doi:10.36849/JDD.7305

 ORIGINAL ARTICLE

Racial and Ethnic Variations in Skin Barrier Properties and Cultural Practices in Skin of Color Newborns, Infants, and Children

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ABSTRACT

Background: The skin of newborns and infants of all races/ethnicity is more susceptible to skin barrier disruption than adult skin. This consensus paper offers insights into potential skincare implications for using gentle cleansers and moisturizers for skin of color (SOC) newborns, infants, and children.

Methods: Six pediatric dermatologists and dermatologists used a Delphi communication technique to adopt 5 statements for SOC newborns, infants, and children on skin barrier integrity and the importance of skin care to promote a healthy skin barrier.

Results: Regardless of ethnicity, newborn and infant skin is still developing and more susceptible to infections and chemical and thermal damage. A growing body of evidence supports skincare starting early in life, recognizing that the ongoing daily use of gentle cleansers and moisturizers containing barrier lipids, such as ceramides, promotes a healthy skin barrier. Understanding cultural differences in everyday skincare practices for SOC newborns, infants, and children is critical for developing an evidence base to substantiate skincare practices.

Conclusions: Closing knowledge gaps in the clinical presentation, cultural differences, and approach to treating skin conditions using skincare for SOC newborns, infants, and children may improve patient outcomes.

J Drugs Dermatol. 2023;22(7):657-663. doi:10.36849/JDD.7305

INTRODUCTION

Newborn and infant skin is still developing, as indicated by elevated trans-epidermal water loss (TEWL), skin surface pH, and desquamation.[1-8] The skin of newborns and infants, with its distinct anatomical and functional properties, is susceptible to skin barrier disruption.[1-8]

Newborn and infant skin has elevated thermal conductance and is more susceptible to infections and chemical and thermal damage because of immature barrier function.[1-9] The neonatal and infant skin requires particular caution with topical skincare regimens.[8-14] Advice on how best to care for newborns' and infants' skin has long been debated, with opinions repeatedly changing over time in response to new concerns.[14] Further, skincare guidelines should also consider racial/ethnic variations in skin properties and cultural practices to allow healthcare professionals to tailor recommendations to individual patients.

Data on racial and ethnic variations, effects on barrier function, and the potential role of adjunctive skin care for newborns, infants, and children are relatively limited. Newborns and infants with a skin of color (SOC) include people of African,

Asian, Latinx, and First Nations descent. Knowledge gaps in the clinical presentation, cultural differences, and approach to treating skin conditions using skincare for SOC newborns, infants, and children contribute to disparities in care.[1]

This manuscript offers insights into these knowledge gaps and their potential skincare implications for using gentle cleansers and moisturizers for SOC newborns, infants, and children.

MATERIALS AND METHODS

A panel of 6 pediatric dermatologists and dermatologists (advisors) who treat newborns, infants, and children of SOC developed a consensus paper for this population on skin barrier integrity and the importance of ceramides (CERs)-containing skincare to help maintain their developing skin barrier. The paper used the Delphi communication technique for interactive decision-making for medical projects.[16,17] The selected information from the literature searches, coupled with the advisors' opinions and experience, was used to adopt statements that aim to provide clinical information for pediatric dermatologists, dermatologists, and pediatric healthcare providers treating SOC newborns, infants, and children.

Structured Literature Review

On February 12, 2022, the advisors convened in Miami Beach, Florida. In preparation for the meeting, a structured search of the English-language literature was performed on December 23, 2021, using PubMed, with Google Scholar as a secondary source. The search included literature on skin barrier function, the current best practices for using nonprescription skincare, and clinical research studies for SOC newborns and infants published in English from 2010 to 2021. Excluded were publications with no original data (unless a review article was deemed relevant), not dealing with nonprescription skincare, and written in a language other than English.

Search Terms: *SOC newborns, infants AND skin barrier physiology, function, dysfunction, barrier maturation, vernix, OR erythema, OR skin breakdown, OR diaper care, umbilical cord care, OR skin barrier protection, AND depletion of stratum corneum lipids, AND atopic dermatitis prevention, AND treatment, OR mitigation of atopic dermatitis, AND skincare, cleansers, moisturizers, emollients, ceramides, ce¬ramide containing skincare, AOR SOC newborns, infants AND skin maturation and moisturization, efficacy, safety, tolerability, OR SOC newborns, infants, AND skin irritation using skincare.*

Selected publications were manually reviewed for additional resources.

