water infused with camwood leaves and other herbs, traditional black soap and shea butter, palm kernel oil, or coconut oil	**LIMH (31 women) –** Olive oil, antiseptic or plain baby soap, and municipal tap water. Baby lotion or cream **Odogbolu PHC (7 women)** – Olive oil, baby soap, borehole water, baby lotion, coconut or olive oil **Ijebu-ode GH (12 women) –** baby soap, tap or borehole water, and lotion. Shea butter or coconut oil is also recommended and used.

Table 2: Association between Community and frequency of AD in Under 5 clinics

Variable	Rural communities	Urban communities	p-value
Percentage frequency of AD in Under-5 clinic records	0.08%	6%	p = 0.001*

Discussion

This study observed that post-natal birth and skincare practices differ significantly in urban areas compared to rural areas. In rural areas, vaginal births are more prevalent due to the lack of specialist obstetric skills, and patients requiring this were referred. There was immediate post-birth skin-to-skin contact between baby and mother and initiation of breastfeeding. (Figure 3a). Skin cleansing and moisturization with neutral to acidic skin care products were more common.

In urban maternity settings, about two-fifths of births were caesarean section deliveries in this study, in keeping with data from other secondary obstetric care facilities in urban areas in Nigeria[19]. This may be due to the availability of specialist obstetric care, and many women presenting at these facilities may have been referred due to high-risk pregnancy indications

or complications.[19] In urban health facilities, the newborn is taken to a resuscitation station immediately after birth for weighing, cleaning, suctioning, or oxygen administration if required. This is followed by cleansing with either olive oil or alkaline soap tap and water. Antiseptic soaps or liquids are also frequently used. Maternal skin-to-skin contact is typically not initiated early or at all, and where it is done, it is started much later, sometimes up to 6 hours later with a caesarean birth.

There was a significant difference in the prevalence of AD in the urban versus the rural clinics. However, the difference in this study may not be accurate due to limited knowledge in diagnosing AD by medical personnel, particularly in rural communities where AD is commonly misdiagnosed as superficial dermatophytosis. Yet urban-rural disparities of AD and other atopic conditions have been reported worldwide and are associated with the hygiene and biodiversity hypotheses.[20–23] These hypotheses postulate that urbanization, higher educational levels, and socioeconomic status have been associated with loss of microbial biodiversity and reduced early childhood exposure to microbes which help prime the immune system.[8,23,24]

This low level of microbial exposure can result in decreased immune tolerance.[23,24] Studies have shown a relationship between low levels of microbial exposure, reduced activation of Th1cell-mediated immunity, and increased Th2 immune activation associated with pathologies like AD.[8,24,25]. It is now well-established that early-life microbiota exposure is a critical factor in the development of the immune function.[4,24] Studies indicate this occurs in the neonatal window when the first microbial and antigen encounters set the stage for subsequent life-long immune function or dysfunction.[12,24,26] Torow et al. and Renz et al. have postulated that the first set of microbes to colonize a baby's skin and GI tract (the pioneer microbes) postpartum will educate the developing neonate's immune system and set the stage for a lifetime pattern of immune function.[4,24,27]

At vaginal delivery, the baby passes from the neutral amniotic fluid through the acidic, microbe-laden vagina receiving both an acid coat and its first inoculum of a mixture of gram-positive and negative aerobic and anaerobic bacteria from the mother's vaginal tract.[4,24] The microorganisms from the mother's vagina and skin will be considered familiar because of the mother's immune influence on the baby and initiate a tolerable immune response in the newborn, thus preventing undesirable inflammatory responses against self-antigens and non-self-antigens.[4,24] During a caesarean section (CS), the baby is removed from the sterile and pH-neutral amniotic fluid without being exposed to acidic vaginal secretions or maternal vaginal microbes. The newborn often has its first microbial contact with microorganisms in the hospital environment. Studies have shown that an unfamiliar initial microbial contact at birth can lead to persistent immune dysregulation.[4,24,27,28]

The pioneer microbes following a CS, particularly when skin-to-skin contact is not immediately initiated, will be foreign to maternal antibodies in the neonate and may trigger an aberrant or hyperreactive immune response.[24,27,28]. Lee et al. theorized that birth via caesarean section might contribute to the immune hyperreactivity seen in AD.[27] However, a study by Renz-Polster et al. showed no association between CS birth and AD, although there was a significant association between CS birth and respiratory atopy (asthma and allergic rhinitis).[28] This is why some researchers suggest that children born via CS should be swabbed with gauze soaked with the mother's vaginal secretions immediately after birth to expose the baby to maternal vaginal microbiota.[29]

