

Skin Care Practices in Indian Newborns and Infants: Current Scenario

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Abstract: Compared to adults, the skin of newborns and infants is more prone to trauma and infection and requires appropriate care for proper maturation and function. Efforts are ongoing to comprehend how skin care practices and products affect the healthy development of newborn skin. The situation in India is more difficult because newborns and infants' skin is often treated with both conventional and modern methods. Additionally, there is a lack of substantial scientific evidence regarding some of the skin care practices for newborns and infants in India. Here, we present a comprehensive analysis of the current state of skin care in Indian newborns and infant populations. This review article was developed after conducting an in-depth literature analysis on the current skincare practices for newborns and infants. It focuses on the evidence supporting the best skin care practices in various settings, including hospital and intensive care units, home practices for massage and bathing, selection and use of emollients and other skin care products, and diaper area care. The role of Anganwadi workers in neonatal or infant care is also reviewed. Hence, there is need for standardized guidelines that incorporate both traditional and modern practices to ensure the health and safety of infants. Moreover, addressing the cultural and regional variations in skin care practices can promote better adherence to recommendations among caregivers. In conclusion, further research is required to establish evidence-based practices tailored to suit the Indian scenario and enhance skin care outcomes for newborns and infants. This review aims to inform Indian pediatricians, dermatologists, and primary care physicians about appropriate skin care practices, ultimately improving the overall health and well-being of newborns and infants.

Keywords: emollients, India, infants, newborns, skin care

Introduction

Skin is the largest organ in the human body and is the main component of integumentary system function.¹ According to the World Health Organization (WHO) 2024 report, around 2.3 million newborns died during first month of their life in 2022; neonatal infections and congenital anomalies, premature birth and birth complications were the most frequent causes of neonatal death.² Skin care for newborns or infants forms an integral part of 'Essential Newborn Care'.³ Hence, it should be given sufficient attention in India. Skin care practices are varied across cultures and communities and can adversely affect babies' healthy skin. Some of these practices followed across India may lack substantial scientific evidence to support their use in routine practice. There is still a significant gap in the scientific literature regarding the effectiveness and safety of many traditional practices. The lack of substantial evidence may lead to the perpetuation of potentially harmful practices, reinforcing the need for developing standardized care practices.

Newborns and infants are a vulnerable population and improper handling, lack of skin care can lead to serious infections. In 2021, the Indian Academy of Pediatrics published guidelines for pediatric skin care to establish best practices that can improve current skin care protocols, thereby enhancing the overall health and well-being of infants and children.⁴ In addition to this guidelines, there are few other studies available that aimed to generate evidence-based recommendations for healthy full-term neonates in India and exploring knowledge gaps, cultural beliefs and behavioural pattern of mothers in infantile (infant) skin care

and awareness in mothers.^{5,6} However, a guidance on proper selection and use of skin care products is still lacking. This review article sheds light on and adds in to the current state of skin care for newborns and infants in India including selection of skin care products and management of diaper area and common skin problems and explores some unique situations including traditional practices and the role of health care community in remote areas in Indian newborn and infants. Additionally, it explores the critical role of healthcare providers, including Anganwadi workers, in educating caregivers about safe skin care practices, especially in remote areas of India.

Methods

A literature search was conducted using the PubMed and Google Scholar databases to identify relevant publications that discussed the outcomes of current skincare practices for newborns and infants in India. Search terms included were “neonate”, “infant”, “newborn”, “skincare”, “India”, “emollient”, “diaper area care”, “massaging”, “paediatricians”, “dermatologists”, and “primary care physician”. The retrieved articles were collected and screened to find out the evidence for each section and their suitability for inclusion. Additionally, the reference lists of primary articles were checked to identify relevant studies that might have been missed in the search process. All the members reviewed and discussed the articles obtained and finalised them for inclusion in the manuscript. All the authors participated in the development and review of the manuscript.

Discussion

Skin Barrier

Overview

The skin comprises of several layers of ectoderm and mesoderm that acts as a physical barrier between the environment and the body's muscles, internal organs, bones, and connective tissues. Skin is highly dynamic and adaptive organ in the body and has a variety of roles, including facilitation of sensation, temperature regulation, barrier function, vitamin D production, immune-protection, electrolyte, and water homeostasis, ultraviolet⁷ light absorption, etc.^{8,9} The efficacy of the skin in carrying out these functions is largely determined by its structural characteristics, including thickness, porosity, vascularisation, and conductance.^{9,10}

Age-Related Changes in Skin Barrier

The structural characteristics of the human skin vary throughout the life cycle. In infants (6–24 months), the skin is 20%–30% thinner than an adult's,¹¹ and this difference is even more pronounced in full term and preterm newborns. The skin undergoes dramatic structural and functional changes during the first five years of life, marked primarily by increased thickness and vascularisation, which continue to occur at puberty, with maintenance through adulthood.^{11–14} Considering the skin of newborn undergoes an extensive process of maturation, skin care should be personalized per the individual newborns.⁸

Importance of Skin Barrier

As a result of the natural skin development cycle, the newborn and infant skin is a relatively inefficient external barrier compared to adults.^{7,8} This might be due to thinner stratum corneum and epidermis, smaller corneocytes and granular cells, and larger intercellular junctions in infants compared with adults.^{7,8,15} Therefore, newborn and infant skin is much more sensitive to the absorption of environmental toxins, trauma, impaired temperature regulation, dehydration, and the penetration by UV light and infectious agents than the adult skin.¹⁶ Furthermore, the barrier function of newborn skin is compromised by skin cell and tissue immaturity, atmospheric temperature, and internal and external microbial milieu.^{8,16} However, with time newborns and infants develop the ability to produce barrier components and protectants, including specialised immune cells, natural oils, and melanin.

Risk Associated with Inappropriate Skin Care

Improper skin care in newborns and infants involves the lack of recognition of the delicate nature, penetrability and immunological naïveté of the neonatal skin; thus, creating significant clinical risk.¹⁷ In newborns, inappropriate skin care practices increase the risk of trans-epidermal water loss (TEWL), dehydration, septicaemia, and skin sepsis or infection.¹⁷ In infants, diaper forms an occluded environment, which is vulnerable to skin overhydration and decrease

in pH.^{16,18} Skin care practices that expose newborns and infants to hard water for prolonged periods increase the risk for eczema and dry skin.¹⁷ Exposure to indoor heating, pollutants, and environmental toxins can weaken barrier function and increase the risk of allergic or microbial infiltration in newborns and infants.¹⁹

