



## SOOTHING DIAPER DERMATITIS NATURALLY: GENTLE TREATMENTS FOR BABY'S SKIN

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### ABSTRACT

Diaper dermatitis (DD) or diaper rash is an inflammatory skin process seen primarily in the diaper area of neonate and infant patients. It results from a confluence of factors including prolonged exposure to moisture, friction, and irritants in urine and feces. Newborns have very immature barrier function in their skin, which makes it especially vulnerable to breaking down, inflammation, and microbial infection. DD is prevalent, with 50% to 65% of infants having it, peaking between ages 9 to 12 months. DD can vary in its severity from mild to severe, and can be very uncomfortable for infants as well as for caregivers. Conventional therapies for DD often involve the use of barrier creams, corticosteroids, and antifungal agents. These treatments, though, can sometimes irritate the skin, or cause other long-term side effects. This has led to increasing interest in alternative treatments, especially topical gels available as plant-based. This paper discusses the effectiveness of these natural products based on their formulation, active ingredient(s), and therapeutic effects. We study various herbal extracts having anti-inflammatory, antimicrobial, and skin-soothing properties (aloe vera, chamomile, calendula, and coconut oil) to manage the DD. There is a growing interest among healthcare professionals in the use of plant-based gels as a natural and gentler alternative to traditional ointments in treating diaper rashes. By emphasizing the therapeutic potential of these herbs, the review underscores their potential use in alleviating inflammation, preventing infections, and providing soothing properties as natural, safe, and sustainable alternatives for the management of diaper rash.

### INTRODUCTION

Diaper dermatitis (DD) is a term used to describe inflammatory reactions in the skin located in the diaper area, which can also be referred to as napkin dermatitis or diaper rash. [Benitez Ojeda A.B., 2021.] The term "diaper" does not mean that the diaper itself is causing the dermatitis directly, but that the condition occurs from a confluence of factors in the diapering area, including prolonged moisture, friction and exposure to irritants in urine and feces. A clear understanding of the multifactorial etiology of DD will allow the development of preventative and therapeutic strategies, making it important to investigate these factors in specific regions. [Scheinfeld, 2005]

In this article, we will answer some common questions caregivers often have about DD and outline best practices for skin care as well as how to decrease contributing factors, prevent and manage the condition as a whole.

Several important factors contribute to the pathogenesis of irritant diaper dermatitis (IDD), including maceration,

friction, and urine and feces. The immaturity of newborn skin makes it particularly vulnerable because of the increased susceptibility to skin barrier disruption and absorption of irritants. Also, the diaper area may be exposed to moisture from urine and feces over time as well as diaper occlusion, causing skin overhydration and pH changes. [Katarzyna Sznurkowska, 2015]

This environment leads to damage of the stratum corneum, which in turn results in a skin barrier dysfunction. Chronic exposure to urine and feces raises pH of skin, promotes change in microbial colonization as well as activation of fecal enzymes which further you can explain skin barrier. Irritant diaper dermatitis is caused by skin contact with irritants that damage the stratum corneum (the outermost layer) of the skin and increase its permeability; wet, dirty diapers can cause this damage due to friction. All these factors together are induced the pathophysiology of diaper dermatitis. [Janna m. vassantachart, 2018]

In addition, as the population ages, more will continue to be adult patients suffering from incontinence-associated

dermatitis (IAD) that has many of the same properties as diaper dermatitis in the infant form. Similar to IDD, moisture, occlusion, friction and increased skin hydration cause the stratum corneum barrier to weaken IAD. [Hilde Beele, 2018]

Fecal enzymes also damage skin. In elderly persons, epidermal barrier recovery may be prolonged by age-related changes in the skin that move pH further from the protective acidic state and lead to increased susceptibility to xerosis. In addition, malnourishment or deficiencies of micronutrients, prevalent in older adults, may block the skin from healing. [B Koletzko, 2015]