Furthermore, using antiseptic cleansers or liquids commonly practiced in urban health facilities may cause further dysbiosis of normal skin microbiota with dire implications on immune development and function, except for the use of antiseptic chlorhexidine gel on the umbilical cord to prevent infection.[30,31] Recent studies have also shown the benefits of immediate skin-to-skin contact, delayed bathing, and kangaroo skin care for newborns.[5,32] A systematic review by Bee et al. on neonatal skincare practices in mainly urban health facilities in Africa, however, observed that postpartum skin-to-skin care was very low, similar to observations in this study.[2]

During vaginal delivery, the baby receives an acidic coat to prime certain pH-dependent enzymatic processes necessary for healthy skin barrier function.[24] This is followed by the use of acidic and pH-neutral skin care products in most rural settings but with alkaline skin care products in most urban settings in this study. The pH of the post-birth environment may also have a significant role in the epidermal barrier development of newborns, as many processes required to maintain skin barrier integrity depend on enzymatic activities that require an acidic pH for optimal function.[25,33] The generation of ceramides, cholesterol, and fatty acids from lipid precursors is also critical to maintaining epidermal barrier integrity, and this involves enzymatic processes requiring an acidic medium.[33] Neonatal skin is alkaline with resultant poor stratum corneum cohesion and reduced antimicrobial defense.[34] The infant stratum corneum takes a few months to reach pH 5-6 and stabilizes in childhood and adulthood until old age when the pH rises again.[34] Considering that most enzymatic processes function within a relatively narrow pH window, even a temporary increase in skin pH may be expected to disrupt some barrier function biochemical processes.[25,33,34] Thus, pH-balanced skincare products would allow optimum maturity of pH-dependent epidermal barrier functions.[33,34] The association between permeability barrier dysfunction and allergic inflammation is one of the most critical issues in the pathophysiology of atopic dermatitis.[26,35]

In AD, the skin surface pH is elevated compared to healthy skin, which is normally 4.0 to 6.0.[33,34] This is due to the insufficiencies of filaggrin and filaggrin-generated natural moisturizing factors (NMFs) like urocanic acid and other free fatty acids impair the buffering capacity of the skin and lead to the increased skin surface pH.[35] The most significant genetic association with AD is the filaggrin gene mutation.[26,36] However, the observation that epidermal barrier dysfunction in AD and other inflammatory dermatoses can occur independently of the FLG genotype indicates that other aetio-pathologic factors exist.[25,26] Filaggrin dysfunction has also been associated with exogenous substances like hard water, highly-alkaline soaps, surfactants or detergents, and certain microbial organisms that can trigger a vicious cycle of immune dysregulation leading to barrier dysfunction from the disruption of stratum corneum pH, hydration, and trans-epidermal water loss.[26,36] Researchers have shown that the acidification of the stratum corneum substantially prevents the development of barrier abnormalities and downstream immune abnormalities in an AD model.[36,37] Thus, maintaining a normal acidic pH is crucial for many protective functions and could prevent AD or reduce its severity.[36,37]

Emollients are also essential in skin care for all ages and have both prophylactic and therapeutic roles with AD and several inflammatory dermatoses. In the traditional birth centres, African vegetable oils like red palm oil, coconut oil, and shea butter are used as moisturizers for newborns. These are typically mildly acidic and have potent antioxidant and emollient properties.[38] Red palm oil is a potent pro-vitamin A source rich in phytonutrients like tocotrienol (vitamin E), squalene, and coenzyme q10 (ubiquinol).[38,39] Shea butter has significant antioxidant, anti-inflammatory, and moisturizing effects with efficacy similar to recognized ceramide-based creams.[38,40] Coconut oil has been found to reduce TEWL and increase skin hydration.[41,42] It also has antimicrobial effects, as Verallo-Rowel et al. demonstrated significant decreases in Staphylococcus aureus colonization with coconut oil use compared to olive oil in patients with AD.[43]