Management of Common Skin Conditions in Newborns and Infants

The details of the common skin conditions in newborns reported in studies across India are presented in Table 1.^{20–31} Sebaceous gland hyperplasia (SGH, 6.0%–89.4%), Epstein pearls (10.5–89.1%), and Mongolian spot (42.5%–84.7%) were the most common physiological skin lesions, and eczema (9.3%), erythema toxicum neonatorum (ETN, 8.4%–36.4%) and Milia (3.0%–51.1%) were the frequent transient noninfective conditions reported in newborns.^{20–23,25–31} The majority of physiological lesions require no therapy however, it is vital to differentiate the benign and clinically significant skin lesions to avoid unnecessary treatments.²⁸ The SGH are yellow coloured florid multiple papules (found over the nose, cheeks and upper lips), which are the manifestation of maternal androgen stimulation, and resolves within few weeks without any treatment.³² Another lesions observed are Epstein pearls, which are yellowish white keratinous cysts (found in alveolar ridges or junction of soft and hard palate in the midline) and disappear within few weeks and do not require any treatment.^{32,33} Although Mongolian spots or patches are benign in nature, they might be associated with inborn errors of metabolism and neurocristopathies, and thus should be differentially diagnosed critically to avoid future health risk.³⁴ Additionally, Mongolian spots sometimes can be confused with bruises secondary to child abuse, hence, documentation at birth is necessary.^{34,35} Mongolian spots do not require any treatment and fade away with increasing age however, sometimes certain cosmetic techniques are used in adults.^{36,37} The ETN is the most common skin eruption (multiple erythematous macules and papules) usually appears on first or second week of life in the healthy full-term newborns, which stimulate flea bites.³² The ETN do not require any treatment and the best approach is to give assurance to caregivers that it is benign and will resolve in 5–14 days.^{38,39}

Current Indian Neonatal and Infant Skin Care Practices

Neonatal Skin Care at Birth

Skin Assessment

Although skin care assessment is an integral part of neonatal skin care practice, evidence suggest that skin assessments tools including the neonatal skin condition score (NSCS), Neonatal Skin Risk Assessment Scale (NSRAS) and Braden Q are used rarely in neonatal intensive care units (NICUs) in India.⁴⁰ Hence, it is essential that the skin care assessment should get much attention for the overall improvement of skin care practice in India.

Cleansing the Newborn Soon After Birth

In both urban and rural scenarios, it is common for neonatal skin to be wiped free of blood and/or meconium after birth.⁵ Indian paediatricians recommend using a wet cloth to wipe, followed by a dry cloth.⁴ For drying of newborn's skin, wiping is widely preferred considering thermoregulation and resuscitation as a priority.⁴¹

In full-term newborns, the skin surface is neutral or alkaline (pH 6.2–7.5) during birth, and progresses to mildly acidic (pH 5.0–5.5) over the first 4 weeks of life.⁴² As a part of initial care in nursing homes, the vernix caseosa is wiped off from the wet skin of the newborn. A recent study from Uttar Pradesh showed that culturally, people wipe off the vernix caseosa considering it as a dirty substance that is infectious to newborn.⁴³ However, in addition to the Indian Academy of Paediatrics (IAP) recommendation, a recently published evidence-based consensus for full-term newborns suggested avoiding vigorous rubbing of newborn skin as it may disturb the function of the vernix caseosa, which usually sloughs off or gets absorbed naturally within 48 hours after birth.^{4,5} Moreover, the WHO guidelines and neonatal resuscitation program (NRP) also advocated against vigorous rubbing of the newborns.^{44,45} Additionally, lanugo is normal and naturally sheds with in first few days of birth, and removal of lanugo using cultural practices can lead to infections.⁴⁶ Thus, mothers and health care providers (including Accredited Social Health Activists [ASHA] workers) should be educated on proper cleansing procedures used for the newborns.

Table 1 Common Skin Conditions Reported in Newborns and Infants Across Studies from India

Author, et al	Study	Region	Population	Skin Conditions Reported
Quazi S, et al, 2023 ²⁰	Cross-sectional observational study	Maharashtra	474 newborns (Day 0–28 of birth)	90 (19.0%) had single dermatosis, 384 (81.0%) had ≥1 form of dermatosis Most common were SGH (22.2%), Epstein pearls (10.5%), ETN (8.4%), physiological desquamation (5.3%), miliaria (4.6%)
Choudhary P, et al, 2022 ²¹	Hospital-based, descriptive, observational study	Rajasthan	5000 newborns (Day 0–28 of birth)	92% had physiological skin changes: SGH (65.3%), milia (51.1%), physiological desquamation (41.2%), and vernix caseosa (35.0%)
Gupta B, et al, 2021 ²²	Observational study for one year	Southern Assam	150 newborns (Day 0–28 of birth)	Five most common dermatoses were diaper dermatitis (17.3%), miliaria (14.0%), erythema toxicum neonatorum (13.3%), infantile seborrheic dermatitis (12.7%), sebaceous gland hyperplasia (6.0%), and Mongolian spot (6.0%)
Kar C et al, 2020 ²³	Observational descriptive study for one year	West Bengal	108 newborns	Infective skin diseases (43.5%), nevi and other developmental disorders (19.5%), keratinisation disorders (9.3%), eczematous conditions (9.3%), and miscellaneous (17.6%)
Behera B, et al, 2018 ²⁴	Hospital-based cross-sectional observational descriptive study	Odisha	150 newborns (Day 0–28 of birth)	199 had two dermatoses while 104 had one. 812 different dermatoses were reported Mongolian spot (42.5%), SGH (38.8%), and Epstein pearls (32.8%) were the common observations
Shivakumar S, et al, 2018 ²⁵	Cross-sectional observational study for one year	Karnataka	104 newborns of <28 days old	Mongolian spot (33.0%), erythema toxicum neonatorum (26.0%), physiological desquamation of the skin (20.0%), milia (10.6%), and miliaria (5.8%)
Shubhankar M, et al, 2017 ²⁶	Single-centre observational study from January 2015 to December 2016	Odisha	500 newborns	- Out of the 70.7% physiological lesions, benign transient lesions were 44.6% (papulopustular dermatoses, 25.9%; erythema toxicum, 13.1%) - Out of 37.8% birthmarks, pigmentary birthmarks were 24.5% and Mongolian spots were 19.4% - Out of 29.3% pathological lesions, nappy rash was 18.01%
Sandeep B, et al, 2016 ²⁷	Hospital-based observational study for one year	Bangalore	260 newborns below 28 days of life	Mongolian spot (61.6%), erythema toxicum neonatorum (36.4%), milia (32.4%), physiological jaundice (10.4%), vernix caseosa (7.2%), transient pustular lesions (6.8%), and physiological desquamation (6.4%)
Haveri FT and Inamadar AC, 2014 ²⁸	Cross-sectional prospective study from November 2007–May 2009	Karnataka	1000 newborns within the first 4 weeks of life	Skin lesions reported were sebaceous gland hyperplasia (89.4%), Mongolian spot (84.7%), knuckle pigmentation (57.6%), linea nigra (44.5%), hypertrichosis (35.3%), acrocyanosis (30.9%), miniature puberty (13.3%), physiological scaling (10.5%), and vernix caseosa (7.7%)
Sachdeva M, et al, 2002 ²⁹	Observational study from April to October 2000	Amritsar	500 consecutive newborns within five days of birth	The physiological skin changes observed were Mongolian spot (60.2%), superficial cutaneous desquamation (40%), icterus (25.6%), milia (23.8%), sebaceous gland hyperplasia (21.4%), occipital alopecia (18.8%), lanugo (14.4%), peripheral cyanosis (9.4%), breast hypertrophy (5.8%) and miniature puberty (5.6%)
Nanda A, et al, 1989 ³⁰	Observational study for seven months	Chandigarh	900 consecutive newborns within 48 hrs of birth	Commonly observed skin lesions were Mongolian spots (62.2%), milia (34.9%), sebaceous hyperplasia (31.8%), salmon patches (28.4%), and erythema toxicum neonatorum (20.6%)

Abbreviations: ETN, erythema toxicum neonatorum; SGH, sebaceous gland hyperplasia.

