

REVIEW ARTICLE

Are baths desirable in atopic dermatitis?

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Abstract

Background Bathing is a therapeutic measure commonly advised in atopic dermatitis (AD). Whether baths improve skin condition remains yet unclear. Our objectives were to appreciate the effect of 1-month tap water bathing on the submerged skin of AD patients, and to evaluate the proportion of AD patients in favour of baths.

Methods A Medline search of the last 30 years was performed in November 2012 using the Medical Subject Heading terms 'Atopic Dermatitis' OR 'Eczema' combined with 'Baths' OR 'Bath' OR 'Hydrotherapy' OR 'Cleansing' OR 'Soak'. Interventional studies measuring skin changes after tap water bathing were selected for the first analysis. Observational studies reporting the proportion of AD patients favourable to baths were selected for the second analysis. Important details regarding methods and results were independently extracted by two authors. Random-effects models were used to combine data on outcomes and conduct meta-analyses.

Results Of the 271 abstracts initially identified, seven studies met the selection criteria. All were of good quality. The number of patients with AD ranged from 89 to 260 (41.4–66.3% female). The pooled effect size of skin changes after baths was -0.10 (95% confidence interval: -0.47 to 0.28) in random-effects meta-analysis. The meta-analytical pooled proportion of AD patients in favour of baths was 29.1% (18.5–42.7).

Conclusions We found no evidence of an effect of 1-month tap water bathing on skin changes in AD. Only 29 percent of AD patients were favourable to baths. Use of baths in AD should be decided together with the patient.

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Conflicts of interest

All the authors have no conflicts of interest to disclose.

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Introduction

Atopic dermatitis (AD) is a chronic inflammatory skin disease affecting 10–20% of children in developed countries,¹ with significant morbidity and worsening quality of life.² In addition to corticosteroid or topical immunomodulatory therapy, management of the underlying pruritus relies on symptomatic measures including the local application of emollients or moisturizers.^{2,3} However, a key component of successful AD management is appropriate skin care, including advice for bathing.^{4,5}

Importantly, there is ongoing debate in the literature regarding the usefulness of bathing in the management of AD,⁵ and AD guidelines have not provided compelling recommendations regarding optimal bathing. Some authors consider water as a curative agent,^{6–9} although others consider bathing to be instead an additional skin irritant.^{10–14} These positions are primarily explained by the professional experience of physicians⁵ and are

related to the fact it has not yet been elucidated whether baths change the physical properties of AD patients' skin, either by improving moisturizing or, conversely, by aggravating cutaneous dryness.

The effects of baths on AD participants' skin have not received yet a structured critical evaluation. The purpose of this systematic review and meta-analysis was to systematically review and quantitatively synthesize evidence appreciating the effect of tap water bathing on submerged skin in AD patients. And since considering patients' view can provide further guidance on the acceptance of this care, our secondary objective was to evaluate the proportion of AD patients favourable to baths.

Methods

A systematic Medline literature search of the last 30 years was performed in November 2012 using the Medical Subject

Heading (MeSH) terms 'Atopic dermatitis' OR 'Eczema' combined with 'Baths' OR 'Bath' OR 'Hydrotherapy' OR 'Cleansing' OR 'Soak'. An iterative process was used to ensure all relevant articles had been obtained. A further hand search of bibliographic references of extracted papers and existing reviews was also conducted to identify potential studies not captured in the electronic database searches.

Study selection and analysis

One member of the team (MES) screened abstracts from the initial search and obtained articles deemed potentially relevant. Initial screening criteria for the abstracts were: (i) observational studies (i.e., cross-sectional, case-control and cohort studies); (ii) interventional studies; (iii) human participants of all ages

with AD; (iv) treatment with water as an outcome in relation to AD; and (v) study written in English or French. If a study met the initial selection criteria or its eligibility could not be determined from the title and abstract (or abstract not provided), the full text was retrieved. Two reviewers (MES and CA) then independently assessed the full text for inclusion status. Any disagreements were resolved by discussion. Final selection criteria were applied when AD participants had tap water tub baths without adjuvant measures and their skin was examined before and after bathing; or when they gave their opinion on baths. The study selection is shown on a flow diagram (Fig. 1).

