Review Article

Role of Moisturisers in Atopic Dermatitis: Expert Group Recommendations from a Malaysian Panel via Modified Delphi Consensus Method

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Abstract

Atopic dermatitis (AD) is a chronic inflammatory skin condition, characterised by dry skin, pruritus and recurrent eczematous lesions. Challenges in the management of AD include fear associated with the use of corticosteroids, compliance issues and frequent flare-ups impacting the quality of life. Moisturisers are the cornerstone of AD management. In this study, we aim to develop the evidence-based consensus recommendations regarding the role and choice of moisturisers for AD. An electronic search of the PubMed/MEDLINE and Cochrane Library was undertaken to identify the relevant articles using keywords such as 'atopic dermatitis', 'eczema', 'moisturiser', 'humectant', 'occlusive', 'emollient', 'selection', 'ingredients', 'efficacy', 'safety', 'formulation', 'paediatric', 'adult', 'prevention' and 'guidelines'. A modified Delphi consensus methodology was used to achieve the consensus. A committee of nine dermatologists from Malaysia constituted the panel. Twenty-five questions belonging to five domains were drafted: (i) challenges impacting the regular use of moisturisers in AD; (ii) selection criteria; (iii) role of bioactive ingredients in alleviating AD symptoms; (iv) clinical effectiveness of moisturisers and (v) early initiation of moisturisers for AD prevention. Consensus was set a priori as a minimum agreement of 80%. The panel agreed that moisturisers for AD management should contain humectants, occlusives and emollients to replenish epidermal lipids, retain moisture, reduce inflammation and restore skin barrier function. Regular moisturisation decreases flare-ups and enhances the effectiveness of topical corticosteroids. The experts recommended selecting moisturisers tailored to patient needs, considering factors such as the intensity of skin dryness, site of application, formulation, active ingredients, environmental humidity, climate and cost.

Keywords: Atopic dermatitis, consensus, disease management, moisturisers

Introduction

Atopic dermatitis (AD) is a chronic inflammatory skin condition that significantly impairs the quality of life (QoL).[1] It is characterised by dry skin (xerosis), pruritus and recurrent eczematous lesions.[2,3] Multiple factors such as immune dysregulation (overexpression of Th2 and Th22 cytokines), defects in terminal epithelial differentiation (deficiency of filaggrin [FLG]), alterations in stratum corneum (SC) intercellular lipid composition, skin microbiome changes and environmental triggers (irritants, pruritogens [itch mediators that directly or indirectly worsen itch], extreme temperatures, sweating, air pollution

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and cigarette smoking) affect skin barrier function in people with AD [Figure 1].[4-6] In most cases, AD begins in the early childhood, and in some cases, persists into the adulthood.[7,8] In Malaysia, the prevalence of AD saw a notable increase from 9.5% in 1995 to 12.6% in 2003, suggesting a rising trend of this skin condition over the years.[3] A cross-sectional survey study conducted by Goh *et al*. in 2018 revealed that the overall prevalence of AD amongst Malaysian children was 13.4%.[9] In Malaysia, a significantly higher prevalence of AD has been observed in females compared to males.[10] The prevalence of AD is strongly correlated with a family history of atopic diseases amongst the first-degree relatives.[11] Patients with AD experience negative effects such as sleep disturbances, psychological distress, reduced productivity at school or work and notable impairment in QoL.[12-18] Topical agents, such as moisturisers, topical anti-inflammatory agents and topical antiseptic/antimicrobial agents, are the mainstay of AD treatment.[3,19-22] Current challenges in the management of AD include steroid phobia, compliance issues and frequent flare-ups that impact QoL.[23] Moisturisers are the cornerstone of AD management, owing to their ability to soothe the skin, increase SC hydration and spare the amount of topical corticosteroid (TCS) treatment needed.[24] Most moisturisers show beneficial effects but there is limited evidence of the superiority of one moisturiser over another. Determining an appropriate moisturiser for patients with AD will likely improve acceptability and adherence to moisturiser application. In this study, we aim to develop a consensus statement on the role and choice of moisturisers for AD.

Methods

Panel selection

A panel of nine experts (mean age: 44.1 years) with significant experience in dermatology participated in developing this consensus manuscript. Around 89% of experts ($n = 8$ out of 9) had expertise in managing paediatric and adult patients with AD. Panel members were carefully selected from three zones of Peninsular Malaysia (South: 22.2%; Central: 66.7%; North: 11.1%) based on their academic track records, experience in dermatology (mean clinical experience: 9.33 years) and type of practice (public: 11.1%; private: 11.1%; mixed practice [government, private and/or academic]: 77.8%). The percentage of paediatric patients with AD seen each month ranged from 1% to 80%, while for adults, it ranged from 10% to 80%. A chair was identified amongst the panel to drive the consensus process. A diverse panel was selected to achieve a broader perspective and generalisation of consensus.