The searches yielded 128 papers and, after the exclusion of 21 articles, 107 papers clinically relevant to current best practices in SOC newborns and infants to promote skin barrier integrity and to help mitigate atopic dermatitis (AD) remained. Of the 107 papers, 60 addressed newborns, infants, and skincare generally, and 19 discussed specifically SOC newborns, infants, and skincare. Although the number of clinical studies on skincare for this group is growing, there were no robust comparative studies on skincare for SOC newborns, infants, and children to justify a systematic review.[17]

To estimate the state of the art in skin care for SOC newborns, infants, and children, the 23 clinical studies were graded independently by 2 reviewers (AA and HA). The reviewers assigned a level of evidence for each treatment (Type of study: A [high quality clinical double-blind, randomized controlled trial (RCT)], B [lesser quality RCT], C [comparative study with severe methodological limitations], and 1 [further research is unlikely to change confidence in the estimate of treatment effect] to level 4 [any estimate of effect is very uncertain]) using the pre-established criteria.[17]

Development of the Statements

The reviewers drafted 17 evidence-based statements on the role of skin care in promoting a healthy barrier in SOC newborns and infants and the potential mitigation of AD in SOC children. During the meeting, the advisors were divided into 3 groups, and drawing from the draft statements, they each selected their top 5 statements. After discussion, the advisors reached a consensus on 5 statements focusing on the science of racial/ethnic skin barrier differences and the importance of cultural practices, underscoring the need for clinicians to understand that there are physiological and cultural differences to consider when treating newborns and infants with SOC.

RESULTS

Statement 1: *Excluding culture and ethnicity restricts our overall understanding of health research evidence.*

Studies evaluating racial/ethnic differences in skin properties have been small-scale and mainly include adults rather than children.[10,18] These studies have shown inter-individual differences and inconsistencies in anatomical study sites measured, which are greater than racial/ethnic differences measured by the investigators.[10,18] Xerosis occurs in all races; however, the severity and impact of xerosis between racial/ethnic groups can vary.[18]

Misdiagnosis of dermatologic conditions is common in newborns/infants with SOC, as many clinicians expect these conditions to look and behave as they do in White infants.[19,20]

An algorithm for practitioners to address skin conditions in newborns and infants was published previously; however, the racial/ethnic variations in the skin of neonates as well as cultural differences, require additional considerations for clinicians and

FIGURE 1. Infant with a violaceous atopic dermatitis lesion on the cheek. *Photo courtesy of Jaggi Rao MD*

offer even more opportunity to tailor their approach to skincare for these patients.[15] A study on SOC newborns in the United Kingdom (UK) evaluated TEWL, pH, stratum corneum (SC) hydration, melanin, dryness, and erythema at birth and week 4; while parents/caretakers completed a qualitative diary on skin care practices and skin observations.[67] SC hydration and melanin increased in the first 4 weeks of life, and SC pH and erythema decreased significantly. Parents reported being frequently insecure, and noted all minor skin changes in the infants' skin prompted product use. The study observed that skin integrity and skin care practices of infants from SOC groups in the UK differed significantly from White infants. The SOC study group used more skincare products than their White counterparts, particularly oils (used on 62.4% of SOC infants, n=83). This study, and more deliberative studies with SOC newborns, infants, and children that investigate racial/ethnic and cultural differences, may be useful for infant skin care guidelines to provide culturally sensitive advice relevant to the real-world context of newborns and infant care.

Statement 2: *Genetic and environmental factors influence the stratum corneum barrier properties and function. Biophysical studies are needed to help patients make informed skincare choices.*

Increasingly studies on SOC groups show variability in the skin's physiological properties, which influences the SC condition and sensitivity to exogenous agents.[18] Investigations using biophysical measurements to report racial/ethnic differences in skin properties may include TEWL, water content, SC pH, ceramide level, and skin reactivity.[18] Studies reporting TEWL differences between adult SOC groups have yielded conflicting results. Studies on adults showed differences in SC characteristics among SOC groups. These included a higher TEWL and ceramide content in Asian skin and lower water and ceramide content in Black skin.[18] Additionally, the study showed a higher skin reactivity in Asian compared with Black and White skin.[18] Additional biophysical assessments to better determine racial/ethnic variations in skin properties would assist in more tailored skincare product selection.[10,18]