Skin-to-Skin Care

As per the WHO recommendation, newborns need to be placed in skin-to-skin contact with the mother immediately after birth and this should be continued uninterrupted for an hour.⁴⁷ Hypothermia is a common risk reported within three hours after birth, and skin-to-skin care practice reduces hypothermia significantly. It also helps to stabilise the newborn and begin breastfeeding early. However, this practice is marginally followed in India. A study from western India depicted non-adherence to skin-to-skin contact, mainly due to a lack of awareness about this essential newborn care practice.⁴⁸

Therefore, it is important to provide education regarding newborn and infant skin care to both parents and healthcare providers.

Bathing Practices

Bathing practices for newborns in India are frequently ritualised and influenced by culture and region (Table 2).^{49–57} In developing countries, bathing a newborn immediately after birth is a common practice⁴⁹ primarily to remove vernix caseosa that is considered “dirty”.⁵⁰ In contrast, evidence suggests immediate bathing significantly increases the risk of hypothermia and infections.^{49,58} The Indian and global guidelines recommend bathing of newborns should be delayed till the newborn has attained thermoregulatory stability which is usually attained 6–24 hours after birth.^{4,5,59,60}

Bathing the newborn by immersing in water is superior to washing.^{61–63} Evidence supports the benefit of adding mild cleansing agents to water for bathing newborns and infants; however, most evidence are either inconclusive or shows that mild cleansers have moderate superiority in preventing TEWL.⁶¹ However, the use of liquid synthetic detergent (syndet) for bathing has been shown to be superior to water alone, by reducing pH imbalance and minimising TEWL.⁶¹

Umbilical Cord Care

Approximately 20% of newborns with sepsis die in hospitals, and a prospective study from Odisha reported that unhygienic umbilical cord care is responsible for nearly 63% of neonatal sepsis.^{49,64} Hence, optimal umbilical cord care is essential to prevent systemic neonatal sepsis. Effective, affordable, and safe community-driven interventions for the neonatal skin and umbilical cord care with an aim to prevent neonatal infections is the need of the hour, especially in developing countries.⁴⁹ The WHO states that the umbilical cord remnant, which typically naturally regresses within weeks, should be cleaned with lukewarm water every day and kept dry and free of dressings. When the stump is soiled, it should be cleaned with Syndet or mild soap, and dried.^{59,60} Chlorhexidine (2.5% v/v chlorhexidine gluconate solution IP) has been used in Indian NICU to prevent umbilical sepsis and colonisation.^{65–67} The diaper should be used below the stump, and bandage or chemical should not be applied on the stump, for optimal umbilical cord care.⁴

Diaper Area Care

The diaper area of newborns and infants is particularly vulnerable to friction, maceration, over-hydration, occlusion, erosion, and basification, due to the continuous contact of diaper with the skin and the retention of urinary and faecal products in the diaper.⁵ Nosocomial sepsis is commonly reported in the NICUs in India, resulting in considerable morbidity and mortality.⁶⁸ It is therefore critical to keep the diaper area clean, dry, and free of physical trauma and shearing forces. In India, cloth diapers have been used frequently in NICU.⁶⁸ Currently, disposable diapers are consistently used as they probably decrease the incidence of nosocomial sepsis and prove to be cost-effective in NICU.⁶⁸

The diaper area is generally cleaned with moistened cloths or cotton balls, followed by a dry cloth to pat the area. The use of mild cleansers is acceptable, and the use of neutral or slightly acidic pH cleansers has been supported. Frequent change of the diaper helps in avoiding dermatitis. The use of topical agents like zinc oxide between changes has also been shown to be more protective than talcum powder.⁶⁹ A rural community-based study from Tamil Nadu revealed that majority (70%) of mothers had inadequate knowledge, 28% reported moderate knowledge and only 2% had adequate knowledge for diaper rashes in infants.⁷⁰ An observational study from India reported that awareness programs to the mothers of 0–1 year child resulted in a significant improvement in knowledge ($p=0.02$), attitude ($p=0.01$) and practice ($p=0.01$) on prevention and management of diaper dermatitis.⁷¹ Hence, mothers and the caregivers should be educated on diaper area care and the risk of subsequent health issues related to improper care.

Use of Emollients

Emollients have been used to soften dry skin and combat the pathogenic and allergenic effects on barrier function.⁵ Various plant oils have been used as emollients in newborn skin.⁷² Olive and mustard oils might have damaging effects on neonatal and infant skin and should be avoided.^{4,72} Oils rich in linoleic acids, such as safflower, argan, sunflower, and almond oil, have been proven to promote skin barrier function and fasten the recovery of the impaired skin barrier. Mineral oils, coconut oil, and petrolatum have also demonstrated similar properties.^{73,74} Sesame and coconut oils were mostly used in Maharashtra while olive oil and mustard oil were preferred in Madhya Pradesh.⁷⁵ As per a recently

Table 2 Common Bathing Practices Reported in Various Studies in Newborns and Infants from India

Odisha	Bathing the baby soon after birth ⁴⁹
Gujarat	Bathing the baby seven days after the birth ⁵¹ Elders prefer wiping the newborn with a cloth soaked in lukewarm water ⁵¹
Tamil Nadu	Turmeric-infused ceremonial baths are commonly conducted on 9th or 10th day of life. ⁵² Bathing was done before dropping off of umbilical cord within 24–48 hours. Most baths were done with massaging. ⁵⁶
Uttarakhand	Traditional chickpea flour baths are commonly given on 3rd day of life ⁵³
Mangalore	Mothers or caregivers add herbs in baby's bath to prevent or reduce the cold to the newborn ⁵⁴ Traditions such as adding 40 stones, placing a needle or adding a gold coin in baby's bath water, with unknown rationale ⁵⁵
Uttar Pradesh	First bath after 24–48 hours. ⁵⁷ Boys were bathed with warm water and girls with cold water with a belief that girls possess more "heat" within and hence it was necessary to "calm" and "cool" their behaviour ⁵⁰

conducted study in Uttar Pradesh, emollient therapy with sunflower oil improved neonatal growth and reduced mortality risk by 58% in infants.⁷⁶ However, the efficacy of emollient therapy in prevention of atopic dermatitis remains inconclusive.^{77,78}