Of the 271 originally identified abstracts, 52 met the initial inclusion criteria (see Appendix I). Forty-five of the initial 52 studies were excluded due to absence of tap water tub baths by

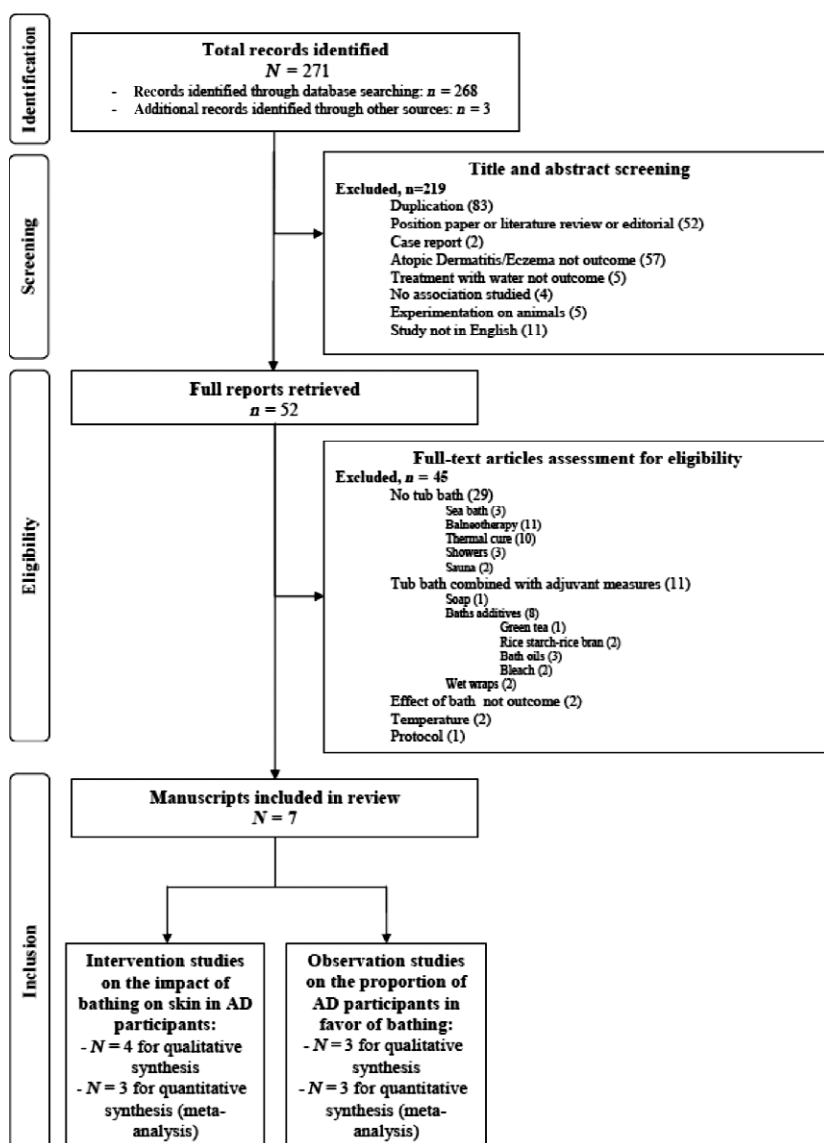


Figure 1 Flow diagram of selection of studies focusing on bath in atopic dermatitis.

participants (sea bath, $n = 1$; balneotherapy, $n = 2$; thermal cure, $n = 10$; shower, $n = 3$, sauna, $n = 2$) or because tap water tub baths were combined with adjuvant measures (soap, $n = 1$, bath additives, $n = 8$, wet wraps, $n = 2$) or because the effect of baths on the skin was not assessed as an outcome measure ($n = 4$). One publication providing only a study protocol without result was also excluded. The remaining seven studies were included in this review.^{15–21} The quality of each study was assessed independently by two reviewers (MES and CA) using the ‘Crombie criteria’²² adapted by Petticrew *et al.*²³ (see Appen-

dix II). Important details regarding the methods and results were extracted from selected articles and summarized (Table 1).

