

# Bathing in Atopic Dermatitis in Pediatric Age

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Atopic dermatitis is a chronic inflammatory skin disease. The treatment plays an important role in influencing the patients' quality of life. The basic management consists of appropriate skin cleansing, including bathing and eventually using bathing additives. Recommendations regarding frequency and duration of bathing, water temperature and usefulness of bathing additives are widely different, often leading to confusion among patients.

Keywords: atopic dermatitis ; bathing ; bathing additives ; bleach baths ; baby cleansers ; bath oils ; salt bath ; natural additives

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## 1. Introduction

Atopic dermatitis (AD) is a chronic inflammatory skin disease that can significantly impact the quality of life of patients and their families. It is the most common skin disease in children, affecting up to 20% worldwide <sup>[1]</sup>. Given its chronic course, treatment is an important aspect of the disease that will accompany patients throughout their lives. A complex and multifactorial etiopathogenesis characterizes AD. Genetic susceptibility plays a major role, leading to different alterations in the skin barrier, microbial dysbiosis <sup>[2]</sup> and immunologic dysregulation <sup>[3]</sup>. Alteration in the skin barrier, including abnormal lipid metabolism and altered epidermal structural protein, such as filaggrin and protease inhibitors, can lead to increased transepidermal water loss [TEWL], increased pH <sup>[3]</sup> and consequent susceptibility to infections and sensitization to aeroallergens <sup>[4]</sup>. The innate immune system of the skin is impaired in patients with AD, characterized by an imbalance of T-helper type 2 [Th2] to Th1 cytokines, resulting in a high IgE-mediated hypersensitivity. The interaction between pathogens and the skin's immune cells plays an important role in inflammation, activating an inflammatory cycle and a higher susceptibility to bacterial infection <sup>[3]</sup>. Environmental triggers such as allergens, skin irritants, infections and physical irritants (e.g., tobacco smoke, traffic exhaust, extreme temperatures, cold or humidity) can also exacerbate AD symptoms <sup>[5][6][7]</sup>. The diagnosis of AD is made based on clinical presentation and family history. No gold standard laboratory test for AD exists <sup>[8]</sup>. The distribution of lesions differs depending on age, with infants and young children typically affected on the face and extensor surfaces of extremities. These features are followed by allergic rhinoconjunctivitis, food allergies and asthma ["atopic march"] <sup>[9]</sup>. The main feature of the atopic skin is the severe xerosis. The lesions display a heterogeneous course that includes both acute and chronic phases. The former is characterized by itchy, relapsing, eczematous lesions, erythema, vesiculation, oozing and exudation, characterized by lichenification and desquamation. Infections like bacterial, viral and fungal infections are common AD complications. The atopic skin is massively colonized with *Staphylococcus aureus* [*S. aureus*] in damaged and non-damaged skin, aggravating the inflammatory skin condition <sup>[10][11]</sup>. After the diagnosis, the first step is correctly assessing disease severity, which is crucial for selecting and monitoring treatment response <sup>[8][12][13][14]</sup>. Different instruments are used to establish AD severity. The classical composite score is the 'Scoring of Atopic Dermatitis' (SCORAD), which evaluates AD signs and symptoms. The second most commonly used tool is the Eczema Area and Severity Index (EASI), which only considers clinical signs, excluding subjective symptoms. Finally, the Patient-Oriented Eczema Measures for Eczema [POEM] is a symptoms-only score to measure subjective symptoms but not objective signs <sup>[8]</sup>. Regarding AD monitoring, it has been demonstrated that elevated TEWL in early infancy may identify patients at high risk of developing AD <sup>[15][16]</sup>. TEWL measurement can be considered sufficiently accurate for disease monitoring <sup>[17]</sup>. The main goal of AD treatment is to relieve the symptoms, improve skin barrier function and prevent complications. It is important for patients and their caregivers to have a clear picture of the disease and to understand which existing therapeutic strategy is more suitable for their symptoms. Recently, numerous guidelines have been published for atopic dermatitis management in children <sup>[8][12][13][14]</sup>. The treatment regimen for AD is complex, encompassing a variety of approaches to effectively manage the condition. One of the main steps consists of appropriate skin cleansing followed by applying emollients. Emollients help hydrate the skin's SC and reduce TEWL <sup>[8][12]</sup>.

## 2. Duration, Frequency and Temperature

Most international guidelines recommend bathing daily for about 5–10 min with warm water and using emollients immediately after bathing. However, there is some variation in the specific recommendations in the context of atopic dermatitis in pediatric age (**Table 1**).