Mono-laurin, formed from lauric acid, an abundant short-chain fatty acid in coconut oil, is responsible for its antimicrobial activity.[43] The use of olive oil for newborns is common in Nigeria and worldwide, but studies have shown that olive oil may be detrimental to the skin barrier. Danby et al. reported that olive oil increased TEWL in AD and non-AD patients compared to sunflower oil-treated and non-treated controls.[44,45] This barrier-damaging property is hypothesised to be due to the high oleic acid composition, which increases the permeability of the epidermal barrier and disrupts the arrangement of the lipid lamellar.[44] Coconut oil and palm oil used in traditional skin care have low oleic acid composition.[38] Some studies advise caution with

using oils for neonatal skin care.[44,45] However, a systematic review showed that the use of coconut oil for preterm infants was beneficial for preventing infections and encouraging normal skin barrier function.[41] Other potentially harmful skincare practices, like the use of engine oil and 'mentholatum' for newborns, have also been documented but were not observed in this study.[1,31]

Conclusion

The first exposure of the newborn in the urban maternity setting is usually to the microbes of the hospital environment due to delayed skin-to-skin contact, while postpartum neonatal skin care often involves the use of alkaline soap and moisturizers. In traditional birth centres in rural areas, the first exposure of the neonate is to microbes from the mother's acidic vaginal tract and skin, and postpartum neonatal skincare for at least six weeks following vaginal delivery often involves the use of pH-neutral cleansers, emollients, and moisturizers. These observed variations in prevalent birth modes and post-natal skincare may affect immune system priming to which AD has been linked. Thus, neonatal skincare practices may contribute to the variation in AD prevalence in these rural and urban communities. However, further, more focused observational studies on infant skincare and its relationship with AD in Nigeria and Africa are required to validate this.

Limitations of the study

1. Confounding variables like other possible environmental allergens and the prevalence of FLG mutation were not studied in this study. Further studies are needed to address these.
2. The AD diagnosis obtained from retrospective clinic records was not made by a dermatologist but by non-specialist medical officers who, in rural settings, may be unable to diagnose AD.
3. The mode of delivery of the under-5s assessed for AD was unavailable. This would have given a more direct and reliable association between AD and mode of delivery. Further studies will be conducted in this area.

Recommendations

Prospective studies that will follow the newborns for at least three years and document skin pH, mode of delivery, post-delivery and skin care practices, and AD prevalence in urban and rural settings would provide more reliable evidence. Further studies would also provide a more scientific background for appropriate neonatal skin care guidelines.

Acknowledgments:

- The administrative and nursing staff at the Lagos Island Maternity hospital, Lagos, Odogbolu Local Govt Primary health centre, and General Hospital Ijebu Ode
- The rural/traditional birth attendant (TBA) centres and practitioners at Imosan, Odogbolu, and Ijebu Ode Ogun State.
- Dr. Utseoritsejor Tuedon, who was a research assistant on this work

Conflicts of Interest: None

Funding: This study was funded by the first author. There was no external funding.

REFERENCES

1. Amare Y, Shamba DD, Manzi F, Bee MH, Omotara BA, Iganus RB, et al. Current Neonatal Skin Care Practices in Four African Sites. J Trop Pediatr. 2015 Dec 1;61(6):428–34.
2. Bee M, Shiroor A, Hill Z. Neonatal care practices in sub-Saharan Africa: a systematic review of quantitative and qualitative data. J Health Popul Nutr. 2018;37(1):1–12.
3. Wisniewski JA, Phillipi CA, Goyal N, Smith A, Hoyt AEW, King E, et al. Variation in Newborn Skincare Policies Across United States Maternity Hospitals. Hosp Pediatr. 2021 Sep 1;11(9):1010–9.
4. Renz H, Skevaki C. Early life microbial exposures and allergy risks: opportunities for prevention. Nat Rev Immunol. 2021 Mar;21(3):177–91.
5. Johnson E, Hunt R. Infant skin care: updates and recommendations. Curr Opin Pediatr. 2019;31(4):476–81.
6. Leung DYM, Boguniewicz M, Howell MD,

Nomura I, Hamid QA. New insights into atopic dermatitis. J Clin Invest. 2004 Mar 1;113(5):651–7.