Common Skin Care Practices for Newborns and Infants in Indian Households

Massaging Practices

Newborns and infants are usually massaged with oils in various parts of Asia including India.⁷⁹ Grandmothers or elderly women perform this massage practice, usually from the first day of birth.⁸⁰ The details of massaging practices for newborns and infants in Indian households are described in Figure 1.^{51,52,55,81–85} A cross-sectional study from India reported that infant massage might be associated with increased bone strength, improved sleep and baby growth.⁷⁵ Although, massage therapy for newborns and infants is considered safe without any significant harmful effects,⁷⁵ around 83% mothers reported that neither healthcare provider discussed nor routinely advised infant oil massage.⁷⁵ Nonetheless, the long-term effects of massage practices and clear guidance on the process need to be established.^{79,80}

Use of Kajal

Indian households generally use kajal to cover eyes of newborns and to protect the newborns from spiritual ills.⁵³ It remains a common practice in India, where 57% of mothers apply kajal to their infants.⁵³ In contrast, paediatricians strongly advise against this practice since kajal contains lead, which could disrupt barrier function and result in hazardous lead exposure.^{86,87} Hence, awareness regarding benefit-risk of kajal in newborns needs to be created among the mothers and caregivers.

Paediatricians' Recommendations for Newborn and Infant Skin Care Products in India

Influence of long-standing practices along with propagation of marketed commercial skin care products for newborn and infant care can create confusion for parents, who rely heavily on the internet for guidance on product selection.⁸⁸ Unfortunately, such faith renders parents vulnerable to both overwhelming exposure to skin care products and misinformation about these products.^{89,90} Therefore, it is crucial for paediatricians to publicise the recommendations about skin care products.

The Indian Academy of Paediatrics published a set of recommendations for neonatal and infant skin care, detailing the level of evidence for each recommendation,⁴ and a recently published consensus summarized the evidence-based recommendations for skin care in healthy and full-term newborns in India.⁵ However, only a few of the recommendations have received paediatricians' attention as the guidelines are recent. Therefore, it is crucial that policy makers develop and communicate comprehensive and clear guidelines on newborn and infant skin care products for parents and caregivers, which may be easily accessible.

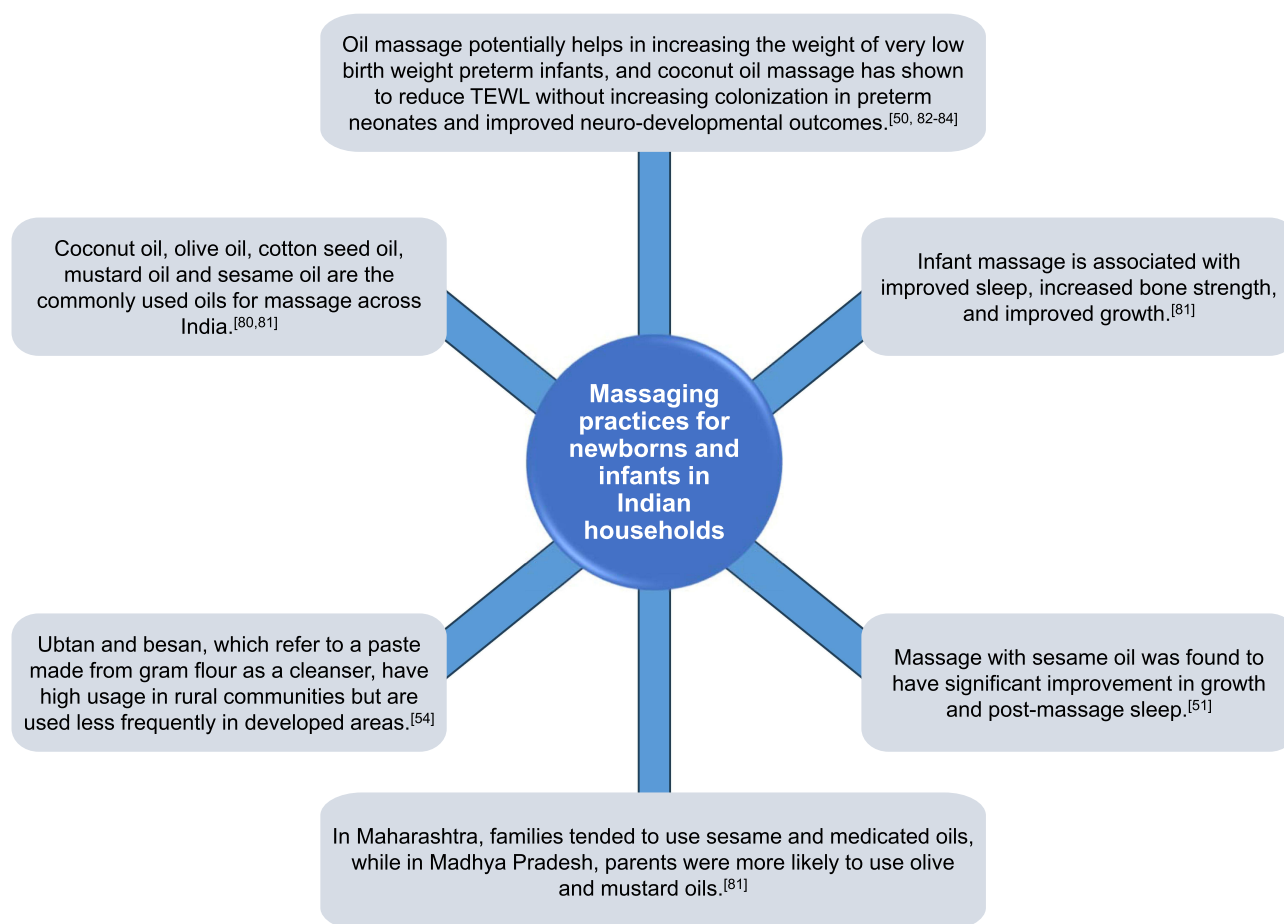


Figure 1 Common massaging practices for newborns and infants in Indian households.

Abbreviation: TEWL, trans-epidermal water loss.

Roles of Nurses, Midwives and Anganwadi Workers in Publicising Newborn Skin Care Information

Healthcare professionals who assist in delivery or early neonatal care are often important sources of information for neonatal care. Since 2005, hospital births in India have vastly increased.⁹¹ Consequently, nurses are frequently a reliable source of knowledge for new parents regarding methods and products for neonatal and newborn skin care.