Statement 3: *Literature suggests racial/ethnic variations in ceramide content, stratum corneum structure, and filaggrin mutations.*

Although the role of race and ethnicity in the pathophysiology of AD remains unclear, variations in the epidemiology, clinical presentation, disease course, and impact on quality of life have been reported in different racial/ethnic populations.[36-42] An extensive population-based survey of 102,353 families representing all 50 US states (National Survey of Children's Health [NSCH]) showed that African American children are 1.7 times more likely to have AD than their White counterparts even when adjusting for household income, parental education level, metropolitan vs rural environment, and health insurance coverage status.[36]

Although several studies have consistently found filaggrin (FLG) loss-of-function mutations in up to 50% of European and 27% of Asian patients with AD, FLG mutations were 6 times less common in African Americans than in European American patients, even in patients with severe AD.[41] Korean, Japanese,

FIGURE 2. Child with a dark brown atopic dermatitis lesion. *Photo courtesy of Jaggi Rao MD.*

FIGURE 3. Infant with a reddish brown atopic dermatitis lesion. P*hoto courtesy of Jaggi Rao MD.*

Chinese, Singaporean, and Taiwanese populations all have specific FLG null mutations unique to their ethnic group, and they rarely exhibit the mutations commonly observed in White patients with AD.[43] FLG mutations seem to play less a pathogenic role in patients of African origin than in individuals of European or Asian ancestry.[41,43]

Loss of function in FLG has been associated with skin barrier abnormalities, the abnormal architecture of the lamellar bilayer, and increased TEWL in White patients with AD.[44] The prevalence of loss of function in FLG varies by population, with lower frequencies reported in AD patients of East Asian and African descent.[44]

Some data do suggest that an increase in TEWL and a decrease in CER in Black skin may contribute to pruritus and its related conditions.[45,46] Studies from AD patients of Asian and African descent living in Europe and the US indicate that pruritus may be more frequent and severe.[46] Further variations in mast cell composition have been shown in Black skin, which may be of functional relevance.[47]

Studies mostly on White newborns have indicated an impaired SC barrier function at birth in AD-predisposed newborns.[11] An impaired skin barrier function assessed at birth and 2 months of age may precede clinical AD.[12] Following this assumption, therefore, a genetically predisposed child may present with xerosis; however, the exposure to environmental triggers may lead to actual AD flares.[31,32]

Two small prospective, randomized controlled trials demonstrated that daily moisturizer use prevented AD in 32% of Japanese and 50% of Anglo-American high-risk newborns.[50,51] The Japanese study further suggested that allergic sensitization during this period was associated with AD but not with moisturizer use.[50] More recent and ongoing studies are still evaluating whether neonatal moisturization in AD-prone newborns is significantly beneficial.[52]

Although there are few studies including SOC infants and children, skincare such as cleansers and moisturizers should be integral to AD prevention, treatment, and maintenance for all newborns, infants, and children.[14,15]

Statement 4*: In all ethnic categories, newborn/infant skin has elevated transepidermal water loss, altered skin surface pH values, and increased desquamation, making it more susceptible to sensitization, infections, and chemical and thermal damage.*

Skin surface pH at birth is typically more alkaline than adult skin, ranging from 6.34 to 7.5, depending on the anatomical site.[14,15] A mature SC has a pH usually between 4.0 to 6.0, while the body's internal pH is about 7.4.[24] Skin acidification plays an important role in barrier maturation and the activation of enzymes involved in the extracellular processing of SC lipids.[6,8-11,14]

FIGURE 4. Gray atopic dermatitis lesion in a deeply pigmented child. *Photo courtesy of Jaggi Rao MD.*

Studies comparing newborn and infant with adult skin properties in various SOC populations found similar differences in SC thickness, water handling properties, and SC pH between infants and adults, as studies that did not distinguish between ethnicities.[1,35,55-57] Infant SC was thinner than adult SC and exhibited higher SC pH, water content, and TEWL levels (Table 1).[1,35,55-57]