7. Thomsen SF. Atopic dermatitis: natural history, diagnosis, and treatment. Int Sch Res Not. 2014;2014.
8. Lebwohl MG, Del Rosso JQ, Abramovits W, Berman B, Cohen DE, Guttman E, et al. Pathways to managing atopic dermatitis: consensus from the experts. J Clin Aesthetic Dermatol. 2013 Jul;6(7 Suppl):S2–18.
9. Ayanlowo O, Puddicombe O, Gold-Olufadi S. Pattern of skin diseases amongst children attending a dermatology clinic in Lagos, Nigeria. Pan Afr Med J. 2018;29(1):1–10.
10. Puddicombe OT, Odusote OA, Lesi FEA, Ayanlowo AO. Impact of atopic dermatitis on the quality of life of Nigerian children: A hospital-based cross-sectional study. South Afr J Child Health. 2018;12(4):137–42.
11. Lifschitz C. The impact of atopic dermatitis on quality of life. Ann Nutr Metab. 2015;66(Suppl. 1):34–40.
12. Brunner PM, Leung DYM, Guttman-Yassky E. Immunologic, microbial, and epithelial interactions in atopic dermatitis. Ann Allergy Asthma Immunol. 2018 Jan 1;120(1):34–41.
13. Strachan DP, Wong HJ, Spector TD. Concordance and interrelationship of atopic diseases and markers of allergic sensitization among adult female twins. J Allergy Clin Immunol. 2001 Dec 1;108(6):901–7.
14. Thomsen SF, Ulrik CS, Kyvik KO, Hjelmborg J v B, Skadhauge LR, Steffensen I, et al. Importance of genetic factors in the etiology of atopic dermatitis: a twin study. In: Allergy & Asthma Proceedings. 2007.
15. Akinboro AO, Mejiuni AD, Akinlade MO, Audu BM, Ayodele OE. Spectrum of skin diseases presented at LAUTECH Teaching Hospital, Osogbo, southwest Nigeria. Int J Dermatol. 2015;54(4):443–50.
16. Ogunbiyi AO, Daramola OO, Alese OO. Prevalence of skin diseases in Ibadan, Nigeria. Int J Dermatol. 2004;43(1):31–6.
17. Lopez Carrera YI, Al Hammadi A, Huang YH, Llamado LJ, Mahgoub E, Tallman AM. Epidemiology, Diagnosis, and Treatment of Atopic Dermatitis in the Developing Countries of Asia, Africa, Latin America, and the Middle East: A Review. Dermatol Ther. 2019 Dec 1;9(4):685–705.
18. Flohr C, Mann J. New insights into the epidemiology of childhood atopic dermatitis. Allergy. 2014;69(1):3–16.
19. Akinola OI, Fabamwo AO, Tayo AO, Rabiu KA, Oshodi YA, Alokha ME. Caesarean section – an appraisal of some predictive factors in Lagos Nigeria. BMC Pregnancy Childbirth. 2014 Jun 30;14(1):217.
20. Yemaneberhan H, Flohr C, Lewis SA, Bekele Z, Parry E, Williams HC, et al. Prevalence and associated factors of atopic dermatitis symptoms in rural and urban Ethiopia. Clin Exp Allergy. 2004;34(5):779–85.
21. Schram M, Tedja A, Spijker R, Bos J, Williams H, Spuls PI. Is there a rural/urban gradient in the prevalence of eczema? A systematic review. Br J Dermatol. 2010;162(5):964–73.
22. Desalu OO, Adeoti AO, Ojuawo OB, Aladesanmi AO, Oguntoye MS, Afolayan OJ, et al. Urban–Rural Differences in the Epidemiology of Asthma and Allergies in Nigeria: A Population-Based Study. J Asthma Allergy. 2021;14:1389.
23. Kaesler S, Skabytska Y, Volz T, Biedermann T. The biodiversity hypothesis and immunotolerance in allergy. Allergo J Int. 2018;27(5):140–6.
24. Torow N, Hornef MW. The neonatal window of opportunity: setting the stage for life-long host-microbial interaction and immune homeostasis. J Immunol. 2017;198(2):557–63.
25. Jang H, Matsuda A, Jung K, Karasawa K, Matsuda K, Oida K, et al. Skin pH is the master switch of kallikrein 5-mediated skin barrier destruction in a murine atopic dermatitis model. J Invest Dermatol. 2016;136(1):127–35.
26. Elias PM. Stratum corneum acidification: how and why? Exp Dermatol. 2015/02/17 ed. 2015 Mar;24(3):179–80.
27. Lee SY, Yu J, Ahn KM, Kim KW, Shin YH, Lee K shin, et al. Additive effect between IL-13 polymorphism and cesarean section

delivery/prenatal antibiotics use on atopic dermatitis: a birth cohort study (COCOA). PloS One. 2014;9(5):e96603.

