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LITERATURE REVIEW

# Modifiable lifestyle factors influencing the severity of atopic dermatitis – implications for prevention and health education

*a literature review*

## HIGHLIGHTS

- Atopic dermatitis (AD) severity is shaped not only by genetics and immune dysregulation but also by modifiable lifestyle and environmental factors.

- Balanced, fibre-rich, anti-inflammatory diets and omega-3 fatty acids support skin barrier integrity; processed foods, refined sugars and high-glycaemic items may worsen symptoms.
- Chronic stress and sleep disturbance drive flares through HPA-axis dysregulation, creating a bidirectional loop between AD and mental health.
- Moderate aerobic exercise can reduce stress and modulate immune responses, but sweating and heat may transiently aggravate AD — individualised regimens are recommended.
- Air pollution, indoor allergens and extreme weather damage the skin barrier and activate inflammation; structured patient education and primary-care involvement improve long-term outcomes.

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## ABSTRACT

**BACKGROUND:** Atopic dermatitis (AD) is a chronic, relapsing, immune-mediated inflammatory skin disorder characterised by intense pruritus, erythema and dry, scaly lesions. It is frequently associated with other IgE-mediated conditions such as allergic rhinitis, asthma and food allergies. Beyond genetic predisposition, immune dysregulation and skin barrier dysfunction, lifestyle and environmental factors — diet, stress, sleep, physical activity and environmental exposures — significantly influence disease severity and progression.

**AIM:** To provide a comprehensive overview of current evidence on modifiable lifestyle and environmental factors affecting the course and severity of AD, focusing on diet, psychological stress, sleep disturbances, physical activity and environmental exposures, and to highlight implications for clinical management, patient education and public health.

**MATERIALS AND METHODS:** A narrative literature review was conducted using PubMed, Scopus and Web of Science between January and March 2026. Search terms combined "atopic dermatitis," "eczema," "diet," "nutrition," "obesity," "stress," "sleep," "physical activity" and "environmental exposure." Of 312 publications screened by title and abstract, 65 English-language articles published between 2013 and 2026 were selected for detailed review.

**RESULTS:** Balanced, nutrient-dense, anti-inflammatory diets — rich in antioxidants, omega-3 fatty acids and fibre — support skin barrier integrity, whereas processed foods, added sugars and pro-inflammatory protein sources may exacerbate symptoms. Chronic stress and sleep disturbances aggravate flares via HPA-axis dysregulation. Moderate aerobic exercise reduces stress and modulates immune responses, though sweating and heat may worsen symptoms in some patients. Air pollution, indoor allergens and extreme weather impair the skin barrier and trigger inflammation. Structured education and primary-care involvement improve adherence and long-term outcomes.

**CONCLUSIONS:** Integrating diet, stress management, physical activity, environmental control and education into individualised care plans supports sustainable control of AD and improves quality of life. Lifestyle modifications and environmental interventions should be promoted as a shared responsibility among healthcare providers, patients and caregivers.


**KEYWORDS** atopic dermatitis; lifestyle; diet; sleep; stress; physical activity; obesity; environmental factors.

## PLAIN LANGUAGE SUMMARY

Atopic dermatitis (AD), also known as eczema, is a long-lasting skin condition that causes intense itching, redness and dry, scaly patches. It often starts in childhood and can affect both children and adults. Although genes and the immune system play an important role, everyday choices can make symptoms much better or worse. Eating more vegetables, fruit, fibre and oily fish, while cutting down on highly processed foods and sugar, helps calm inflammation and protect the skin barrier. Stress and poor sleep often trigger flare-ups, so relaxation techniques, regular sleep and — where useful — psychological support are valuable. Regular, moderate physical activity is beneficial, but sweat and overheating may worsen itching, so patients should plan exercise, wear breathable clothing and care for their skin before and after. Air pollution, dust mites, very dry or hot indoor air, harsh detergents and tobacco smoke can also irritate the skin and should be avoided. Structured patient education, eczema schools and good cooperation with the family doctor help patients and carers understand the disease, use treatment correctly and reduce flare-ups in the long term.

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## 1. INTRODUCTION

Atopic dermatitis (AD), which is a specific form of eczema, is a skin immune-mediated inflammatory disease with a chronic-recurrent course. This disorder causes intense itching, redness, dryness, and scaly skin lesions. It is a complex disease that can affect people of all ages, but it often shows up differently in children and adults. In children, it usually appears on the face, scalp, and extensor surfaces of the limbs, while in adults, lesions typically affect areas such as the elbows, knees, and neck [1]. AD is associated with other IgE-related disorders such as allergic rhinitis, asthma and food allergies. Its pathogenesis involves a complex interaction between genetic determinants and environmental exposures, ultimately resulting in epidermal barrier impairment and aberrant immune responses. About 10–30% of children and 2–10% of adults in developed countries have AD, and the number of cases has been rising over the past few decades [2].