Evidence review and questionnaire development

A comprehensive literature review was conducted on PubMed/MEDLINE and Cochrane Library to identify the pertinent articles published from January 2000 to October 2023. Diverse keyword combinations, including 'atopic dermatitis', 'eczema', 'burden', 'Malaysia', 'moisturiser', 'humectant', 'occlusive', 'emollient', 'selection', 'factors', 'bioactive', 'active', 'ingredients', 'composition', 'symptoms', 'efficacy', 'safety', 'formulation', 'paediatric', 'adult', 'prevention', 'management', and 'guidelines' were utilised, along with appropriate variations in search phrases and Boolean operators (AND, OR). The included sources comprised original research articles (randomised controlled trials [RCTs], longitudinal

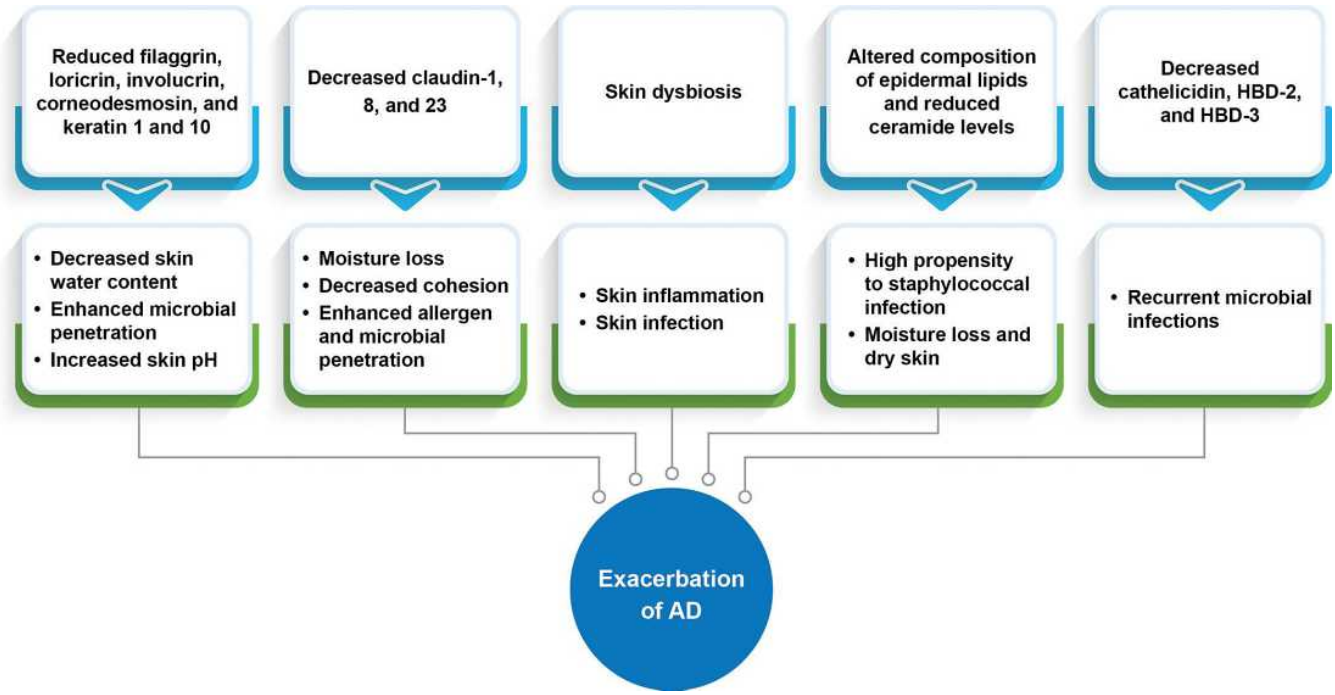

Figure 1: Dysregulation of the skin barrier in AD.[4] AD: Atopic dermatitis; HBD: Human β-defensin

studies, prospective and retrospective cohort studies, observational studies, case-control studies, and cross-sectional studies), reviews, systematic literature reviews, meta-analyses, practice guidelines, and consensus recommendations. Excluded sources were research studies involving animals or published in a language other than English. Replicates were eliminated during the filtering process.

A modified Delphi process [Figure 2] was used to reach a consensus.[25] Following the results of the literature search, a total of 25 clinically relevant questions and statements (statements [n = 17], other questions [n = 8]) belonging to five major domains were drafted. The broad study objectives were as follows:

- Dermatologists' perspective on the current burden of AD and issues that affect the routine use of moisturisers in the management of AD
- Selection criteria for moisturisers in AD management
- Role of bioactive ingredients in alleviating the symptoms of AD
- Clinical effectiveness of moisturiser treatment in people with AD
- Early initiation of moisturiser use for the prevention of AD.

The survey was designed after an in-depth literature review to increase the study's rigor and ensure efficient responses [Supplementary Material]. The questionnaire was finalised in discussion with the chair and was rolled out to all the participants through an online survey platform (Round 1 Delphi survey). Key articles were shortlisted and shared with the participants before the survey.

Consensus process

In this study, the consensus threshold [Table 1] was set at a minimum of 80% of participants agreeing or disagreeing with a statement or an option.[25-27] A roundtable meeting of experts was conducted in Malaysia to review the Round 1 Delphi survey results and statements that did not attain consensus during Round 1 (<80% consensus). The differences in opinions were also discussed for the modification of statements for the next round of voting (Round 2 Delphi survey). Experts made their decisions based on the available evidence and/or clinical expertise in the field. The questionnaire was rolled out to all the participants through an online survey platform (Round 2 Delphi survey). Consensus statements were developed based on the opinions and agreement of the majority. The final draft of the consensus report was circulated amongst the panel for review and approval.