The European guidelines [8] recommend only a short duration (5 min) with the use of bath oils in the last 2 min of bathing [temperature of water 27–30 °C]. There are no recommendations about the weekly frequency. An update in the European guideline [13] reports that a small, randomized study regarding the frequency of bathing procedures did not show any difference between twice-weekly versus every day [18]. Eichenfield et al. recommended up to once-daily bathing to remove serous crust and the subsequent administration of moisturizers [12]. Finally, the Korean consensus guidelines [14] specify that bathing should not exceed once per day. Emerging research suggests that the frequency of bathing may not significantly impact the severity of AD. A systematic review by Tammy Hua and colleagues found that bathing or showering more than 7 times per week versus less than 7 times per week was not associated with significant differences in EASI score [18].

**Table 1.** Comparison between international guidelines about way of bathing in atopic dermatitis in children.

	AAD [12]	JTF [19]	European Guidelines [8]	EuroGuiDerm [13]	Japanese Guideline [20]	Korean Guideline [14]
Bathing time	No standard for duration: short periods (5–10 min)	At least 10 min	Short duration (only 5 min) + use bath oils (in the last 2 min of bathing)	Short duration (only 5 min) + use bath oils (in the last 2 min of bathing)	No clear indication (depends on the patient and the symptoms")	Short duration (5–10 min)
Weekly/daily frequency	No standard for frequency: it is generally recommended to do up to once daily bathing.	\	\	No difference in bathing daily versus twice weekly	\	Not exceed once per day
Temperature of bath water	Warm water (no mention of degree centigrade)	Warm water (no mention of degree centigrade)	27–30 °C	The water temperature should not be too high (no mention of degree centigrade)	36–40 °C	27–30 °C

## 3. The Use of Additives

### 3.1. Sodium Hypochlorite (Bleach Baths)

Bleach baths [dilute sodium hypochlorite (NaOCl 0.005%)] represent a promising treatment for AD, but there is still some debate about their use. A recent systematic review and meta-analysis of 307 patients with moderate-to-severe AD demonstrated that dilute bleach baths decreased about 22% of the AD severity [21]. The clinical benefit of NaOCl is primarily attributed to its antimicrobial activity [22][23][24]. Recent evidence suggested that the antimicrobial effect is probably obtained at higher concentrations than those used in AD treatment [25]. A study by Rathore et al. [26] found that a 2.5 µL/mL dilution of bleach, equivalent to one-half cup of bleach in a one-quarter-filled bathtub, had a significant effect on killing the community-associated methicillin-resistant *S. aureus* [CA MRSA] in vitro. Similar ex vivo studies found that bleach concentrations greater than 0.03% were required to eradicate *S. aureus* biofilm, although those levels are cytotoxic to human cells and should not be used clinically [27][28]. Multiple studies suggested that NaOCl has other effects besides the antimicrobial, including modulating the surface microbiome without causing antibiotic resistance [29] and reducing the secretion of inflammatory cytokines in affected skin tissue, leading to anti-pruritogenic and anti-inflammatory effects [30].

### 3.2. Baby Cleansers

There is no consensus on using cleansers in the skincare of patients with AD. They are commonly used to facilitate grease and dirt stripping. There are three types of cleansing agents: soaps, synthetic detergents (syndets) and lipid-free cleansing agents. Most soaps have an alkaline pH that can worsen the typical higher pH of atopic skin and enhance the protease function, leading to barrier dysfunction. Syndets are non-soap surfactants with a pH closer to normal skin, a

decreased irritancy potential, a lack of sensitization and the capability to maintain or restore the skin's acid mantle [31]. The type of surfactant in a cleanser can affect its irritancy potential. Surfactants are needed to lift dirt and oils from the skin, but some types can cause tightness, dryness, irritation and itch after washing [32]. Anionic surfactants are the most common type of surfactants used in cleansers, but they have the greatest irritancy potential, while the nonionic and amphoteric types are less irritating. However, a study conducted in Japan showed that washing with water alone was not inferior to washing with soap for maintaining remission of eczema in pediatric patients with well-controlled AD in Japan [33].

### 3.3. Bath Oils

Bath oils are valuable for skin care, especially in infants and children. Their use as bathing additives is believed to create a lipid film on the skin surface after the bath [34], acting as a natural skin barrier. A trial conducted in Berlin [35] on children and adults with dry skin investigated the effectiveness of using bath oil additives compared to non-oil-containing skin cleansers for bathing or showering. This study showed that regular bath oil use improves skin barrier function by normalizing the increased TEWL and reducing the loss of natural moisturizing factors. A study demonstrated that using bath oils as early skin care in young infants also decreases the risk of AD development [36]. On the contrary, a review by Shams et al. found no evidence of clinical benefit from including oils as bath additives to treat conditions like atopic eczema [37]. However, it seems the effect of bath oils on skin barrier function is minimal because they do not create a continuous film on the surface. Plenty of different types of bath oils can be used with different capacities to maintain lipid barrier integrity and different capabilities to leave irritating substances on the surface after the bath [38]. Mineral oil is a semi-occlusive ingredient that penetrates the upper layers of the SC. It enhances the skin barrier by reducing the TEWL [39]. Another common product used for the treatment of dermatologic conditions is lanolin. Evidence found that lanolin is useful in recovering the skin barrier and reducing skin bacterial penetration [40].