28. Renz-Polster H, David MR, Buist AS, Vollmer WM, O'Connor EA, Frazier EA, et al. Caesarean section delivery and the risk of allergic disorders in childhood. Clin Exp Allergy. 2005;35(11):1466–72.
29. Dominguez-Bello MG, De Jesus-Laboy KM, Shen N, Cox LM, Amir A, Gonzalez A, et al. Partial restoration of the microbiota of cesarean-born infants via vaginal microbial transfer. Nat Med. 2016 Mar;22(3):250–3.
30. Cole-Adeife O, Anaba E, Otrofanowei E, Akinkugbe A, Ayanlowo O. The Use of Antiseptic Soaps and Disinfectants in a Semi-Urban Community in Lagos. Niger J Dermatol. 2022;12(2).
31. Okpaleke MH, Ndikom CM, Bulama KU. Incidence of umbilical cord infection in neonates receiving 7.1% chlorhexidine gel and methylated spirit in Ibadan. J Neonatal Nurs. 2019 Feb 1;25(1):20–5.
32. Madhu R, Chandran V, Anandan V, Nedunchelian K, Thangavelu S, Soans ST, et al. Indian Academy of Pediatrics Guidelines for Pediatric Skin Care. Indian Pediatr. 2021 Feb 1;58(2):153–61.
33. Schmid-Wendtner MH, Korting HC. The pH of the skin surface and its impact on the barrier function. Skin Pharmacol Physiol. 2006;19(6):296–302.
34. Ali SM, Yosipovitch G. Skin pH: from basic science to basic skin care. Acta Derm Venereol. 2013;93(3):261–9.
35. Elias PM, Schmuth M. Abnormal skin barrier in the etiopathogenesis of atopic dermatitis. Curr Allergy Asthma Rep. 2009;9(4):265–72.
36. Hatano Y, Man MQ, Uchida Y, Crumrine D, Scharschmidt TC, Kim EG, et al. Maintenance of an Acidic Stratum Corneum Prevents Emergence of Murine Atopic Dermatitis. J Invest Dermatol. 2009 Jul 1;129(7):1824–35.
37. Lee HJ, Lee NR, Kim BK, Jung M, Kim DH, Moniaga CS, et al. Acidification of stratum corneum prevents the progression from atopic dermatitis to respiratory allergy. Exp Dermatol. 2017 Jan;26(1):66–72.
38. Ayanlowo O, –Adeife OC, Ilomuanya M, Ebie C, Adegbulu A, Ezeanyache O, et al. African oils in dermatology. Dermatol Ther. 2021;e14968.
39. Chong WT, Tan CP, Cheah YK, B. Lajis AF, Habi Mat Dian NL, Kanagaratnam S, et al. Optimization of process parameters in preparation of tocotrienol-rich red palm oil-based nanoemulsion stabilized by Tween80-Span 80 using response surface methodology. PLoS One. 2018;13(8):e0202771.
40. Hon KL, Tsang YC, Pong NH, Lee VW, Luk NM, Chow CM, et al. Patient acceptability, efficacy, and skin biophysiology of a cream and cleanser containing lipid complex with shea butter extract versus a ceramide product for eczema. Hong Kong Med J. 2015;21(5):417–25.
41. Pupala SS, Rao S, Strunk T, Patole S. Topical application of coconut oil to the skin of preterm infants: a systematic review. Eur J Pediatr. 2019;178(9):1317–24.
42. Evangelista MTP, Abad□ Casintahan F, Lopez□ Villafuerte L. The effect of topical virgin coconut oil on SCORAD index, transepidermal water loss, and skin capacitance in mild to moderate pediatric atopic dermatitis: a randomized, double□ blind, clinical trial. Int J Dermatol. 2014;53(1):100–8.
43. Verallo-Rowell VM, Dillague KM, Syah-Tjundawan BS. Novel antibacterial and emollient effects of coconut and virgin olive oils in adult atopic dermatitis. Dermatitis. 2008;19(6):308–15.
44. Danby SG, AlEnezi T, Sultan A, Lavender T, Chittock J, Brown K, et al. Effect of olive and sunflower seed oil on the adult skin barrier: implications for neonatal skin care. Pediatr Dermatol. 2013;30(1):42–50.
45. Cooke A, Cork MJ, Victor S, Campbell M, Danby S, Chittock J, et al. Olive oil, sunflower oil or no oil for baby dry skin or massage: a pilot, assessor-blinded, randomized controlled trial (the Oil in Baby SkincaRE [OBSeRvE] Study). Acta Derm Venereol. 2016;96(3).