Results

The expert panel (n = 9) analysed the evidence and practice guidelines/consensus recommendations on the role of moisturisers and their clinical effectiveness in the management

Table 1: Consensus criteria[25-27]

Statement results	Consensus threshold
'Agreement' (consensus)	'When ≥80% of participants agree or disagree with a statement'
'No consensus'	'When <80% of participants agree or disagree with a statement'
Exclusion	The statement is excluded if consensus is not achieved after two rounds

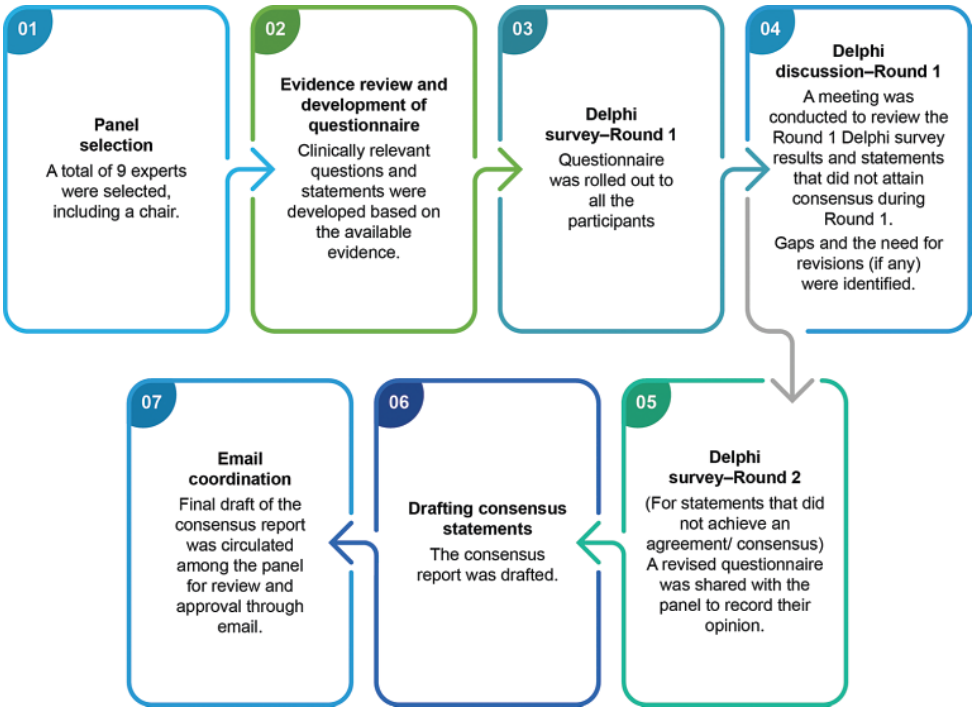

Figure 2: Overview of the process used to develop the clinical consensus statement

of AD published between January 2000 and October 2023. In round 1, consensus was reached for 10/17 statements (58.82%). Two statements did not achieve consensus during the round 1 discussion. The remaining five statements that did not achieve consensus after the first round were modified for the second round of voting. The final consensus statements were drafted based on the responses that had met the consensus threshold (≥80%) at the end of the process. This article will first discuss the evidence review for each of the study objectives followed by the expert consensus.

Dermatologists' perspective on the current burden of atopic dermatitis and issues that affect the routine use of moisturisers in the management of atopic dermatitis

In this Delphi survey, the experts were surveyed regarding diagnosing AD in their clinical practice. Around 55.5% of experts (n = 5) reported that 15%–29% of their paediatric patients (aged <18 years) were diagnosed with AD. In addition, a significant proportion of experts (88.9%; n = 8) indicated that approximately 5%–29% of their adult patients (aged >18 years) were diagnosed with AD. Experts mentioned that dissatisfaction with the formulation type influences routine moisturiser use in patients with AD. Experts opined that patients usually discontinue the use of moisturisers after their symptoms have subsided, increasing the risk of disease relapse. Concerns regarding the presence of ingredients that irritate or sensitise the skin also impact the routine use of moisturisers in AD. Some experts opined that preservatives in moisturisers could lead to allergic contact dermatitis in patients with sensitive skin, thus affecting compliance with therapy.

Selection criteria for moisturisers in atopic dermatitis management

The application of moisturisers is the mainstay of AD management.[28] Humectants, occlusives and emollients are the three main types of moisturising ingredients [Table 2].[29,30] Emollients lubricate and soften the skin, occlusive ingredients provide barrier protection and reduce water loss and humectants attract and bind water.[29,30] Currently, moisturisers are available in different formulations (ointments, creams, lotions and gels).[31,32] While ointments are greasy, creams and lotions contain water and are more user-friendly and acceptable.[32] Moisturisation is vital for overall skin care and enhancing hydration and barrier function. Due to the complex pathophysiology of AD and its significant impact on patients' QoL, it is recommended to implement therapies that improve disease characteristics, such as oxidative stress, impaired skin barrier, skin inflammation, and pruritus.[19-22,28,33,34] In people with AD, moisturisers should offer prolonged hydration and soothe, moisturise and protect the skin from irritation.[19] They should be easy to apply, non-greasy, non-staining and chosen based on patient preference for better compliance. Moisturisers with known allergens (e.g., fragrances, parabens, tocopherol, propylene glycol, formaldehyde, formaldehyde releasers, benzyl alcohol, methylisothiazolinone, D-limonene, *Lavandula angustifolia* oil and *Melaleuca alternifolia* oil) should be avoided.[19,35-37] Patients must be educated on avoiding ingredients known to cause skin irritation, such as those found in cleansers, detergents and moisturisers. They should be informed about common irritants (e.g., sodium lauryl sulphate and Acetyl alcohol) and allergens (e.g., peanut oil, fragrances and parabens) to help prevent exacerbations and optimise AD management.[19,38,39] Table 3 lists guideline/consensus recommendations on the objectives of managing AD and selection criteria for moisturisers for AD management.[19,20,22,28,33]

Table 2: Main types of moisturising ingredients according to their properties[29,30]