Despite extensive research, the pathophysiology of atopic dermatitis has not been completely clarified. Studies have shown that AD has a strong genetic component. Children of parents with allergic diseases are at increased risk: if one parent is affected, their child is three times more likely to develop AD; if both parents are affected, the risk increases five-fold. Genetic factors include mutations in genes encoding structural and functional skin proteins, as well as epigenetic changes, incomplete gene penetrance and genomic imprinting. In people with AD, the immune system tends towards an overactive Th2 response, resulting in elevated levels of IL-4, IL-5 and IL-13. These cytokines promote IgE production and activate eosinophils, driving inflammation that further impairs the skin barrier and compounds the primary defects caused by genetic and structural abnormalities [3].

AD not only causes physical discomfort but also impairs quality of life, sleep and psychological well-being. In addition to genetic and immunological factors, lifestyle and environmental influences significantly affect both the onset and severity of AD. Modifiable factors such as diet, obesity, psychological stress, sleep disturbances, physical activity and environmental exposures can exacerbate symptoms and contribute to disease progression [4]. By understanding the complex interplay of genetic, immune and environmental factors, researchers hope to develop more effective management strategies for this common and debilitating condition.

## 2. OBJECTIVE

The aim of this literature review is to provide a comprehensive overview of the current evidence on modifiable lifestyle factors that influence the severity and course of atopic dermatitis. It focuses on factors such as diet, stress, sleep disturbances, physical activity and environmental exposures, and examines how these factors interact with genetic predisposition and immune dysfunction to shape disease outcomes. The review also considers practical implications for clinical management, patient education and public health. A thorough understanding of these factors is essential not only for optimising clinical management but also for guiding prevention strategies and patient education.

## 3. METHODS

This narrative review was conducted to summarise current evidence on modifiable lifestyle factors influencing the severity and course of atopic dermatitis (AD).

A literature search was conducted in PubMed, Scopus and Web of Science between January and March 2026. The search strategy combined the following keywords: “atopic dermatitis,” “eczema,” “diet,” “nutrition,” “obesity,” “stress,” “sleep,” “physical activity” and “environmental exposure.”

The search initially identified 312 publications, which were screened for relevance by title and abstract. After applying inclusion and exclusion criteria, 65 articles were selected for detailed review. Studies were included if

they were published in English between 2013 and 2026, available in full text and focused on lifestyle-related factors influencing AD. Studies that examined only pharmacological treatments, non-modifiable factors or mentioned lifestyle factors only marginally were excluded.

As a narrative review, no formal meta-analysis or quality assessment was performed. The goal was to provide a clear overview of lifestyle factors affecting AD and to discuss their relevance for clinical practice, patient education and public health. Limitations include heterogeneity in how lifestyle factors were defined and measured, the simultaneous evaluation of multiple determinants in many studies, and restricted access to some full-text articles. Despite these limitations, the available literature provides an adequate basis for discussing the potential role of lifestyle factors in AD.

## 4. RESULTS

### 4.1. Lifestyle-related factors

#### 4.1.1. Diet and nutrition

When it comes to managing symptoms of AD, dietary interventions can play a significant role. However, their effectiveness can vary greatly from person to person, depending on factors such as age, eating habits and overall immune health [5]. AD is often associated with food allergies due to the combination of an overactive immune response and a compromised skin barrier. The gut microbiome significantly influences immune responses in AD: an imbalanced gut flora can exacerbate reactions to food allergens, increasing inflammation and worsening symptoms. Dietary interventions can therefore impact AD both directly (through allergen exposure) and indirectly (by modulating the gut microbiota) [6].

A diet rich in fruits, vegetables, lean proteins and whole grains, while low in processed foods and added sugars, provides essential nutrients that support healthy skin. Adequate hydration further helps maintain skin moisture and barrier function. Personalised dietary plans that take into account food allergies or sensitivities are valuable for AD management. Overall, a balanced, nutrient-dense diet can reduce inflammation, strengthen the skin barrier and improve AD symptoms [6].

Recent evidence indicates that specific dietary components affect AD severity through multiple mechanistic pathways involving immune regulation, skin barrier function and the gut–skin axis. High intake of refined carbohydrates and high-glycaemic-index foods may exacerbate inflammatory responses, potentially increasing AD severity [5,6]. Diets characterised by frequent intake of added sugars relate to pro-inflammatory metabolic responses and may modulate immune programming, particularly during early-life exposure [5,6]. Conversely, higher intake of dietary fibre appears to favourably modulate the gut microbiota. Fermentation of fibre by commensal bacteria increases short-chain fatty acids (SCFAs), which reduce inflammation and strengthen epithelial barrier integrity [5,6]. This supports the gut–skin axis hypothesis: the quality of carbohydrates, rather than just the quantity, may influence AD severity.