Although the specific treatment of IDD and IAD are different, beneficial skin care practices for the prevention of both conditions share commonalities in that they aim to support the skin barrier, maintain proper dryness, prevent skin friction and minimize exposure to irritants. The recommended best practices, which include the use of disposable, superabsorbent, and breathable diapers, as well as frequent diaper changes, gentle cleansing, and the application of protective emollients and agents to help restore the skin's natural barrier, are plausible. [Adelaide A. Hebert, 2021]. Corticosteroids and antimicrobials, for example, are modern topical treatments capable of addressing symptoms of diaper dermatitis fast. But overuse or poor use of these agents can cause unwanted effects, such as dermal atrophy, pigmentary changes, hypothalamic-pituitary-adrenal axis suppression and bacterial resistance. Hence, alternative therapies are being sought to substitute traditional treatments. [Sharifi-Heris, Z., 2018].

This review focuses on nonsteroidal, nonantibiotic topical agents with documented therapeutic activity for diaper dermatitis. In addition, a pathophysiological framework to diaper dermatitis will be proposed as a thread for understanding potential treatment targets and the cosmetic features of skin care products indicated for the prevention and management of diaper dermatitis will also be discussed. [Adelaide A Hebert, 2021]

#### **Prevalence and Burden of diaper dermatitis**

Diaper dermatitis (DD) is one of the most frequently observed skin conditions among neonates and infants, causing distress and pain for both infants and their caregivers. The incidence and prevalence of DD, as reported in a wide literature varies in the regions. Between 50% to 65% of infants will develop diaper rash at some time. The peak prevalence of DD is generally at 9–12 months of age. The severity of DD ranges from mild to very severe; 58% of affected neonates have mild rash, 34% moderate rash, and 8% severe rash. Approximately 7% of parents with infants with diaper rash will consult a primary care physician. [Ulrike Blume-Peytavi, 2018]

#### **Causative factors**

DD is a multifactorial disease with many possible contributors. Because newborn skin is immature, it is more susceptible to skin barrier disruption and irritant absorption. Similar to the microbiome, skin barrier function and development also differ by anatomical region. Due to prolonged exposure to urine and feces, and the occlusive environment of the diaper, creating an acidic effect, the skin in the diaper area is more likely to irritate. This too much of hydration damages the skin's outermost layer, the stratum corneum, thereby impairing its barrier function. The skin's acid mantle regulates the activities of the enzymes in the stratum corneum that are responsible for structuring the skin, which is crucial for its integrity. Long-term exposure to urine and feces on the diapered skin alters the pH, causes shifts in the microbial population, activates fecal enzymes, and further disrupts the skin barrier. Skin breakdown is exacerbated by friction and maceration – the wetness makes the skin more sensitive to irritants. *Candida albicans* and bacteria such as *Staphylococcus aureus*,  $\beta$ -hemolytic *Streptococcus* sp., *E. coli*, *Bacteroides* sp. are associated with DD. [Lorena S Telofski, 2012]

Another contributing factor in the rash includes that's how frequently they pee and poop, hygiene, products used on the skin, type of diaper, frequency of changing the diaper, diet, medication, and gastrointestinal illnesses.

#### **Prevention of diaper dermatitis**

Clinical studies on skin care practices and advancements in diaper technologies (improvements in design/composition/performance) throughout the years have led to great progress in the frequency and severity of DD. Skin care to prevent DD mainly focuses on maintaining skin barrier function and minimizing wetness, friction and exposure to irritants such as urine and faeces. To prevent DD, diaper changing should be frequent, disposable, superabsorbent, breathable, nonclothing diapers are preferred over cloth diapers, cleansing should be gentle, and protective emollients should be applied. Education of parents and caregivers about the etiology of DD and preventive and therapeutic measures is essential to ensure compliance. [Blume-Peytavi U, 2018]

#### **Prevention and Management – Nonmedical skincare practices**

The management of DD centers around two key goals — facilitating skin recovery from interstitial cutaneous lesions and reducing recurrences. Thus, understanding the etiology and removing the any causative factors is essential for effective prevention and therapy.