Class	Mode of action	Examples
Humectants	Increase the amount of water retained by the SC due to their hydrophilic nature	Glycerine/glycerol Urea Hyaluronic acid Sorbitol Alpha hydroxy acids (glycolic acid, lactic acid, sodium pyrrolidine, and carboxylic acid) Propylene glycol
Occlusives	Form a hydrophobic film on top of the SC to trap moisture in the skin, transiently increasing hydration	Lanolin Mineral oil Cholesterol Paraffin Silicone
Emollients	Lubricate and soften the skin by filling the cracks between the SC	Ceramide *Vitellaria paradoxa* (formerly *Butyrospermum parkii* or shea butter) Linoleic acid Lauric acid Stearic acid Isopropyl palmitate

SC: Stratum corneum

Expert opinions/consensus recommendations

Moisturisers for AD should contain humectants, occlusives and emollients to replenish epidermal lipids, retain moisture, reduce inflammation and restore skin barrier function [Table 4A]. The key desired characteristics of moisturisers recommended by the expert panel are summarised in Figure 3. Experts unanimously agreed that skin type, the intensity of skin dryness, site of application, environmental humidity, climate and cost are the key factors to consider when selecting a suitable moisturiser for AD. Experts opined that patient preferences and tolerance should be considered when selecting a moisturiser formulation to enhance adherence to the therapy. Fragrances, sodium lauryl sulphate, parabens, and formaldehyde-releasing preservatives are the most common allergens and irritants and should be avoided in patients with AD. The experts strongly opined that the cream formulation is user-friendly and improves treatment compliance among paediatric and adult patients with AD. In patients with dry and sensitive skin, cream, and ointment moisturiser formulations are preferred over lotion and gel formulations, considering the hot and humid climate of Malaysia.

Table 3: Guideline/consensus recommendations on the objectives of managing atopic dermatitis and selection criteria for moisturisers for atopic dermatitis management[19,20,22,28,33]

Study title	Key highlights
'Expert consensus on holistic skincare routine for AD'[19]	● An ideal/recommended moisturiser for patients with AD should help protect skin barrier function and may have anti-inflammatory and antioxidant properties ● Moisturisers should provide sustained hydration after a single application as well as immediate relief from itching, redness and irritation ● Fragrances, preservatives and tocopherol are the most common allergens in moisturisers and should be avoided in patients with sensitive skin
'Consensus guidelines for the management of AD: An Asia-Pacific perspective'[22]	● Consistent moisturiser use is a crucial component in the overall management strategy for AD. Clinicians must establish short- and long-term goals or 'pillars' of therapy, including educating and empowering patients and caregivers, avoiding environmental triggers, maintaining the skin barrier function, and controlling the itch-scratch cycle ● The selection of moisturiser should depend on the skin type, degree of dryness and the humidity in the air
'Guidelines on the management of AD in India'[33]	● Moisturisers are the mainstay of therapy and should be consistently incorporated in all treatment stages, including maintenance, to ensure optimal skincare
'Approach to the assessment and management of adult patients with AD: A consensus document'[20]	● The objectives of managing AD involve minimising skin inflammation and itching, restoring skin barrier function, and enhancing the overall QoL of patients with AD
'Diagnosis and treatment of AD in children and adults: European Academy of Allergology and Clinical Immunology/ American Academy of Allergy, Asthma and Immunology'[28]	● Basic therapy for AD should address the skin barrier defect with regular use of moisturisers and skin hydration, along with identification and avoidance of irritants and non-specific triggers ● The selection of moisturiser depends on the individual skin status, seasonal and climatic conditions and the time of day

AD: Atopic dermatitis, QoL: Quality of life

Role of active ingredients in alleviating the symptoms of atopic dermatitis

Over the last few years, moisturisers have been supplemented with various bioactive ingredients to improve SC hydration and epidermal action.[30] Natural moisturising factors (NMFs) are intrinsic, extremely hygroscopic compounds that are essential for the maintenance of hydration levels in the SC.[30] NMF deficiency or reduction is linked to increased SC abnormalities that manifest as dry skin, scaling, flaking, and increased surface pH.[40,41] Urea is one of the first and most extensively investigated NMF compounds. Topical urea enhances epidermal barrier function, including antimicrobial defence, by regulating gene expression in keratinocytes relevant to

Table 4A: A summary of statements that achieved consensus

Statements	Vote (%)
I. Selection criteria for moisturisers in AD management	
1. Moisturiser use is the cornerstone of AD management and is suggested for patients of all ages and at all the stages of the disease	100
2. Skin type, intensity of skin dryness, site of application, environmental humidity, climate and cost are the key factors to consider when selecting a suitable moisturiser for AD	100
3. Key desired characteristics of a moisturiser for AD include	
a. Restores and strengthens the skin barrier that protects against environmental triggers	100
b. Decreases moisture loss	100
c. Moisturises and protects the skin from irritation	100
d. Does not contain additives that irritate or sensitise the skin	100
e. Has anti-inflammatory properties	100
f. Provides immediate relief from itching, redness and irritation	100
g. Restores lipid lamellae	100
h. Does not clog pores	100
i. Modulates skin microbiota	88.9
4. Moisturisers for AD should contain humectants, occlusives, and emollients to replenish epidermal lipids, retain moisture, reduce inflammation and restore skin barrier function	100
5. Most common allergens and irritants should be avoided in patients with AD	
a. Fragrances	100
b. Sodium lauryl sulphate	100
c. Parabens	88.9
d. Formaldehyde-releasing preservatives	88.9
II. Role of active ingredients in alleviating the symptoms of AD	
6. An ideal/recommended moisturiser for controlling dry noninflamed skin in AD should include humectants, occlusives, emollients and additional ingredients that restore the skin barrier and have anti-inflammatory or antioxidant properties	100
7. An ideal/recommended moisturiser for managing dry inflamed skin in AD should contain	
a. Humectants	100
b. Emollients	100
c. Antipruritic/soothing agents	88.9
d. Occlusives	88.9
e. Additional ingredients that restore the skin barrier and have anti-inflammatory or antioxidant properties	100
8. Effective active ingredients that aid in alleviating skin dryness and can be considered in patients with AD	
a. *Vitellaria paradoxa* (formerly *Butyrospermum parkii* or shea butter)	100
b. Ceramides	100
c. Cholesterol	100
d. Glycerine/glycerol	100
e. Urea (2%–10%)	100
f. Hyaluronic acid	100

Contd...