In rural, tribal, and remote communities, Anganwadi centres are the major source of healthcare delivery. Anganwadi workers (AWW) are the crucial (and sometimes the only) source of information regarding current medical recommendations on neonatal and infant skin care practices for their designated communities. Evidence reports that AWW or ASHA have low levels of current medical knowledge about common conditions like neonatal jaundice or common practices like skin-to-skin care.⁹² Numerous studies have revealed that AWW are efficient at disseminating advice on best practices for care to areas where access to modern healthcare is less common.^{81,93,94} These AWW or ASHAs take provisional care of the newborns until six weeks of birth.⁸² Generally, AWW or ASHAs counsel the mother on postpartum care for both mother and the child.⁸² The AWW or ASHAs are also responsible for umbilical cord care, thermal care (including skin-to-skin care), skin care, eye care, and breastfeeding.^{82,83} AWW or ASHAs also perform general skin assessments of all newborns in the Anganwadi centres and pay extra home visits to for preterm or very low birth weight newborns, to identify the risk factors.⁸²

Special Circumstances of Neonatal and Infant Skin Care

Certain neonatal and infant conditions including preterm babies, neonatal jaundice, seborrheic dermatitis, and atopic dermatitis warrant special attention about skin care practices.

- **Preterm babies:** Preterm babies have a less developed skin barrier, a more trauma-prone stratum corneum, poorer thermoregulation ability and a considerably higher risk for TEWL than term babies.⁹⁵ They are also more vulnerable to environmental toxicity from fragrances, bases, and over-hydration. Once physiologically stabilised in the NICU, preterm babies attain immense benefit from skin-to-skin care practices.⁹⁶ Evidence suggests that skin-to-skin care practices have outsized benefit in preterm newborns but are typically performed less frequently than in full-term newborns.⁸⁴
- **Neonatal jaundice:** Other special situations where special skin care is required include full-term babies with neonatal jaundice undergoing phototherapy and preterm babies who spend much of their time in incubators. These babies may be at risk for increased TEWL and hence require more intensive emollient therapy.⁸⁵
- **Seborrheic dermatitis:** Seborrheic dermatitis a common dry skin condition often encountered during a baby's first hair wash is highly amenable to mineral oil therapy.⁴ Alike neonatal jaundice, seborrheic dermatitis sometimes require increased use of emollients or mild steroid creams.
- **Atopic dermatitis:** Atopic dermatitis, which results from immune dysfunction in genetically susceptible infants and presents with excoriated truncal and extensor lesions, may get benefitted from the emollient therapy,¹⁷ However, the evidence for the primary prevention of atopic dermatitis using emollient therapy is mixed and more research in this field is warranted.⁵

Conclusion

Owing to the unique and delicate nature of the neonatal and infant skin, it is crucial for paediatricians to provide simple and clear skin care recommendations to the mother and their families, and to stay abreast of new developments in the still-emerging field of paediatric dermatology. Of equal importance is for larger organisations to provide skin care guidance for nurses, midwives and healthcare providers who treat remote Indian neonatal and infant populations. In India, there is wide variability in cultural practices that can potentially affect the healthy skin of newborns or infants. Recommendations must recognise the role of tradition, culture, and community in neonatal and infant skin care practices. Essential practices include proper diaper care, timely and gentle bathing, and appropriate use of emollients to support skin barrier function. The review provides clarity on culturally significant practices like oil massage, which can promote physical growth, and the use of kajal, which poses risks due to lead exposure. Integrating evidence-based practices with culturally sensitive approaches ensures optimal outcomes in developmental, immunological, and psychological benefits that are likely to be realised throughout the lifespan.

Acknowledgments

We thank Nigar Malik, B. Pharm and Rabi Panigrahy, PhD, both from SIRO Clinpharm Pvt. Ltd. (funded by JNTL Consumer Health Pvt. Ltd., India) for writing and editorial support. Authors also thank Dr Ankita Pandita for additional review and editorial support.

Author Contributions

All authors meet the International Committee of Medical Journal Editors (ICMJE) criteria and all those who fulfilled those criteria are listed as authors. All authors reviewed and approved the final draft of the manuscript. All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This work is funded by JNTL Consumer Health (India) Pvt Ltd. Authors did not receive any financial support from the funder related to this work.

Disclosure

Dr Sneha Menon and Dr Priti Thakor are employees of JNTL Consumer Health (India) Pvt Ltd. All other authors declare that they have no competing interests in this work.