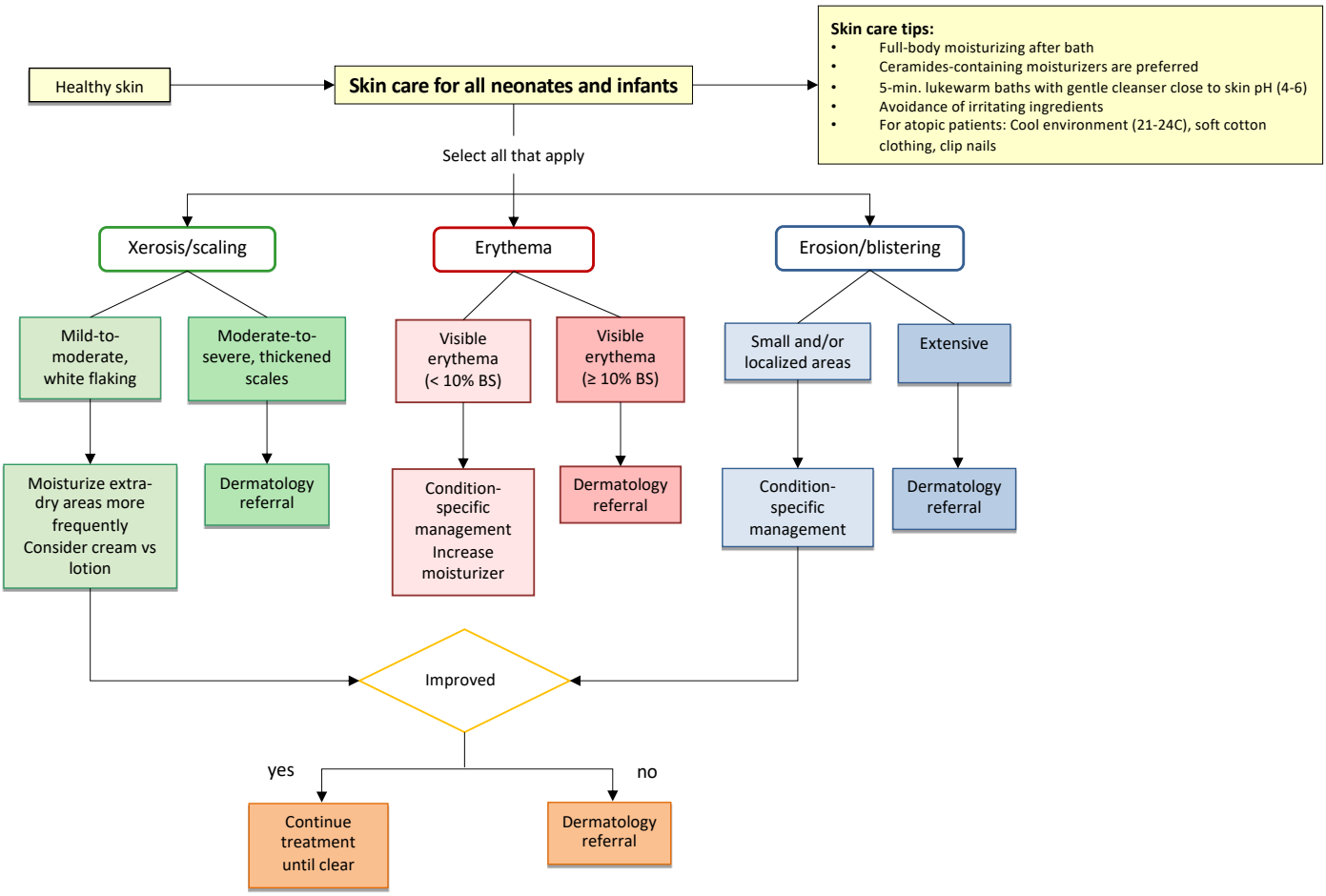
The skin of newborns and infants is more fragile and at risk of heat loss, has elevated thermal conductance, and is more susceptible to infections and chemical and thermal damage than adult skin.[1-9] Exposure to common irritants, including saliva, nasal secretions, urine, feces, fecal enzymes, dirt, and microbial pathogens for long periods can lead to discomfort, irritation, infection, and skin barrier disruption in the vulnerable newborn and infant skin.[14,15] Particular caution with topical skincare regimens is needed for newborns and infants, requiring products with a physiological pH-(4.0 to 6.5).[8-14] The use of cleansers and moisturizers containing SC lipids may help maintain and promote the protective skin barrier and soothe with long-term moisturizing benefits.[14]