Table 4A: Contd...

Statements	Vote (%)
g. PCA	88.9
h. Colloidal oatmeal	88.9
i. Linoleic acid	88.9
9. Colloidal oatmeal is an effective skin-soothing ingredient useful in reducing irritation in patients with AD	88.9
10. Effective active ingredients that have been shown to accelerate the recovery of skin barrier function in patients with AD	
a. Ceramides	100
b. Urea (2%–5%)	88.9
c. Colloidal oatmeal	88.9
d. Cholesterol	88.9
11. Effective active ingredients with roles in reducing inflammation in patients with AD	
a. Colloidal oatmeal	100
b. Saponins, flavonoids and riboflavin from protein-free oat plantlet extracts	100
c. Licochalcone A	88.9
d. Niacinamide	88.9
e. α-bisabolol	88.9
f. *Ophiopogon japonicus*	88.9
III. Clinical effectiveness of moisturiser in AD	
12. Moisturisers are recommended at any stage of AD, preventing flare-ups, and maintaining a flare-free state	88.9
13. Regular use of a moisturiser alleviates the symptoms of AD (reduces dryness of skin and itch) versus no moisturiser in patients with AD	100
14. Regular use of moisturiser reduces the incidence of flares and prolongs the time to flare in patients with AD	100
15. Moisturisation enhances the effectiveness of TCS and has a steroid-sparing property in patients with AD	100

Table 4B: Summary of statements that did not achieve consensus and were excluded

Statements
IV. Early initiation of moisturisers to prevent AD
1. Prophylactic application of moisturiser initiated in early infancy has a role in the primary prevention of AD in normal-risk infants
2. Early use of moisturiser in infancy is an effective strategy for the primary prevention of AD in high-risk infants

AD: Atopic dermatitis, TCS: Topical corticosteroid, PCA: Pyrrolidone carboxylic acid

their differentiation and antimicrobial peptide expression.[42] At low concentrations (2%–10%), urea is typically indicated for moisturising and improving the skin's barrier function.[30,43,44] However, topical urea may cause mild skin irritation and symptoms such as stinging, itching or burning sensation, especially when applied to excoriated or fissured skin.[30,43,44] Arginine, pyrrolidone carboxylic acid (PCA), glycerol, and lactic and hyaluronic acid have been shown to alleviate skin dryness and enhance skin texture.[30,44-48]

Vitellaria paradoxa (formerly *Butyrospermum parkii* or shea butter) has been used traditionally in Africa for various dermatologic purposes, including the treatment of AD. *Vitellaria paradoxa* has potent anti-inflammatory properties and has been reported to reduce skin dryness in patients with sensitive skin and AD.[48-51] Hon *et al.* investigated the effectiveness of a shea butter-containing moisturiser in paediatric patients with AD and reported a substantial reduction in mean pruritus score and improved QoL.[51] In another study, shea butter-containing moisturiser was shown to significantly improve skin dryness, pruritus, erythema, desquamation and lichenification in adults with AD after 2 weeks.[48]

Ceramides play an important role in forming a permeability barrier in the skin. Deficiency in ceramide fraction is linked to barrier dysfunction, decreased SC hydration and risk of allergen penetration.[30,52] Several studies have demonstrated that the application of a topical moisturiser containing ceramides can reduce transepidermal water loss and desquamation, alleviate pruritus, improve skin barrier function and enhance QoL in patients with AD.[45,53,54] Cholesterol, linoleic acid and palmitic acid have also shown potential in maintaining the integrity of the skin barrier and hydration in patients with AD.[51,55-60] Inclusion of niacinamide, a physiologically active form of niacin or Vitamin B_3, in moisturisers has been shown to alleviate dry skin conditions and improve the integrity of the SC.[61,62] Tanno *et al.* highlighted that nicotinamide stimulates the synthesis of ceramides, free fatty acids and cholesterol in cultured human keratinocytes, concomitant with the upregulation of serine palmitoyltransferase, which is the rate-limiting enzyme in sphingolipid synthesis.[63]

Colloidal oatmeal has long been used in the treatment of dermatological conditions. Oatmeal extract has been shown to inhibit the release of nuclear factor kappa B (NF-κB) from keratinocytes and pro-inflammatory cytokines and histamine.[64] It also modulates arachidonic acid, cytosolic phospholipase A2 and tumour necrosis factor-alpha (TNF-α).[65] Colloidal oatmeal has been shown to provide barrier protection along with anti-inflammatory and soothing benefits to patients with AD.[24,30,66-75] A decrease in the rate of flare-ups and TCS consumption was reported with the use of oat-containing moisturiser.[24,69] Saponins and riboflavin from protein-free oat plantlet extracts possess anti-inflammatory and immunoregulatory properties, which are beneficial for the treatment of AD.[76]