Meta-analysis

Two different analyses were performed. The first analysis assessed the effects of 1-month tap water bathing on AD patients’ submerged skin. All results were expressed in terms of Hedges’ bias-corrected ‘effect size’ of the skin changes after bathing. Standardized effect size measures are typically used when results from multiple studies are being combined, especially

Table 1 Main characteristics of selected studies

Study	Design of the original study	Location	Population	Diagnosis of atopic dermatitis	Intervention considered in the review	Outcome considered in the review
Effects of bathing on AD participants’ skin						
Proksch <i>et al.</i> 2005 ¹⁵	Randomized, double-blinded study in AD cases using the participant as his own control	Germany	$n = 30$; 40% female Age range: 20–54 years	Hanifin and Rajka classification	Pre-post design Bath: tap water Submerged: forearm Duration: 15 min Frequency: daily for 6 weeks	Hydration (Corneometer CM 825) TEWL (Tewameter TM 210) Skin roughness (PRIMOS optical 3D) Skin redness (Chromameter CR300)
Huang <i>et al.</i> 2009 ¹⁶	Randomized, investigator-blinded, placebo-controlled study in AD cases	USA	$n = 14$; Female: na Age range: 0.7–15.7 years	Based on author’s clinical experience	Pre-post design Bath: tap water Submerged: body Duration: 5–10 min Frequency: ≥ 2 baths/week for 3 months	EASI on submerged sites (upper limbs, trunk and lower limbs)
Chiang <i>et al.</i> 2009 ¹⁷	Cross-over study in AD cases vs. controls	USA	$n = 5$; Female: na Age range: 11–16 years	History and physical examination	Pre-post design Bath: tap water Submerged: arm Duration: 10 min Frequency: one single bath	Hydration 90 min after the bath (NOVA Dermal Phase Meter)
Lavender <i>et al.</i> 2011 ¹⁸	Randomized, investigator-blinded controlled study in AD cases vs. controls	UK	$n = 14$; 57% female Age range: na	Family history of AD	Pre-post design Bath: tap water Submerged: body Duration: na Frequency: ≥ 3 baths/week for 8 weeks	Hydration (Corneometer CM 820) TEWL (AquaFlux model AF200) pH (pHmeter 900)
Proportion of AD patients favourable to baths						
Hon <i>et al.</i> 2005 ¹⁹	Case-control study	China	$n = 181$; 41% female Children	Based on author’s clinical experience	Not applicable	Cleansing habits: bath vs. shower
Chrostowska-Plak <i>et al.</i> 2009 ²⁰	Case-series study	Poland	$n = 89$; 66% female Age range: 18–60 years	Hanifin and Rajka classification	Not applicable	Judgment that hot bath exacerbates AD symptoms
Hon <i>et al.</i> 2013 ²¹	Case-control study	China	$n = 260$; 46% female Mean age: 12.5 years	Hanifin and Rajka classification	Not applicable	Cleansing preference: bath vs. shower

AD, atopic dermatitis; EASI, Eczema Area and Severity Index score; na, not available; TEWL, transepidermal water loss; UK, United Kingdom; USA, United States of America.