References

1. D'Orazio J, Jarrett S, Amaro-Ortiz A, Scott T. UV radiation and the skin. *Int J Mol Sci*. 2013;14(6):12222–12248. doi:10.3390/ijms140612222
2. World Health Organization (WHO). Newborn mortality. Available from: <https://www.who.int/news-room/fact-sheets/detail/newborn-mortality>. Accessed May 31, 2024.
3. WHO Fact sheets. Newborns: improving survival and well-being. 2022. Available from: <https://www.who.int/news-room/fact-sheets/detail/newborns-reducing-mortality>. Accessed Jun 10, 2022.
4. Madhu R, Vijayabhaskar C, Anandan V, et al. Indian Academy of Pediatrics Guidelines for Pediatric Skin Care. *Indian Pediatr*. 2021;58(2):153–161. doi:10.1007/s13312-021-2133-6
5. Gupta P, Nagesh K, Garg P, et al. Evidence-Based Consensus Recommendations for Skin Care in Healthy, Full-Term Neonates in India. *Pediatric Health Med Ther*. 2023;14:249–265. doi:10.2147/phmt.S414091
6. Srinivasa S, Bhavya G, Patel S, Harish S, Anjum SK. Knowledge, attitude and practice of mothers in infantile skin care. *Int J Contemporary Pediatrics*. 2018;5(2):536. doi:10.18203/2349-3291.ijcp20180550
7. Mack MC, Chu MR, Tierney NK, et al. Water-holding and transport properties of skin stratum corneum of infants and toddlers are different from those of adults: studies in three geographical regions and four ethnic groups. *Pediatric Dermatology*. 2016;33(3):275–282. doi:10.1111/pde.12798
8. Oranges T, Dini V, Romanelli M. Skin Physiology of the Neonate and Infant: clinical Implications. *Adv Wound Care*. 2015;4(10):587–595. doi:10.1089/wound.2015.0642
9. Souto EB, Figueiro JF, Fernandes AR, et al. Physicochemical and biopharmaceutical aspects influencing skin permeation and role of SLN and NLC for skin drug delivery. *Heliyon*. 2022;8(2):e08938. doi:10.1016/j.heliyon.2022.e08938
10. Jain P, Rauer SB, Möller M, Singh S. Mimicking the Natural Basement Membrane for Advanced Tissue Engineering. *Biomacromolecules*. 2022;23(8):3081–3103. doi:10.1021/acs.biomac.2c00402
11. Stamatas GN, Nikolovski J, Mack MC, Kollias N. Infant skin physiology and development during the first years of life: a review of recent findings based on in vivo studies. *Int J Cosmet Sci*. 2011;33(1):17–24. doi:10.1111/j.1468-2494.2010.00611.x
12. Visscher MO, Adam R, Brink S, Odio M. Newborn infant skin: physiology, development, and care. *Clin Dermatol*. 2015;33(3):271–280. doi:10.1016/j.clindermatol.2014.12.003
13. Darmstadt GL, Dinulos JG. Neonatal skin care. *Pediatr Clin North Am*. 2000;47(4):757–782. doi:10.1016/s0031-3955(05)70239-x
14. Stamatas GN, Roux PF, Boireau-Adamezyk E, Lboulkili I, Oddos T. Skin maturation from birth to 10 years of age: structure, function, composition and microbiome. *Experimental Dermatology*. 2023;32(9):1420–1429. doi:10.1111/exd.14843
15. Stamatas GN, Nikolovski J, Luedtke MA, Kollias N, Wiegand BC. Infant skin microstructure assessed in vivo differs from adult skin in organization and at the cellular level. *Pediatric Dermatol*. 2010;27(2):125–131. doi:10.1111/j.1525-1470.2009.00973.x
16. Rahma A, Lane ME. Skin Barrier Function in Infants: update and Outlook. *Pharmaceutics*. 2022;14(2):433. doi:10.3390/pharmaceutics14020433
17. Stamatas GN, Morello AP, Mack Correa MC, Stamatas GN. The infant skin barrier: can we preserve, protect, and enhance the barrier? *Dermatol Res Pract*. 2012;2012:198789. doi:10.1155/2012/198789
18. Visscher MO, Chatterjee R, Munson KA, Pickens WL, Hoath SB. Changes in diapered and nondiapered infant skin over the first month of life. *Pediatric Dermatol*. 2000;17(1):45–51. doi:10.1046/j.1525-1470.2000.01711.x
19. Schachtel A, Dyer JA, Boos MD. Climate change and pediatric skin health. *Int J Womens Dermatol*. 2021;7(1):85–90. doi:10.1016/j.ijwd.2020.07.006
20. Quazi S, Choudhary S, Singh A, Madke B, Khan K, Singh S. A cross-sectional study on the prevalence and determinants of various neonatal dermatoses. *Journal of Family Medicine and Primary Care*. 2023;12(11):2942–2949. doi:10.4103/jfmpe.jfmpe_513_23
21. Choudhary P, Mehta RD, Ghiya BC, Sharma D. A clinical study of physiological cutaneous manifestations in early neonates at a tertiary care center in western Rajasthan. *Ind J Paediatric Artic Dermatol*. 2022;23(1):43–48. doi:10.4103/ijpd.IJPD_28_19
22. Gupta B, Das S, Das K. A clinical study of dermatoses in neonates in Silchar medical college. *IP Indian J Clin Exp Dermatol*. 2021;7(3):197–211. doi:10.18231/j.ijced.2021.039
23. Kar C, Sardar S. Pattern of pathological cutaneous lesions of neonates in neonatal care unit of a peripheral tertiary institution in West Bengal. *Indian J Paediatr Dermatol*. 2020;21(1):22. doi:10.4103/ijpd.IJPD_7_19
24. Behera B, Kavadya Y, Mohanty P, Routray D, Ghosh S, Das L. Study of physiological and pathological skin changes in neonates: an east Indian perspective. *Ind J Paediatric Artic Dermatol*. 2018;19(1):40–47. doi:10.4103/ijpd.IJPD_21_17
25. Shivakumar S, Manjunathswamy BS, Metgud T, Doshi B. Cutaneous manifestations in neonates: a 1-year cross-sectional study in a tertiary care hospital. *Indian J Health Sci and Biomed Res*. 2018;11(2):125. doi:10.4103/kleuhsj.kleuhsj_221_17
26. Shubhankar M, Pravakar M, Ranjan BD, Sambodana P, Swayamsiddha M, Swayamsiddha M. Prevalence and presentation of cutaneous lesions in healthy neonates: a single-center study from Eastern India. *Indian J Child Health*. 2017;4(4):566–570. doi:10.32677/IJCH.2017.v04.i04.024
27. Sandeep B, Susheela C, Keerthi S. Cutaneous Lesions in Newborn Babies: a Hospital-based Study. *Int J Sci Study*. 2016;4(5):43–49.
28. Haveri FT, Inamadar AC. A cross-sectional prospective study of cutaneous lesions in newborn. *ISRN Dermatol*. 2014;2014:360590. doi:10.1155/2014/360590
29. Sachdeva M, Kaur S, Nagpal M, Dewan SP. Cutaneous lesions in new born. *Indian J Dermatol Venereol Leprol*. 2002;68(6):334–337.