### 3.4. Bath Salts

Bath salts are water-soluble, pulverized minerals added to water during a bath. They are believed to be beneficial in dermatologic disease for removing the dead keratin material and improving the condition of impetiginized or ichthyotic skin. Different studies have highlighted the beneficial effects of dead sea salts [MgCl] in patients suffering from AD [41][42]. The Dead Seas' water has a very high salt content and is particularly rich in magnesium that binds to water, influencing epidermal proliferation and differentiation and reducing skin inflammation [41][43]. A study conducted on 1408 patients with AD showed complete clearance of skin lesions in 90% of patients after 4–6 weeks of therapy in the Dead Sea area [44]. However, the efficacy of salt baths alone has not been studied systematically in AD.

### 3.5. Rice Starch

Many reports showed that adding rice bran to bath water had beneficial effects on skin erythema, lichenification and itching in patients with AD [45]. A study involving 13 patients with AD aged 19–38 years demonstrated that adding rice starch to bath water (10 g/L, 15 min twice-daily exposure for 4 consecutive days) had a beneficial effect on damaged skin barrier and improved barrier function. The authors hypothesized that the healing effect of starch was because small molecules can penetrate the upper layers of the fissured skin and form a homogenous layer [46].

### 3.6. Citric Acid

Considering the increased pH of the SC in inflamed skin, the acidification of the skin may be a possible preventive or therapeutic strategy in AD. On this line, an intervention study was conducted, dissolving citric acid in tap water until the bath water had a pH of 3.0. The experiment showed that acidic water bathing was effective for severe or refractory AD, and the improvement was demonstrated by obtaining a lower EASI score and TEWL and increased SC hydration [47].

### 3.7. Acetic Acid

There is conflicting evidence on using vinegar as a coadjuvant for treating AD. Studies conducted ex vivo and on murine models have shown that acetic acid has a beneficial effect on reducing eczema [48] and has antimicrobial properties [49]. However, a study examined the effects on *Staphylococcus aureus* abundance after 14 days of topical dilute apple cider vinegar (0.5% acetic acid) in 11 subjects with AD compared with 11 healthy controls. The results suggested no difference in the mean abundance of *S. aureus* in AD subjects and no significant differences in the skin bacterial microbiome of healthy control subjects [50].

### 3.8. Other Additives

Other bath additives have been studied to treat AD with less conclusive evidence. In clinical trials, green tea extracts have markedly reduced AD severity and pruritus reduction [51][52]. Similar results were obtained in a study in which 121 patients with recalcitrant AD were instructed to drink oolong tea every day for six months, with a marked to moderate improvement of their condition after one month [53]. These data showed that topical tea during the bath may be an alternative in children with AD. Tannic acid [TA] is a natural agent in grapes and green tea with anti-inflammatory, antioxidant, antimicrobial, antimutagenic and anticarcinogenic activities. In a double-blind cross-over trial, bath additives containing tannic acid improved pruritus in patients with AD without adverse effects [54]. Pine tar and various tar ingredients have also been studied for their antiallergic ingredient. A pilot study by Kam Lun Hon et al. has provided preliminary data on the efficacy of pine tar bath oil as a potential complementary topical treatment [55]. Due to the paucity of data, further evidence-based findings are needed. The therapeutic properties of sodium bicarbonate have been studied to demonstrate its effectiveness against skin pathologies due to its antimicrobial and anti-pruritic properties.

## 4. Conclusions

Atopic dermatitis is one of the most common cutaneous diseases in children worldwide. Due to its chronic course, the patient and their caregivers need to be adequately educated and confident in the basic management of the disease to gain disease control and improve their quality of life. Effectively managing atopic skin necessitates a multifaceted approach that incorporates a variety of treatment modalities, from simple interventions to more complex measures. The hydration of the skin through emollients represents the cornerstone of the prevention and treatment of atopic dermatitis. At the same time, bathing can have a supporting role if performed correctly. There are still disparate recommendations regarding the frequency, duration and timing of bathing. Daily bathing for about 5–10 min with warm water seems the best option. In addition, there is a crescent interest in the use of bathing additives. They emerged as promising adjunctive therapies with different mechanisms of action, such as anti-inflammatory, antibacterial and anti-pruritus effects, skin barrier repair and restoring the microbiome. The most common additives include bleach baths and baby cleansers, especially in patients with frequent bacterial infections. However, the possibility of the benefit of water baths alone remains unclear. It is possible to conclude that bathing seems to have a favorable risk/benefit balance if performed correctly.

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