when some or all of the studies use different outcome measures.²⁴ Here, measures of skin evaporation (transepidermal water loss, TEWL) were used when available because they are more stable with advancing age^{25,26} and because they have demonstrated to be reliable measures of the severity of AD.²⁷ Changes were assessed on a submerged arm^{28,29} before and after 1 month of tap water baths. This duration was chosen because it is long enough to estimate the medium-term effects of repeated baths, and because it was provided by all selected studies. Effect Size Calculator worksheet was used to derive bias-corrected effect sizes from mean, standard deviation and size of each group (Coe's Calculator retrieved December 16, 2014 from <http://www.cem.org/effect-size-resources>). Qualitative descriptors of effect size were <0.3, small; 0.4–0.8, moderate and >0.8, large.³⁰ A random-effects meta-analysis was then performed on the estimates to generate summary values using an inverse-variance method (Review Manager version 5.1; The Nordic Cochrane Centre, Copenhagen, Denmark). In the second analysis, aimed at determining the proportion of AD participants in favour of baths, we pooled individual study data with a random-effects (DerSimonian-Laird) meta-analysis (Meta Analyst, version 3.13, Tufts Medical Center, Boston, MA, USA). Results of both analyses are presented as forest plots. Heterogeneity between studies was assessed using Cochran's Chi-squared test for homogeneity (χ^2), and amount of variation due to heterogeneity was estimated by calculating I^2 .³¹ Finally, publication biases were appraised by visual inspection of the funnel plots (see Appendix III).

Results

Study characteristics

The four included interventional studies on the effects of baths on AD participants' skin^{15–18} are summarized in Table 1. The number of AD participants ranged from 5 to 30. Female represented 40–50% of AD cases. Participants were children in three studies,^{16–18} whereas the fourth one included younger adults.¹⁵ All studies provided skin characteristics of AD participants before and after 1 month (range 4–5 weeks) of tap water bathing. Generally, these participants were drawn from a control arm in wider clinical trials. For instance, data collection was based on cross-over¹⁷ and randomized controlled trials.^{15,16,18} The intervention, for a period of 1 day¹⁷ to 3 months,^{15,16,18} consisted in tap water tub baths with a frequency ranging from one single bath to daily bathing. Bath duration ranged between 5 and 15 min.^{15,16,18} Various skin characteristics were measured, such as the TEWL, in g/m²/h – a measure of water evaporation and skin barrier property,^{15,18} – the level of stratum corneum hydration [capacitance, in arbitrary unit (AU)],^{15,17,18} or the skin roughness, skin redness and pH measures.^{15,18} Alternatively, several AD severity scores were used, including the Eczema Area and Severity Index score (EASI), the proportion of Body Surface Area and the Investigator's Global Assessment score.¹⁶

The three included observational studies exploring AD patients' opinion on the use of baths^{19–21} are summarized in Table 1. The number of AD patients ranged from 89 to 260. Female represented 41–66% of AD patients. Patients were children in two studies,^{19–21} whereas the third one included adults above 18 years.²⁰ Data collection was based on one case-series study conducted in Poland²⁰ and two case-control studies conducted in Hong-Kong.^{19–21} The opinion of AD cases, or their parents when applicable, regarding the use of baths was collected with a standardized questionnaire designed either to express a preference between bath and shower,^{19–21} or to judge whether baths exacerbate or not the symptoms of AD.²⁰

Baths in AD

Effect of bathing on AD participants' skin Four studies have assessed the effect of bathing on AD participants' skin.^{15–18} Three studies have examined the skin changes after 1, 2 or 3 months with baths.^{15,16,18} The results were mixed, showing either a decrease¹⁵ or an increase^{17,19} of the level of skin hydration over time. For instance, the hydration changed from 47.2 AU at baseline to 44.1 AU after 6 weeks in one study,¹⁵ and from 40.7 AU at baseline to 72.1 AU after 8 weeks in another study.¹⁸ The evaporation, analysed with TEWL in two studies,^{15,18} appeared relatively stable throughout time (Table 1). Also, in one study,¹⁵ the skin roughness was reduced with tap water bathing, while skin redness was unchanged. Finally, another study found that one single bath without moisturizers resulted in an immediate decrease in the level of skin hydration.¹⁷