30. Nanda A, Kaur S, Bhakoo ON, Dhall K. Survey of Cutaneous Lesions in Indian Newborns. *Pediatr Dermatol*. 1989;6(1):39–42. doi:10.1111/j.1525-1470.1989.tb00265.x
31. Vendhan S, Vasudevan B, Neema S. Transient neonatal pustulosis—A precocious form of erythema toxicum neonatorum. *Ind Dermatol Online J*. 2023;14(4):572–573. doi:10.4103/idoj.idoj_566_22
32. Verbov J. Common skin conditions in the newborn. *Seminars Neonatol*. 2000;303–310.
33. University of Florida Health. Epstein pearls. Available from: <https://ufhealth.org/conditions-and-treatments/epstein-pearls>. Accessed 31, May 2024.
34. Gupta D, Thappa DM. Mongolian spots. *Indian J Dermatol Venereol Leprol*. 2013;79(4):469. doi:10.4103/0378-6323.113074
35. Gupta D, Thappa DM. Mongolian spots: how important are they? *World Journal of Clinical Cases: WJCC*. 2013;1(8):230. doi:10.12998/wjcc.v1.i8.230
36. Kagami S, Asahina A, Watanabe R, et al. Laser treatment of 26 Japanese patients with Mongolian spots. *Dermatologic Surg*. 2008;34(12):1689–1694. doi:10.1111/j.1524-4725.2008.34347.x
37. Tanyasiri K, Kono T, Groff WF, et al. Mongolian spots with involvement of mandibular area. *J Dermatol*. 2007;34(6):381–384. doi:10.1111/j.1346-8138.2007.00292.x
38. Morgan AJ, Steen CJ, Schwartz RA, Janniger CK. Erythema toxicum neonatorum revisited. *Cutis*. 2009;83(1):13–16.
39. American Osteopathic College of Dermatology. Erythema Toxicum Neonatorum. Available from: <https://www.aocd.org/page/ETN>. Accessed 31, May 2024.
40. Garegrat RA, Banait N, Pareek P, Gupta R, Suryawanshi P. National Survey of Routine Bathing and Antisepsis Practices in Neonatal Intensive Care Units of India. *J Neonatol*. 2021;35(4):209–213. doi:10.1177/09732179211051307
41. Singh G, Archana G. Unraveling the mystery of vernix caseosa. *Indian J Dermatol*. 2008;53(2):54–60. doi:10.4103/0019-5154.41645
42. Murphy B, Hoptroff M, Arnold D, et al. Compositional Variations between Adult and Infant Skin Microbiome: an Update. *Microorganisms*. 2023;11(6):1484. doi:10.3390/microorganisms11061484
43. Tripathy T, Das S, Tripathy A. Bathing and Weighing of Neonants of Recently Delivered Women in Home Based Newborn Care in Uttar Pradesh, India. *J Soc Welf Manag*. 2020;12:57–64. doi:10.21088/jswm.0975.0231.12220.2
44. Kattwinkel J. Textbook of Neonatal Resuscitation. 6th. *Am Acad Pediat*. 2011.
45. World Health Organization. Guidelines on basic newborn resuscitation. Available from: <https://platform.who.int/docs/default-source/mca-documents/policy-documents/operational-guidance/IND-CH-14-04-OPERATIONAL-GUIDANCE-2009-eng-Manual.pdf>. Accessed June 3, 2024.
46. Saxena V, Jelly P, Sharma R. An exploratory study on traditional practices of families during the perinatal period among traditional birth attendants in Uttarakhand. *Journal of Family Medicine and Primary Care*. 2020;9(1):156–161. doi:10.4103/jfmpe.jfmpe_697_19
47. WHO. Recommendations for management of common childhood conditions. Available from: <https://www.who.int/publications/i/item/9789241502825>. Accessed Jun 10, 2022.
48. Mukherjee D, Chandra Shaw S, Venkatnarayan K, Dudeja P. Skin-to-skin contact at birth for vaginally delivered neonates in a tertiary care hospital: a cross-sectional study. *Med J Armed Forces India*. 2020;76(2):180–184. doi:10.1016/j.mjafi.2018.11.008
49. Goel A, Murmu SK, Shah S, Chawla GS. Role of cultural practices in neonatal sepsis. *Int J Med Sci Public Health*. 2015;4(5):680–683. doi:10.5455/ijmsph.2015.01012015140
50. Awasthi S, Verma T, Agarwal M. Danger signs of neonatal illnesses: perceptions of caregivers and health workers in northern India. *Bull World Health Organ*. 2006;84(10):819–826. doi:10.2471/blt.05.029207
51. Shah B, Dwivedi L. Newborn care practices: a case study of tribal women, Gujarat. *Health*. 2013;5(08):29–40. doi:10.4236/health.2013.58A4005
52. Jenifer M, Benjamin E. Cultural practices and beliefs regarding newborn care in South India. *Indian J Contin Educ Nurs*. 2019;20(2):106. doi:10.4103/IJCN.IJCN_18_20
53. Bangari A, Thapliyal S, Ruchi R, Aggarwal B, Sharma U. Traditional beliefs and practices in newborn care among mothers in a tertiary care centre in Dehradun, Uttarakhand, India. *Int J Community Med Public Health*. 2019;6(6):2600. doi:10.18203/2394-6040.ijcmph20192330
54. Sunanda B, Paul S. A study on the cultural practices of postnatal mothers in selected hospitals at Mangalore. *NUJHS*. 2013;3(03):048–053. doi:10.1055/s-0040-1703677
55. Sujatha R. Cultural practices and beliefs on newborn care among mothers in a selected hospital of Mangalore Taluk. *NUJHS*. 2014;4(02):021–026. doi:10.1055/s-0040-1703759
56. Arumugam L, Kamala S, Ganapathy K, Srinivasan S. Traditional Newborn Care Practices in a Tribal Community of Tamil Nadu, South India: a Mixed Methods Study. *Indian J Community Med*. 2023;48(1):131–136. doi:10.4103/ijcm.ijcm_498_22
57. Islam MA, Ms K, Aa K, et al. Newborn Care Practices and Associated Factors Influencing Their Health in a Northern Rural India. *Children*. 2023;10(2):408. doi:10.3390/children10020408
58. Vijayalakshmi S, Patil R, Datta SS. Community based study on newborn care practices and its determinants in rural Pondicherry, India. *Neonatal Biol*. 2014;3:1–5. doi:10.4172/2167-0897.1000158
59. Blume-Peytavi U, Cork MJ, Faergemann J, Szczapa J, Vanaclocha F, Gelmetti C. Bathing and cleansing in newborns from day 1 to first year of life: recommendations from a European round table meeting. *J Eur Acad Dermatol Venereol*. 2009;23(7):751–759. doi:10.1111/j.1468-3083.2009.03140.x
60. World Health Organization. Pregnancy, childbirth, postpartum and newborn care: a guide for essential practice (3rd edition). 2022. Available from: <https://www.who.int/publications/i/item/9789241549356>. Accessed 13, Jun, 2022.
61. Blume-Peytavi U, Hauser M, Stamatas GN, Pathirana D, Garcia Bartels N. Skin Care Practices for Newborns and Infants: review of the Clinical Evidence for Best Practices. *Pediatr Dermatol*. 2012;29(1):1–14. doi:10.1111/j.1525-1470.2011.01594.x
62. Lund C, Kuller J, Durand DJ. Baby's first bath: changes in skin barrier function after bathing full-term newborns with water vs liquid baby cleanser. *Pediatric Dermatology*. 2020;37(1):115–119. doi:10.1111/pde.14037
63. Lavender T, Bedwell C, Roberts SA, et al. Randomized, controlled trial evaluating a baby wash product on skin barrier function in healthy, term neonates. *J Obstetric Gynecologic Neonatal Nursing*. 2013;42(2):203–214. doi:10.1111/1552-6909.12015
64. Sankar MJ, Neogi SB, Sharma J, et al. State of newborn health in India. *J Perinatol*. 2016;36(s3):S3–S8. doi:10.1038/jp.2016.183
65. Gathwala G, Sharma D, Bhakhri B. Effect of topical application of chlorhexidine for umbilical cord care in comparison with conventional dry cord care on the risk of neonatal sepsis: a randomized controlled trial. *J Trop Pediatr*. 2013;59(3):209–213. doi:10.1093/tropej/fmt003