Studies have reported the inclusion of extracts of *Aquaphilus dolomiae*, allantoin, α-bisabolol, licochalcone A, glycyrrhetinic acid (GA) and *Ophiopogon japonicus* in skincare formulations owing to their anti-inflammatory properties.[24,30,77-84] The extract of *Aquaphilus dolomiae* displays properties that are likely beneficial for the treatment of pruritus and xerosis, including immunomodulatory effects.[78-80] Martin *et al.* highlighted that *Aquaphilus dolomiae* extract counteracted the mitogenic effect of *Staphylococcus aureus* secretome on $CD4^+$ T-cells.[77] Allantoin promotes cell division and epithelisation, expediting the skin's regeneration process in cases of inflammation. The robust moisturising capabilities of allantoin-containing ointments or creams facilitate the shedding of dead skin cells, resulting in smoother skin texture.[81] Similarly, α-bisabolol and GA have shown soothing

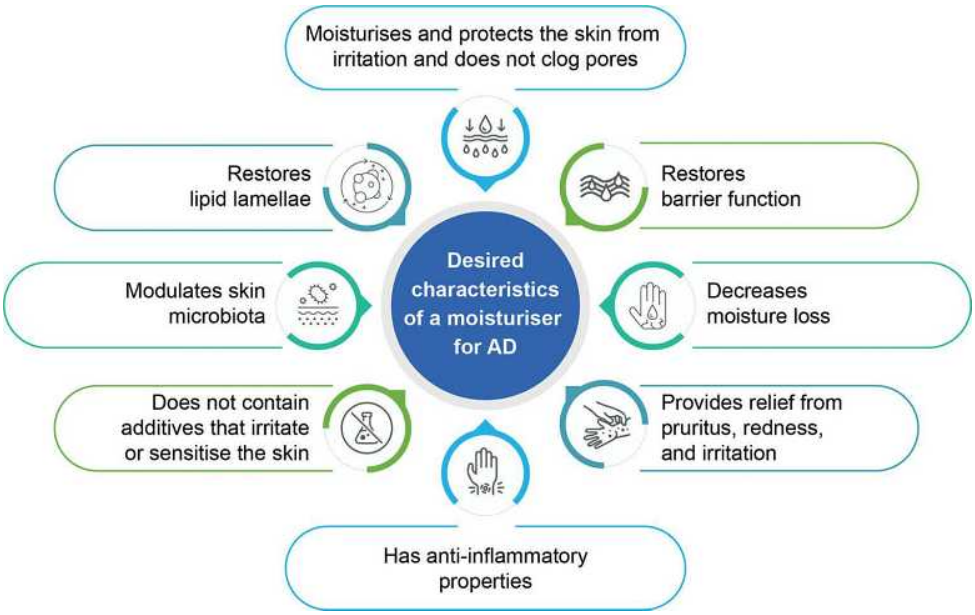

Figure 3: Ideal/recommended moisturiser for AD. AD: Atopic dermatitis

effects and reduction of eczema-associated inflammation.[24,30,82] Wananukul *et al.* reported that a moisturiser containing licochalcone A was found to produce similar outcomes in terms of scoring AD score compared to 1% hydrocortisone.[84] *O. japonicus* is an herbal medicine prescribed by traditional practitioners for inflammatory diseases in many Asian countries. An *et al*. investigated the inhibitory effects of ophiopogonin D (OP-D), a steroidal glycoside derived from *Radix O. japonicus*, in an AD-like mouse model.[85] The study reported that OP-D effectively reduced skin thickening and mast cell activation in AD-like mouse back skin tissues. A significant reduction in cytokine expression levels was noted. In human keratinocytes inflamed by TNF-α, OP-D inhibited p38 and ERK protein activation and reduced NF-κB nuclear translocation.[85] Another study by Mainzer *et al*. found that oligofructans derived from *O. japonicus* effectively improved AD symptoms (erythema, pruritus) and QoL.[86] The study highlighted that this active ingredient could potentially be combined with moisturising treatments to extend the remission phase for patients.[86]

Consensus recommendations on the role of ingredients in alleviating the symptoms of atopic dermatitis

Xerosis or dry skin in AD is caused by disrupted epidermal differentiation, resulting in impaired intercellular lipid bilayers of the SC and a deficiency of FLG-derived NMFs. Apart from humectants, occlusives and emollients, the panel recommended the inclusion of bioactive ingredients with anti-inflammatory/antioxidant properties in moisturisers for controlling dry, inflamed and non-inflamed skin in AD [Table 4A]. There was no consensus on the inclusion of an antipruritic/soothing agent in moisturisers for controlling dry, non-inflamed skin.

Choosing the proper moisturising ingredients is critical for AD management. The expert panel agreed that *Vitellaria paradoxa* (shea butter), ceramide, cholesterol, glycerine/glycerol, NMFs (such as urea [2%–10%], hyaluronic acid and PCA), colloidal oatmeal and linoleic acid are effective active ingredients that alleviate skin dryness in patients with AD. Colloidal oatmeal is an effective skin-soothing ingredient that reduces irritation in patients with AD. Maintaining skin barrier function is vital for mitigating the skin's susceptibility to irritants, allergens and microbes. Ceramide, urea (at low concentrations [2%–5%]), colloidal oatmeal and cholesterol are the effective active ingredients and have been shown to accelerate the recovery of skin barrier function in patients with AD. Reducing inflammation is one of the main objectives of long-term AD control. Experts agreed that colloidal oatmeal, saponins, flavonoids and riboflavin from protein-free oat plantlet extracts, licochalcone A, niacinamide, α-bisabolol and *O. japonicus* are the effective active ingredients that help reduce inflammation in patients with AD.