For ease of interpretation, a meta-analysis was performed on three studies testing the effect of 1-month tap water bathing on submerged arm skin in 58 AD cases. One study¹⁷ could not contribute to the meta-analysis because the intervention involved only one single bath. As illustrated on Fig. 2, the effect sizes of the selected three studies, ranging from –0.11 to –0.18, had a confidence interval (CI) that crossed the vertical line of 0, on a scale where 0 corresponded to no difference between before and after baths, and negative effect sizes indicated that tap water bathing had a positive effect on submerged skin in AD participants. Consistently, we found a non-significant summary effect size of 0.10 (95% CI: –0.47 to 0.28), which could not reject the null hypothesis. This result was not explained by the heterogeneity between studies ($\chi^2 = 0.33$, $P = 0.85$; $I^2 = 0.0\%$). Moreover, the funnel plot of effect size vs. standard error to investigate possible publication bias was in the pseudo 95% confidence limits, suggesting the absence of publication bias (see Appendix III). Finally, adding the effect sizes of hydration changes^{13,16} to the meta-analysis did not alter the results, with a non-significant summary random effect size calculated at 0.20 (–0.40 to 1.81; $\chi^2 = 14.68$, $P < 0.001$; $I^2 = 86.0\%$).

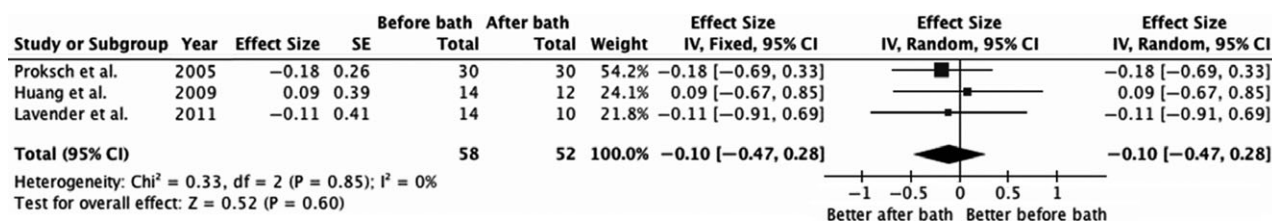


Figure 2 Meta-analysis of interventional studies assessing atopic dermatitis participants' submerged arm skin changes after 1-month bathing: forest plot for effect size of better skin condition before and after bath. The square area is proportional to the weight of each study, and horizontal lines correspond to the 95% confidence interval (95% CI). The diamond represents the summary value. The vertical line corresponds to an effect size of 0.0, equivalent to no difference.

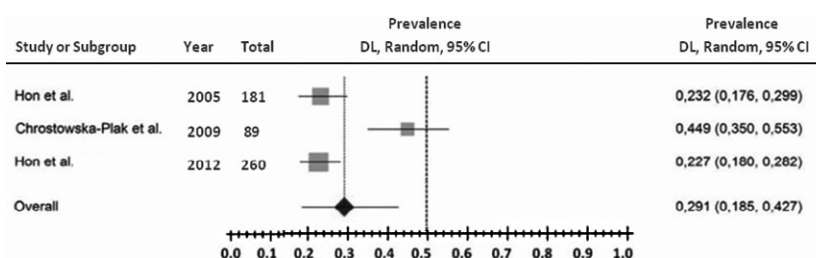


Figure 3 Meta-analysis of observational studies assessing the proportion of atopic dermatitis patients favourable to baths. The square area is proportional to the sample size of each study, and horizontal lines correspond to the 95% confidence interval (95% CI). The diamond represents the summary value. The vertical dashedline corresponds to a proportion of 50%, equivalent to no majority in favour or against baths.

AD patients' position towards bathing Three studies have assessed the proportion of AD patients favourable to baths.^{19–21} The results showed that most of patients preferred showering to bathing (Table 1). A reason provided is that they considered hot bath as a provocative factor of itch.²⁰ Cleansings habits did not depend on disease severity or season.¹⁹ The funnel plot of effect estimates vs. precision was roughly in the pseudo 95% confidence limits, suggesting the absence of publication bias.