Newborns and infants are particularly vulnerable to transcutaneous toxin exposure as they have a high surface-to-weight ratio, immature epidermis, and a compromised skin barrier.[58] Topical agents, which are harmless for adults, may cause respiratory distress, neurological toxicity, and even death in the pediatric and neonatal age groups depending upon systemic absorption.[14,15,58] Topical agents that may cause toxic reactions include isopropanol, benzocaine, pyrethrin, hexachlorophene, salicylic acid, and many others.[14,15,58]

Statement 5: *Skincare for neonates and infants should be:*

- *Safe*
- *Promoting a healthy skin barrier*
- *Fragrance and sensitizing agent-free*
- *Pleasant to use*
- *Containing ingredients that benefit the lipid and water content of the stratum corneum, such as those products containing ceramides.*

FIGURE 5. Algorithm for skincare in newborn and infant skin. Reproduced with permission from Schachner LA et al, *J Drugs Dermatol.*[15]



Given the vulnerability of their skin, safety is the primary consideration for the selection of skincare for newborns and infants. Additionally, SC surface pH, water content, and lipid composition must be considered when maintaining a healthy skin barrier.[14,24] Soaps, surfactants, and detergents, especially those with a pH >6, may excessively remove skin lipids, elevating SC pH and damaging the newborn and infant skin.[14,15] Gentle cleansers (pH 4.0-6.0) containing CERs and no soap are less irritating than alkaline soaps.[14,15,24,59-66]

A study in children comparing a synthetic cleanser of non-ionic and amphoteric surfactants (pH around 5.5) with water showed that neither the cleanser nor water compromised SC integrity.[65] Other reports recommend that a gentle liquid cleanser (pH 4–6.5) is preferred for infants; however, studies are frequently small or have other methodological flaws.[14,15,24,59-66]

The advisors agreed that understanding cultural differences in everyday skincare practices is critical for developing an evidence base to substantiate SOC newborn, infant, and children's skincare practices. The advisors discussed how the potentially sensitizing ingredients, including the use of fragrance or essential oils, is often associated with cultural tradition. These culture practices are important to consider when recommending skincare products or practices to the parents of SOC newborns, infants, and children.

The choice of cleanser and moisturizer is dependent on individual preference.[14,15] However, the advice that may be given to parents includes the use of gentle cleansers and moisturizers containing a mixture of fatty acids, cholesterol, and CERs (Figure 5).[14,15,60,61]

TABLE 1.

Functional Differences Between Newborn, Infant, and Adult Skin				
Functional Differences Between Infant and Adult Skin		**Infant**	**Adult**	**References**
Structural Differences	Epidermal thickness	Thinner	Thicker	8
	Cell attachments and epidermal cellularity	Less	More	8
	Dermo-epidermal junction	Flat	Undulating	8
	Lipids	Less	More	8
Functional Differences	Melanin	Less	More	2
	Sweat	Less	More	2
	Water content	Higher	Lower	8
	Natural moisturizing factor concentration	Lower	Higher	5,6,11
	Stratum corneum pH	Higher	Lower	5,6
	Skin immune system	Lower	Higher	10,11
	Skin surface levels of host defense proteins Low levels of IL-1α were found to increase during the neonatal period	Lower	Higher	10,11

LIMITATIONS

Although the number of clinical studies on skincare for infants and children is growing, there were no robust comparative studies on skincare for SOC newborns, infants, and children. After discussion, the advisors reached a consensus on 5 statements focusing on the science of racial/ethnic skin barrier differences and the importance of cultural practices, underscoring the need for clinicians to understand that there are physical and cultural differences to consider when treating newborns and infants with SOC.

CONCLUSION

Regardless of ethnicity, newborn and infant skin is still developing and more fragile and susceptible to infections and chemical and thermal damage. Understanding cultural differences in everyday skincare practices for SOC newborns, infants, and children is critical for developing an evidence base to substantiate skincare practices.

Data on skincare for SOC infants and children are scarce. However, for all ethnicities, a growing body of evidence supports skincare starting early in life, recognizing the benefits of ongoing daily use of gentle cleansers and moisturizers containing barrier lipids to help maintain the protective SC barrier. Skincare for newborns and infants should be safe, effective, inexpensive, and fragrance- and sensitizing agent-free. Additionally, the skincare should be pleasant to use, containing ingredients that benefit the SC's lipid and water content, such as those products containing CERs.

DISCLOSURES

The authors disclosed receipt of an unrestricted educational grant from CeraVe International for support with the research of this work. The authors also received consultancy fees for their work on this project.

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