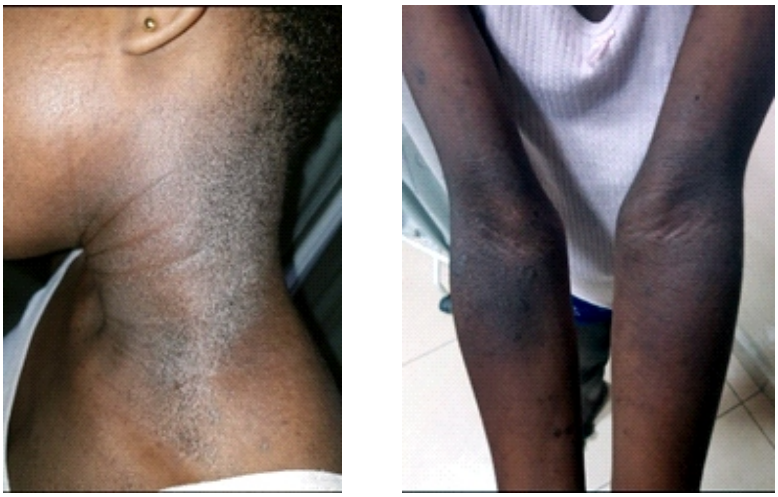

Figure 1 – Flexural dermatitis of AD in a Nigerian child

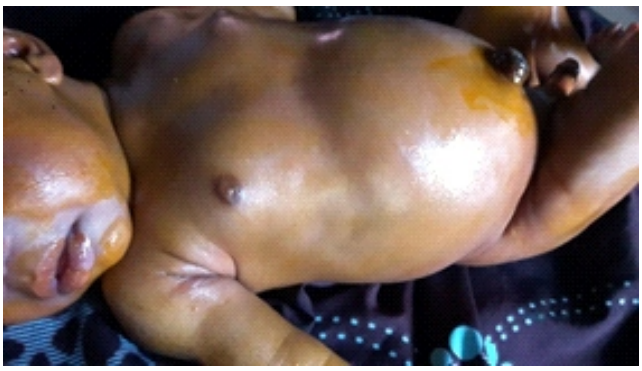

Figure 4 – A new-born cleaned with red palm oil in TBA centre

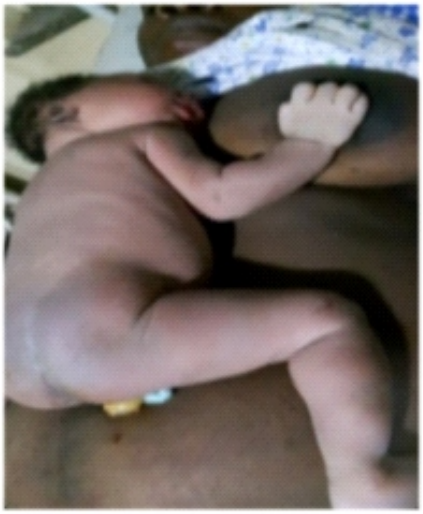

Figure 3a - Skin-to-skin contact after vaginal birth