A meta-analysis was performed on the three studies with a total of 530 cases (Fig. 3). The proportion of patients in favour of baths was lower than 0.5 in the three studies, ranging from 0.227 to 0.449, on a scale where 0.5 corresponded to a number of AD patients favourable to baths equal to the number of AD patients against baths. The summary proportion of AD patients having given their opinion on baths yielded a value of 0.291 (0.185–0.487; $\chi^2 = 94.6$, $P < 0.001$; $I^2 = 47\%$) indicating that 29.1% of AD patients were in favour of baths.

Discussion

This systematic review and meta-analysis provides evidence that 1 month of tap water bathing has no relevant effect, either beneficial or detrimental, on AD participants' skin. It also highlights that only 29.1% of AD patients are favourable to baths. These results should prompt practitioners to revise their bathing

advice, or at least to discuss it further with their patients. In addition, we found that only few studies have specifically examined the issue of baths in AD thus far. This appears all the more surprising in that skin cleansing is a matter of routine practice in AD, a common skin condition affecting until 20% children in developed countries.¹

Bathing in AD

A fine balance is necessary between skin cleansing for hygiene purpose and preservation of skin homeostatic properties. Baths recommendations in AD guidelines remain debated and sometimes contradictory. While the European guidelines advise a short duration of bath to avoid epidermal dehydration^{32,33} the Canadian guidelines recommend longer baths at least once a day, as did a consensus conference on paediatric AD and the 'soak and smear' technique.

Despite a number of studies for or against baths in AD,^{10–14} only few of them have actually examined the medium-term effects of bathing on AD participants' skin. Our systematic review found four studies having assessed the skin effects of baths in AD, and only three of them examined the skin effects of 1 month of tap water bathing.^{15,16,18} The absence of skin changes we highlighted after 1-month tap water bathing suggested that the phenomenon of skin dryness observed

immediately after the bath¹⁷ disappeared within few hours (of note, time interval between last bath and follow-up consultation was not provided in selected medium-term studies), and was not exacerbated by the multiplication of baths. Also, this neutral balance at medium-term may be explained by the cleansing of the skin's surface and reduction of cutaneous antigens and microbes, which are factors contributing to inflammation and pruritus in AD.¹⁷ Finally, the absence of skin changes was observed not only for eczematous skin but also for non-lesional skin in AD participants. Moreover, a similar result was found among healthy controls.¹⁸ This suggests that the results of our meta-analysis with AD participants may also apply to healthy people.

Beyond the absence of relevant evidence for preconization or avoidance of bathing, our meta-analysis revealed that only a minority of AD patients or parents was in favour of baths (29.1%, Fig. 3) whereas 70.9% were critical towards bathing or preferred other cleansing methods. How to explain this position towards bathing is not fully elucidated. First, it could be argued that, although not altering sustainably skin properties, baths are perceived by patients as exacerbating AD symptoms. For instance, Chrostowska-Plak reported that baths, and particularly hot ones, were experienced as an aggravating factor of itch,²⁰ which was explained by increased sweating and subsequent pruritus. Second, it is also obvious that baths have greater constraints than showers, which may explain that the majority of patients rather used showers.^{19,21} In particular, independent of AD condition, running a bath requires a bathtub and takes longer than a shower, not to mention the fact that it also consumes more water. Consistent with this explanation is the finding that the position of AD patients did not differ from that of healthy people, as pointed out by Hon *et al.*¹⁹ who reported no significant difference between AD patients and controls (respectively, 24% and 18% used baths in the past 3 days, $P = 0.127$). Finally, another explanation may rely on the fact that there is no reason to assume that showers, although more convenient than baths, are more detrimental for the skin. Further large controlled trials comparing baths to showers in AD remain yet necessary to confirm this assertion.