66. Sharma D, Gathwala G. Impact of chlorhexidine cleansing of the umbilical cord on cord separation time and neonatal mortality in comparison to dry cord care - a nursery-based randomized controlled trial. *J Matern Fetal Neonatal Med.* 2014;27(12):1262–1265. doi:10.3109/14767058.2013.854325
67. Sharma D, Gathwala G, Shastri S. Chlorhexidine - a novel intervention to decrease the nursery stay and antibiotic exposure duration - randomized trial. *J Matern Fetal Neonatal Med.* 2016;29(2):213–217. doi:10.3109/14767058.2014.993373
68. Babu MC, Tandur B, Sharma D, Murki S. Disposable diapers decrease the incidence of neonatal infections compared to cloth diapers in a level II neonatal intensive care unit. *J Trop Pediatr.* 2015;61(4):250–254. doi:10.1093/tropej/fmv022
69. Chaithirayanon S. Comparative Study between Talcum and Zinc Oxide Cream for the Prevention of Irritant Contact Diaper Dermatitis in Infants. *J Med Assoc Thai.* 2016;99(8):S1–S6.
70. Prithiba G, Priya KK, Rekha R, Rebekahal R, Joseph VM. Assessment of Knowledge of Mothers Regarding Diaper Rashes in Infants in a Selected Rural Community, Kanchipuram District, Tamil Nadu, India. *Medico-Legal Update.* 2020;20:58–60.
71. Maya K, Pai S, D'Souza A. Effectiveness of awareness programme on prevention and management of diaper dermatitis among mothers of children of age 0 to 1 year. *Journal of Health and Allied Sciences NU.* 2015;5(03):077–081. doi:10.1055/s-0040-1703916
72. Aksucu G, Azak M, Çağlar S. Effects of topical oils on neonatal skin: a systematic review. *Adv Skin Wound Care.* 2022;35(12):1–9. doi:10.1097/01.ASW.0000891088.69828.2e
73. Darmstadt GL, Mao-Qiang M, Chi E, et al. Impact of topical oils on the skin barrier: possible implications for neonatal health in developing countries. *Acta Paediatr.* 2002;91(5):546–554. doi:10.1080/080352502753711678
74. Danby SG, AlEnezi T, Sultan A, 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. doi:10.1111/j.1525-1470.2012.01865.x
75. Chaturvedi S, Randive B, Pathak A, et al. Prevalence and perceptions of infant massage in India: study from Maharashtra and Madhya Pradesh states. *BMC Pediatric.* 2020;20(1):512. doi:10.1186/s12887-020-02416-y
76. Kumar A, Mishra S, Singh S, et al. Effect of sunflower seed oil emollient therapy on newborn infant survival in Uttar Pradesh, India: a community-based, cluster randomized, open-label controlled trial. *PLoS Med.* 2021;18(9):e1003680. doi:10.1371/journal.pmed.1003680
77. Priyadarshi M, Balachander B, Gupta S, Sankar MJ. Topical emollient application in term healthy newborns: a systematic review. *Journal of Global Health.* 2022;12:1.
78. Chaioimh C N, Lad D, Nico C, et al. Early initiation of short-term emollient use for the prevention of atopic dermatitis in high-risk infants—The STOP-AD randomised controlled trial. *Allergy.* 2023;78(4):984–994. doi:10.1111/all.15491
79. Chaturvedi S, Tillu G, Kale A, et al. Protocol for Infant Massage in Home Settings: an e-Delphi Approach for Consensus Guidance Integrating Traditional Wisdom with Modern Medicine. *J Trop Pediatr.* 2021;67(3):43. doi:10.1093/tropej/fmab043
80. Kulkarni A, Kaushik JS, Gupta P, Sharma H, Agrawal RK. Massage and touch therapy in neonates: the current evidence. *Indian Pediatr.* 2010;47(9):771–776. doi:10.1007/s13312-010-0114-2
81. Rasaily R, Saxena NC, Pandey S, et al. Effect of home-based newborn care on neonatal and infant mortality: a cluster randomised trial in India. *BMJ Glob Health.* 2020;5(9):e000680. doi:10.1136/bmjgh-2017-000680
82. Pathak PK, Singh JV, Agarwal M, Singh VK, Tripathi SK. Study to assess the home-based newborn care (HBNC) visit in rural area of Lucknow: a cross-sectional study. *J Family Med Prim Care.* 2021;10(4):1673–1677. doi:10.4103/jfmpe.jfmpe_911_20
83. Kumar V, Mohanty S, Kumar A, et al. Effect of community-based behaviour change management on neonatal mortality in Shivgarh, Uttar Pradesh, India: a cluster-randomised controlled trial. *Lancet.* 2008;372(9644):1151–1162. doi:10.1016/S0140-6736(08)61483-X
84. Kymre IG, Bondas T. Balancing preterm infants' developmental needs with parents' readiness for skin-to-skin care: a phenomenological study. *Int J Qual Stud Health Well-Being.* 2013;8(1):21370. doi:10.3402/qhw.v8i0.21370
85. Wananukul S, Praisuwanna P, Kesorncam K. Effects of clear topical ointment on transepidermal water loss in jaundiced preterm infants receiving phototherapy. *J Med Assoc Thai.* 2001;84(6):837–841.
86. Mohta A. Kajal (Kohl) - A dangerous cosmetic. *Oman J Ophthalmol.* 2010;3(2):100–101. doi:10.4103/0974-620X.64242
87. Centers for Disease Control Prevention. Childhood lead exposure associated with the use of kajal, an eye cosmetic from Afghanistan - Albuquerque, New Mexico, 2013. *MMWR Morb Mortal Wkly Rep.* 2013;62(46):917–919.
88. Pehora C, Gajaria N, Stoute M, Fracassa S, Serebale-O'Sullivan R, Matava CT. Are Parents Getting it Right? A Survey of Parents' Internet Use for Children's Health Care Information. *Interact J Med Res.* 2015;4(2):e12. doi:10.2196/ijmr.3790
89. Chou WS, Oh A, Klein WMP. Addressing Health-Related Misinformation on Social Media. *JAMA.* 2018;320(23):2417–2418. doi:10.1001/jama.2018.16865
90. Rubin CB, Brod B. Natural Does Not Mean Safe-The Dirt on Clean Beauty Products. *JAMA Dermatol.* 2019;155(12):1344–1345. doi:10.1001/jamadermatol.2019.2724
91. Bhatia M, Banerjee K, Dixit P, Dwivedi LK. Assessment of Variation in Cesarean Delivery Rates Between Public and Private Health Facilities in India From 2005 to 2016. *JAMA Network Open.* 2020;3(8):e2015022. doi:10.1001/jamanetworkopen.2020.15022
92. Harikrishna BN, Jothula KY, Nagaraj K, Prasad VG. Utilisation of Anganwadi services among pregnant women in rural Telangana: a cross sectional study. *J Family Med Prim Care.* 2020;9(7):3343–3348. doi:10.4103/jfmpe.jfmpe_408_20
93. Sr D, As D, Dighole RV, Patil RP. Anganwadi worker's participation in rural newborn care. *Indian J Pediatr.* 1993;60(5):627–630. doi:10.1007/BF02821721
94. Khandekar V. Strengthening Primary Health Care Through Asha Workers: a Novel Approach in India. *Prim Health Care.* 2014;4. doi:10.4172/2167-1079.1000149.
95. Marissen J, Gomez de Agüero M, Chandorkar P, et al. The delicate skin of preterm infants: barrier function, immune-microbiome interaction, and clinical implications. *Neonatology.* 2023;120(3):295–307. doi:10.1159/000529026
96. Abouelfettouh A, Ludington-Hoe SM, Burant CJ, Visscher MO. Effect of skin-to-skin contact on preterm infant skin barrier function and hospital-acquired infection. *J Clinical Med Res.* 2011;3(1):36. doi:10.4021/jocmr479w

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