**Table 1: Prevention of diaper dermatitis by eliminating causative factors.**

Causative factor	Effect	Intervention
Prolonged and excessive humidity	Friction, skin maceration, microbial overgrowth, increased permeability	Frequent diaper change, use of super-absorbent diapers, cleansing with wipes or water and cotton, application of topical emollients
Alkaline urine and feces	Disruption of pH balance, activation of fecal lipases, proteases, and microbial overgrowth	Use of super-absorbent diapers, gentle cleansing, and application of topical emollients
Cleansing with soaps and detergents	Further breakdown of the skin barrier	Avoid soaps and detergents, use of wipes or water and cotton, topical emollients

**Skin Care — Bathing and Cleansing**

Proper hygiene is critical in preventing skin barrier breakdown. Bathing a newborn is safe if basic safety precautions are taken. Liquid cleansing agents, which are soap free and specially prepared for infant skin, may be used. Clinical evidence demonstrates emollient effectiveness in enhancing skin barrier and in prevention of DD. Ideal cleansers and emollients are pH-neutral or slightly acidic and ought to contain only approved ingredients, such as those approved by the U.S. Food and Drug Administration or the European Medicines Agency. (R Madhu, 2021)

**Wet wipes**

Cotton wool and water vs applicator with baby wipes: Many studies have compared these in regard to their influence on skin condition and barrier function. (TEWL. Baby wipes themselves do not usually damage the skin barrier, but you want to make sure they are wipes that are formulated with pH buffers to counteract the alkalinity of urine and preserve the skin's acidity. Wipes should not contain potential irritants such as alcohol, fragrances, and harsh detergents.

Many studies have examined the effect of cotton wool and water versus baby wipe and have measured skin condition and barrier function. Wipes have also been shown to have a significant effect on skin irritation potential, and effect on transepidermal water loss (TEWL) versus cloth and water. Though baby wipes are not damaging to the skin barrier in general, it is important to select for those that have pH buffers to combat the alkalinity of urine to protect the natural acidic state of the skin. Wipes should not contain irritants like alcohol, fragrances, and harsh detergents. [Karien J Rodriguez, 2020]

**Topical use of emollients**

By forming a film on the skin and providing a supply of lipids that penetrate the stratum corneum, emollients aid in maintaining skin barrier function. Barrier creams and emollients are widely used in developed countries to prevent and treat DD. Creams should only be applied in a thin layer to prevent occlusion and entrapment of moisture beneath skin folds. Emollients may be applied to healthy skin, up to two times a week or more, for preventive care.

**Diaper technology**

Over the past decades, diaper design and performance have greatly heaved, leading to a reduction in the prevalence and severity of DD. Modern day diapers are created with superabsorbent polymers, like the cross-linked sodium polyacrylate, which absorb large amounts of fluid to minimize excess hydration, friction and irritation to the skin. Introduction of superabsorbent diapers: 50% reduction in morbid to severe DD. Plus, diapers have breathable outer layers and a more comfortable fit to reduce irritation even further. [Mauricio Odio, 2014]

**Prevention and Management – Medical skincare practices**

Severe or special cases of DD may need medical attention. This would require a thorough evaluation to rouse out irritant dermatitis due to other causes, such as allergic contact dermatitis, fungal, or bacterial infections. Avoid topical products with irritants or allergens, like fragrances and preservatives. In extreme scenarios, short term systemic low to moderate potency corticosteroids can be utilized to relieve inflammation and question. Potent topical corticosteroids must be avoided because of associated secondary effects, such as skin atrophy, and their systemic absorption. [Benitez Ojeda AB, 2025]

**Natural ingredients for diaper rash lightener****1. Aloe Vera (Aloe barbadensis miller)**

Aloe vera is a popular plant well-known for cosmetic use due to its skin-healing and soothing effects. Packed with polysaccharides, enzymes, and amino acids, the gel derived from the Aloe vera plant works together to help hydrate your skin, decrease inflammation, and speed up skin healing. Its anti-inflammatory properties make it excellent for alleviating the redness, swelling, and irritation associated with diaper rash. Aloe vera also has moisturizing properties that help to rehydrate the skin, allowing to restore the natural moisture balance that is so important in preventing irritation. Aloe vera improves the barrier function of the skin, thereby protecting the affected area from irritants like urine and feces and enabling a quick recovery from diaper rash. [Surjushe A, 2008]