Critical analysis of literature

The main strengths of this meta-analysis were to propose a comprehensive inventory of previous literature thanks to the systematic review methods (as illustrated by the absence of obvious publication bias; see Appendix III), and to explore two different approaches to the same question, one based on objective measures, and the other more subjective but gathering the views of the key interested party. In addition, it is of note that the result we provided on the absence of skin effects of 1-month tap water bathing could be regarded as potent because it was 100% explained by intervention and 0% by between-study heterogeneity (Fig. 2). Regardless, a number of limitations also existed,

particularly regarding the heterogeneity of bath techniques and selected cases.

First, while most of selected studies have assessed the skin effects of repetitive baths after a delay,¹⁷ Chiang *et al.* studied the immediate skin effect of one single bath. This heterogeneous outcome prevented including the latter study in the meta-analysis.

Second, it is also of note that these baths were taken in the context of properly supervised interventions. In everyday life, it is obvious that bath characteristics such as temperature, duration or frequency, though possible determinants of skin effects,²⁰ are not as constant. Although some of previous studies have left some flexibility to participants,^{15–18} further interventions are needed to corroborate these findings and to test the medium-term skin effects in AD with various bath conditions.

Finally, the proportion of patients favourable to baths should be interpreted in the light of various non-health factors. Indeed, since we found that AD cases expressed an opinion towards bathing comparable to that of healthy controls,¹⁹ it could be argued that AD condition has not a major influence on the low proportion of patients favourable to baths, which might arise from other non-health reasons. In particular, age disparity of cases may account for part of the explanation. Indeed, cleansing habits and preferences differ between children and young adults, and even among children depending on their age. For instance, most of younger children would rather sit and play in a bathtub than standing and scrubbing in the shower. In contrast, it is likely that younger adults would rather shower to save time. What is more, it is worth noting that none of the selected studies on children indicated whether the questionnaire was actually filled by the children themselves.^{19,21} However, a questionnaire completed by parents may not report the exact transcription of AD patients' preference, and might reflect logic of practicality rather than a real health concern. Lastly, cultural differences of selected cases should also be considered. Indeed, even if worldwide people have adopted the same general attitudes towards water, using it to clean and sometimes to heal, skin care practices still vary between populations and are mainly based on tradition, experience and cultural factors. This makes it difficult to generalize the results, which were based on Chinese and Polish cases only.

Conclusions

In conclusion, this systematic review and meta-analysis provides suggesting evidence that repetitive tap water baths for 1 month had no significant effect on skin condition in AD. We also found that only a minority of AD patients were in favour of baths. In the absence of clear evidence to recommend bathing instead of showering in AD, an empirical approach tailored to each individual patient should be adopted and the use of baths should be decided together with the patient. Matching cleansing recommendations with patients' preference may

enhance compliance to appropriate daily skin care, with consequent better control of the disease. Further well-conducted randomized controlled trials prove necessary to compare the different ways of cleansing in AD and to determine whether specific bath conditions (including temperature, duration or use of adjuvant measures such as emollient ointment) are effective for the management of AD.

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Contributors statement

Marie-Elodie Sarre: conceptualized and designed the study, acquired data, interpreted data, drafted the initial manuscript, and approved the final manuscript as submitted. William Moote: interpreted data, drafted the initial manuscript and approved the final manuscript as submitted. Ludovic Martin, and Jorge A Mazza: interpreted data, reviewed and revised the manuscript for important intellectual content and approved the final manuscript as submitted. Cedric Annweiler: has full access to the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analyses, conceptualized and designed the study, acquired data, carried out data analyses, interpreted data, drafted the initial manuscript, supervised the study and approved the final manuscript as submitted.

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Appendix : I

Publications meeting the initial inclusion criteria

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Appendix: II

Quality assessment of studies included in the review.