Clinical effectiveness of moisturiser treatment in atopic dermatitis

The majority of the guidelines and consensus recommendations on the management of AD, including the Malaysian Clinical Practice Guidelines on the Management of Atopic Eczema, advocate the regular use of moisturisers in AD, regardless of the disease severity (treatment of poorly controlled AD, treatment of flares and maintenance).[19,21,22,28,29,33,87,88] Several clinical studies support the tolerability and efficacy of moisturisers in patients with AD. A systematic review by van Zuuren *et al.* assessed the effectiveness of moisturisers (oats, urea, glycerol, ceramides, licochalcone and GA-based moisturisers) in adults and children with AD (n = 77 studies; 6603 participants with predominantly mild-to-moderate AD).[24] The usage of moisturisers reduced skin dryness and pruritus, as well as the need for moderate-and high-potency TCSs, and prolonged the time to flare-ups.[24] However, there

was no reliable evidence indicating the superiority of one moisturiser over another. The study also highlighted that TCSs were more effective at improving symptoms of AD when used with a moisturiser, rather than used alone.[24] Another systematic review by Kritsanaviparkporn *et al.* examined the effectiveness of moisturisers in children (≤15 years) with AD.[89] The study showed that the use of moisturisers extended the time to flare-ups by approximately 13.52 days.[89] There was a greater reduction in the risk of relapse during the 1st month of latency compared to the 2nd and 3rd months. Additionally, moisturiser use alleviated symptoms of pruritus. However, minimal benefits were observed in terms of disease severity and QoL.[89] Bhanot *et al.* assessed adverse events related to 29 different emollients, including those containing urea, ceramide, glycerol, herbal ingredients and other components.[44] The proportion of participants experiencing treatment-related adverse events ranged from 2% to 59%. Most adverse events were mild and skin-related, with no reports of any serious adverse events. These findings suggest that the studied emollients are generally safe for use, providing reassurance to clinicians and patients.[44]

Expert opinions/consensus recommendations

Moisturisers are recommended at any stage of AD to prevent flare-ups and maintain a flare-free state [Table 4A]. Experts unanimously agreed that regular use of moisturisers reduces the incidence of flare-ups and prolongs the time to flare-ups in patients with AD. Furthermore, regular moisturisation enhances the effectiveness of TCS and has a steroid-sparing property in patients with AD. The experts preferred moisturisers containing ceramides and NMFs followed by glycerol-containing moisturisers in children with AD in their clinical practice. In adults with AD, moisturisers containing ceramides and NMFs were most preferred by experts, followed by oatmeal-containing moisturisers. Herbal moisturisers and urea-containing moisturisers were the least preferred by experts in their clinical practice in children and adults with AD.

Early initiation of moisturisers to prevent atopic dermatitis

The barrier enhancement for eczema prevention trial was conducted to assess the long-term impact of the daily application of moisturisers on the development of AD in high-risk infants up to 5 years of age.[90] Infants with a family history of atopic disease were assigned to (i) a daily moisturiser group with standard skincare advice or (ii) standard skincare advice alone (control). The findings from the study revealed that daily moisturiser use had no preventative effect on the development of AD.[90] A review by Zhong *et al.* examined the effectiveness of prophylactic emollients in preventing AD in infancy (n = 10 studies).[91] The study reported that the prophylactic and consistent use of moisturisers on infant skin may prevent AD in high-risk populations (due to family history of AD, asthma, food allergy or allergic rhinitis).[91] The study highlighted that while prophylactic moisturiser may delay the onset, it might not entirely prevent the development of AD.[91] In contrast, in the studies that recruited normal-risk infants, there was no significant effect of early moisturiser use on AD prevention.[91] Another RCT involving 124 high-risk neonates for AD was conducted in the United States and the United Kingdom.[92] In the intervention group, parents were directed to administer moisturiser at least once daily within the first 3 weeks after birth.[92] Conversely, the control group was instructed not to use any moisturiser. The study highlighted that improving the skin barrier from birth significantly decreased the cumulative incidence of AD in high-risk neonates within the first 6 months.[92] More recently, the Short-term Topical Application to Prevent AD trial demonstrated that daily moisturiser use initiated in the 1st week of life and continued until 2 months reduced the incidence of AD in the 1st year of life amongst high-risk infants.[93]

Expert opinions

In our study, no consensus was reached on the role of moisturisers in the primary prevention of AD in both normal- and high-risk infants, emphasising the need for further studies in this area [Table 4B].

Discussion

AD is a chronic relapsing inflammatory condition. Acute AD is characterised by papulovesicular eruption with erythema, weeping, oedema, and excoriation, whereas chronic AD is characterised by lichenification and xerosis.[3] Moisturisers play an integral role in the maintenance and prevention of exacerbation of AD, regardless of disease severity. Patient adherence to the use of moisturiser remains a challenge in AD management due to a variety of factors, notably a tendency to discontinue use once symptoms subside and concerns regarding the presence of ingredients that irritate or sensitise the skin. Addressing these obstacles is crucial for mitigating the risk of disease relapse and optimising the long-term management outcomes. The experts opined that it is important to educate patients/caregivers on the correct selection of moisturiser in AD and adhere to consistent moisturiser use even during symptom remission, emphasising its role in maintaining skin barrier integrity and preventing exacerbations. Currently, there is no consensus on the role and choice of moisturisers for AD management in Malaysia. In this study, we reviewed the current clinical evidence and recommendations regarding the use of moisturisers in patients with AD and developed a consensus document on the role and choice of moisturisers for AD. This practical consensus document can assist dermatologists in clinical decision-making when choosing an appropriate moisturiser for AD. Experts agree that moisturisers for AD should: (i) restore and strengthen the skin barrier; (ii) hydrate; (iii) contain anti-inflammatory properties; (iv) provide relief from pruritus, redness, irritation and (v) modulate skin microbiota. Moisturisers with known irritants and allergens should be avoided.