## 2. Chamomile (*Matricaria chamomilla*)

Chamomile: Extracted from the flowers of the plant *Matricaria chamomilla*, chamomile is best known for its calming and anti-inflammatory properties. Chamomile contains some essential oils and flavonoids with antimicrobial as well as soothing properties. Chamomile extract applied topically can relieve the inflammation and irritation associated with diaper rash. Its antimicrobial properties further promote healing by inhibiting the growth of bacteria and fungi that can complicate diaper rash. Chamomile is also a mild ingredient that is safe for infant skin sensitivity; it works in this way to offer relief from discomfort while promoting overall skin health. [Sah A, 2022]

## 3. Calendula (*Calendula officinalis*)

Known as marigold, calendula is a plant revered for its skin healing and anti-inflammatory properties. It has saponins, flavonoids, and carotenoids that help to decrease inflammation, boost wound healing, and protect the skin from injury. Calendula is one of the best remedies for treating diaper rash because it speeds up the regeneration of skin cells and helps in getting back to normal faster. It also has a mild antiseptic activity that cleans the skin and prevents infection. The soothing properties of calendula can help alleviate the pain from diaper rash, and it is commonly used in creams and ointments meant to treat the skin when it's irritated or inflamed. [Sapkota B, 2024]

## 4. Coconut Oil (*Cocos nucifera*)

A potent emollient and antimicrobial agent, coconut oil is also a valuable ingredient in diaper rash treatment. The oil is very high in medium-chain fatty acids, most notably lauric acid, which gives it strong antimicrobial properties to help protect the skin against bacterial and fungal infections. Coconut oil has a moisturizing effect as well, forming a protective layer on the skin that locks in moisture, prevents additional irritation, and protects the skin from exposure to urine and feces. With anti-inflammatory properties, it soothes and calms irritated skin, making it an excellent option for use against diaper rash. What's more, coconut oil is soothing and safe from infancy. [Joshi S, 2020]

## 5. Tea tree oil

Tea tree oil is an immune-enhancing essential oil, and is a potent antifungal, antibacterial, and antiviral. Applied to the skin, tea tree oil can help to prevent and treat secondary infections seen in cases of diaper rash through antimicrobial activity against common pathogens responsible for skin infections (e.g. *Candida albicans* (yeast infections); *Staphylococcus aureus*). Its antimicrobial properties make it a key ingredient in diaper rash therapies, particularly when the rash becomes infected. It also has anti-inflammatory properties, which can help alleviate redness and swelling in the affected areas. However, tea tree oil can be irritating when applied on its own, so it is essential to dilute it before putting it on the skin. When used

appropriately, tea tree oil can help in the treatment of diaper rashes as well, as it can aid in healing and prevent infections.

As such, by prioritising the inclusion of these plant-based ingredients in the range of diaper rash treatments available, caregivers can utilise their healing, soothing and protective benefits to safely and effectively treat diaper rash while also reducing the possibility that the treatment causes further irritation or adverse reaction. These ingredients all play a unique but complementary role in supporting skin health and can be beneficial components of any diaper rash remedy. [Carson CF, 2006]

## 6. Petrolatum-Based Barriers

Improving DD: Petrolatum-based creams have been shown to be effective in decreasing the severity of DD by providing a barrier to moisture and other extrinsic irritants. These products serve to help prevent diaper rash and allow for healing of the skin, when used regularly. [Hebert AA, 2021]

## Outlook and Challenges

Plant-based topical gels show great potential, but significant barriers remain. This includes the standardization of herbal extracts, whether products have stability issues, and whether they can be produced in large quantities. Future work would therefore focus on formulation optimization, large-scale clinical trials, and long-term stability improvement of the product.

## CONCLUSION

With increasing concerns about medication side effects, natural, safe, and effective alternatives need to be developed; plant-based topical gels could meet this demand for the treatment of infant's diaper rash. Antioxidants and herbal extracts in the formulation counteract inflammatory, antimicrobial, and soothing properties resulting in enhanced therapeutic outcomes with minimized risks. They require ongoing research and clinical validation in order to support their wider use in dermatological care.

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