Author and year	Appropriate research design?	Appropriate recruitment strategy?	Response rate?	Is sample representative? (All clinic populations)	Objective and reliable measures?	Power calculation/Justification of numbers?	Appropriate statistical analysis?	Quality indicators met
Proksch <i>et al.</i> 2005 ¹⁵	Yes Randomized, placebo controlled, double-blinded study	Yes	Not reported	Yes Ambulatory adults with mild AD – xerosis	Yes	No	Yes	5/7
Huang <i>et al.</i> 2009 ¹⁶	Yes Randomized, placebo controlled investigator-blinded study	Yes	34 patients recruited 31 patients enrolled 21 completed 3 months visit	Yes Hospitalized children with moderate to severe AD and sign of bacterial infection	Yes	Yes	Yes	7/7
Chiang <i>et al.</i> 2009 ¹⁷	Yes Cross-over study	Yes	Not reported	Yes Ambulatory children with mild to moderate AD	Yes	No	Yes	5/7
Lavender <i>et al.</i> 2011 ¹⁸	Yes Randomized, placebo controlled investigator-blinded study	Yes	225 females approached 100 recruited 71 completed 8 weeks visit	Yes New born with family history of AD	Yes	Yes	Yes	7/7
Hon <i>et al.</i> 2005 ¹⁹	Yes Case-control study	Yes	Not reported	Yes Ambulatory children	Yes	No	Yes	5/7
Chrostowska-Plak <i>et al.</i> 2009 ²⁰	Yes Case-series study	Yes	Not reported	Yes Ambulatory and hospitalized adults	Yes	No	Yes	5/7
Hon <i>et al.</i> 2012 ²¹	Yes Case-control study	Yes	Not reported	Yes Ambulatory children	Yes	No	Yes	5/7

AD, atopic dermatitis.

Appendix: III

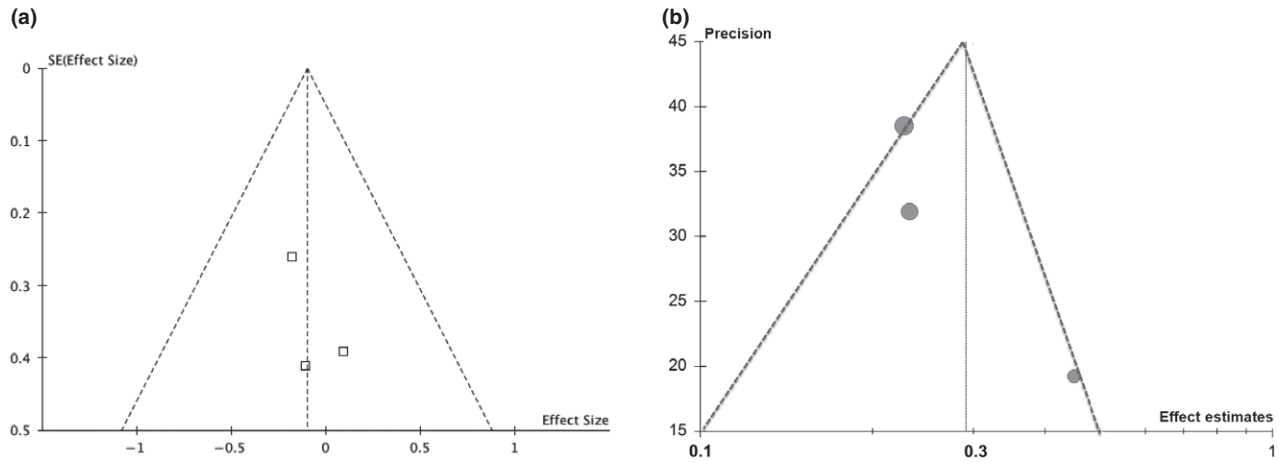


Figure 4 Funnel plots with pseudo 95% confidence limits for assessment of publication bias. (a) Funnel plot for three studies assessing AD participants' arm skin changes after 1-month bathing (effect size against standard error). (b) Funnel plot for three studies assessing AD patients' opinion on baths (effect estimates against precision). SE, standard error