Experts recommend regular and consistent use of moisturisers at any stage of AD. Regular use of moisturiser reduces the incidence of flares and prolongs the time to flare in patients with AD. The European Task Force on Atopic Dermatitis/

European Academy of Dermatology and Venereology Eczema Task Force recommends daily application of moisturiser in a 'soak-and-seal' manner.[94] In our study, the experts suggested twice daily application of moisturiser to all the areas of the body immediately after the bath following gentle drying when the skin is still slightly moist. Twice-daily bathing frequency was preferred by experts over once-daily bathing in patients with AD.

Strengths and limitations of the consensus process

Strengths

The expert committee was formed without any selection bias. The panellists were chosen to represent the breadth of expertise and clinical experience in the subject from all over Malaysia. All experts actively participated in the consensus process. The differences in opinions were also discussed during the meeting.

Limitation

In this study, the expert panel had limited expertise in paediatric dermatology practice. Furthermore, the patient's voice was not included in the consensus process.

Conclusion

The role of moisturisers in AD is paramount, serving as a cornerstone in the management of the disease. This article provides a comprehensive overview of the pivotal role of moisturisers in the management of AD. The regular use of moisturisers reduces skin dryness, pruritus, and the incidence of flare-ups in patients with AD. The expert panel recommended selecting moisturisers tailored to individual patient needs, considering the intensity of skin dryness, the site of application, formulation, active ingredients, environmental humidity, climate, and cost.

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Conflicts of interest

Author **A.M.A.** has received honoraria for serving as speaker and/or advisor for AbbVie, Beiersdorf, Bristol Myers Squibb, Boehringer Ingelheim, DKSH, Galderma, Glenmark, GSK, HOE Pharma, Hyphens, Johnson & Johnson, Loreal, Leo Pharma, Menarini, Novartis, Pfizer, Sanofi, Livemed, Takeda and ZP Therapeutics; is also the principal investigator for clinical trials funded by Boehringer Ingelheim. Author **K.N.H**. has received honoraria from Galderma, Beiersdorf, L'Oréal, and Lipidware for consultation, talks, and research; received honoraria from Novartis, Janssen, Bayer, and Sanofi for educational seminars; and is a research consultant for Universal Dermo Medica. Author **Z.K.** received honoraria from Hyphens; serves as one of the editor for "Malaysian Journal of Dermatology". To ensure impartiality in the review process, another editor will oversee the handling of this manuscript and all editorial responsibilities related to this submission to mitigate any potential bias. Author **F.B.Y.** received an honorarium for serving as speaker and advisory board member for Galderma, Novartis, Leo Pharma, HOE Pharma, L'Oréal, Sanofi, Abbvie, GSK, Johnson and Johnson, Procter and Gamble, and Eli Lilly. He has also participated in clinical trials as site principal investigator for Boehringer Ingelheim and Novartis. Author **C.C.C.** received honoraria from Galderma. Author **W.C.T.** has received honoraria for serving as speaker and/or advisor for AbbVie, Amgen, Beiersdorf, Boehringer Ingelheim, DKSH, Galderma, GSK, HOE Pharma, Hyphens, Johnson & Johnson, L'Oréal, Leo Pharma, Menarini, Novartis, Pfizer, Sanofi, and ZP Therapeutics. Author **E.W.Y.Y.** is an advisory board member for Beiersdorf, Galderma, Menarini, La Roche Posay. Author **L.S.** received honoraria for serving as speaker and/or advisor for AbbVie, Beiersdorf, Boehringer Ingelheim, DKSH, Galderma, Glenmark, GSK, HOE Pharma, Hyphens, Johnson & Johnson, L'Oréal, Leo Pharma, Menarini, Novartis, Pfizer, Sanofi, Taisho, and ZP Therapeutics. Author **T.R.** has received honoraria from Galderma. Author **K.M.K.** is an employee of Galderma.

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Supplementary Material

Conflicts of interest or strong personal opinions among panel members can negatively impact the reliability and validity of the process. Panel members with wide clinical expertise and knowledge in the field of dermatology were carefully selected. They were asked to disclose any conflicts of interest or personal biases that could potentially impact their responses before the process.

An independent facilitator (BioQuest Solutions Pvt Ltd.) was appointed for literature review and questionnaire development. The appointed Chair guided the questionnaire on broad topics and reviewed the questionnaire for its clinical relevance. The independent facilitator performed a thorough literature review to identify relevant articles between January 2000 and October 2023. Diverse keyword combinations, including 'atopic dermatitis', 'eczema', 'burden', 'Malaysia', 'moisturiser', 'humectant', 'occlusive', 'emollient', 'selection', 'factors', 'bioactive', 'ingredients', 'composition', 'active', 'symptoms', 'efficacy', 'safety', 'formulation', 'paediatric', 'adult', 'prevention', 'management', and 'guidelines' were utilized, along with appropriate variations in search phrases and Boolean operators. The questionnaire was broadly segregated to include relevant questions/statements under (i) dermatologists' perspective on the issues that affect the routine use of moisturisers in AD; (ii) selection criteria for moisturisers in AD; (iii) the role of bioactive ingredients in alleviating symptoms of AD; (iv) clinical effectiveness of moisturiser treatment in AD; and (v) early initiation of moisturiser uses for the prevention of AD. The questionnaire was shared with the panel members through an online survey platform.

Anonymity was maintained during the survey process to encourage panel members to provide honest and unbiased feedback. A third-party facilitator was used to collect and collate responses. During group discussions, all panelists were encouraged to participate actively. The differences in opinions were also discussed, and questions/statements were modified and posed for the next round of voting.