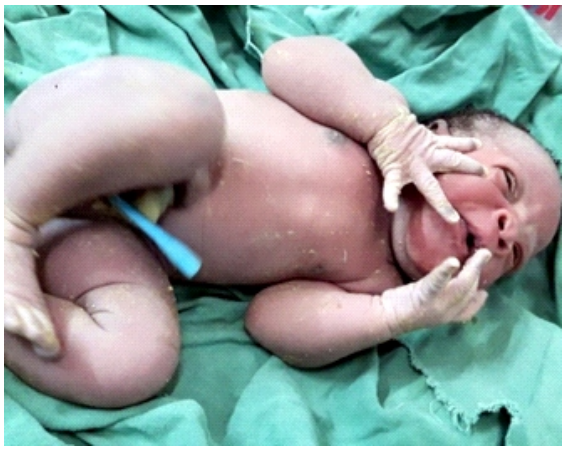

Figure 3b – Baby placed on hospital drapes after CS birth

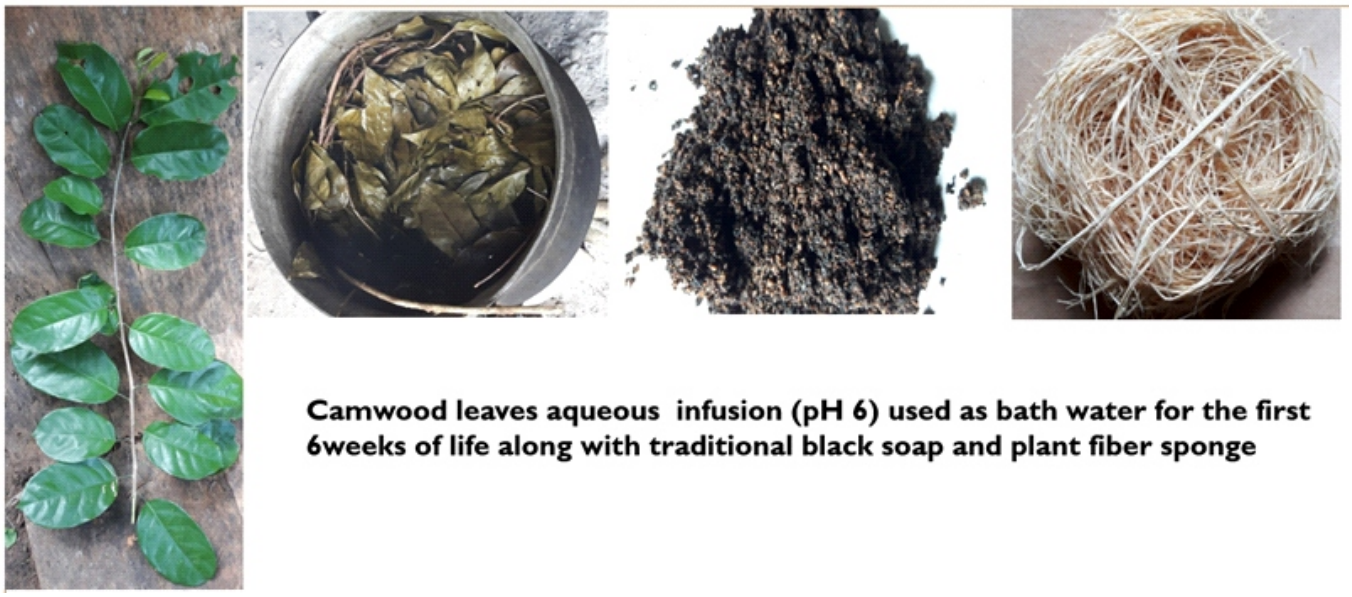

Figure 4 – Newborn bath regimen in TBA centre

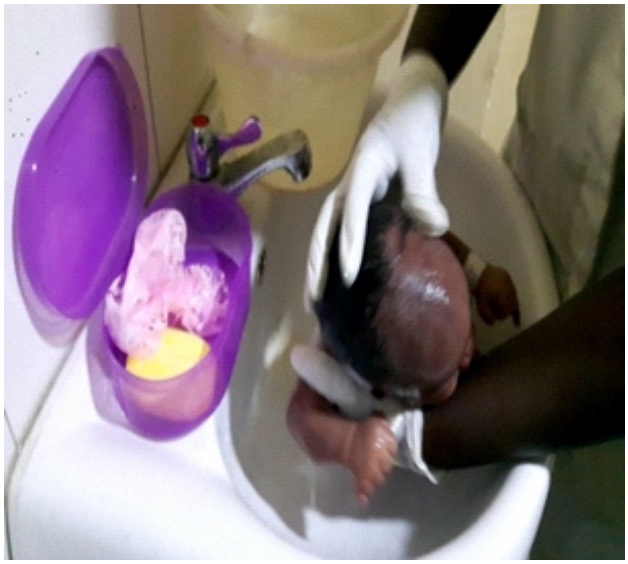

Figure 5 – A new-born bathed with alkaline soap and tap water in an urban maternity facility