Available evidence suggests that the impact of dietary protein on AD depends more on its source than on total intake. Diets high in red and processed meats may contribute to systemic inflammation, potentially aggravating AD severity. In contrast, plant-based protein sources (beans, nuts, seeds) are associated with lower inflammatory markers and improved metabolic profiles. Fish-derived protein, particularly from oily marine species, appears to exert protective effects mainly due to omega-3 polyunsaturated fatty acids (EPA, DHA). Higher intake or circulating levels of these fatty acids have been linked to lower disease risk and less severe symptoms, likely due to anti-inflammatory and immunomodulatory properties [7]. Some clinical studies suggest that omega-3 supplementation may improve skin symptoms in certain patients, although evidence is still inconsistent and further high-quality trials are needed [8].

Recent systematic reviews suggest that probiotic supplementation may improve the clinical course of AD, reflected in reductions in SCORAD index values. A comprehensive meta-analysis of randomised controlled trials reported measurable improvements in disease severity among patients receiving probiotics, particularly Lactobacillus-based formulations used over extended periods [9]. In adult populations, specific strains such as Lactobacillus salivarius, L. acidophilus and L. plantarum were associated with clinical improvement, especially in moderate-to-severe AD [10]. Variability in study protocols, probiotic compositions and intervention characteristics nevertheless makes firm clinical recommendations difficult [9,10].

### 4.1.2. Stress and psychological factors

Psychological stress is increasingly recognised as a major factor influencing the onset, progression and severity of AD. Stress can modulate both cellular and humoral immune responses, contributing to impaired skin barrier function, delayed wound healing and increased transepidermal water loss — all of which can exacerbate AD flares [11]. As a chronic relapsing inflammatory condition, AD frequently worsens during periods of heightened psychological or physical stress, creating a cyclical interaction between disease activity and emotional well-being. Patients with AD commonly experience comorbid anxiety, depression, emotional distress and sleep disturbances, often linked to constant itching and discomfort, with severity of these psychological symptoms correlating with skin-lesion and itch intensity [11].

A systematic review and meta-analysis demonstrated that individuals with AD have significantly higher odds of stress (OR = 1.546), depression (OR = 1.140), anxiety (OR = 1.080) and suicidal ideation compared with healthy populations [12]. Qualitative focus-group research complements these findings: patients perceive stress as a trigger for exacerbations, with intensified pruritus, worsening lesions and disrupted sleep, while the chronic visibility and discomfort of symptoms further amplify emotional distress [13]. The hypothalamic–pituitary–adrenal (HPA) axis is critically involved in AD pathophysiology: although short-term stress can transiently reduce inflammation, AD patients often show HPA-axis dysfunction with blunted cortisol and ACTH responses. Chronic stress also disrupts the skin's local stress-response system, impairing keratinocyte function, lipid synthesis, antimicrobial peptide production and epidermal proliferation, aggravating barrier defects and inflammation [14]. These data support a bidirectional model in which psychological stress contributes to disease exacerbation while persistent AD symptoms in turn intensify psychological distress.

### 4.1.3. Physical activity

Physical activity is an important lifestyle factor influencing the course and management of AD. Although regular exercise is generally associated with improved overall health and reduced systemic inflammation, its relationship with AD is complex. Some studies indicate that patients with AD engage in lower levels of moderate-to-vigorous physical activity than individuals without the disease. Reduced participation has been associated with chronic pruritus, skin discomfort, sleep disturbances and psychological burden, which may limit engagement in exercise and increase the risk of cardiovascular and metabolic diseases [15].

Similar findings have been reported in younger populations: adolescents with AD demonstrate lower peak exercise capacity and weekly exercise volume compared with healthy peers, possibly due to increased skin temperature, sweating and exacerbation of itching during activity [16]. Other studies suggest that AD does not necessarily prevent exercise: survey-based research found adults with AD reporting physical activity levels comparable to the general population [17]. Regular physical activity has also been associated with reduced stress levels in adolescents with AD, which is relevant given the role of stress in disease exacerbations [18]. Experimental studies suggest moderate aerobic exercise may exert beneficial immunomodulatory effects by reducing inflammatory mediators and serum IgE levels [19]. Overall, while sweating and increased skin temperature may aggravate symptoms in some patients, regular moderate physical activity — with appropriate

skin care — may provide important health benefits including stress reduction, improved fitness and immunomodulation.

#### 4.1.4. Environmental exposure

Environmental exposure plays an important role in the development, progression and exacerbation of AD. Large population-based cohort studies have shown a relationship between long-term exposure to air pollution and increased AD risk. Higher urban concentrations of PM2.5 and nitrogen dioxide are associated with more frequent AD diagnoses and flare-ups [20], and rises in air pollution correlate with increased dermatology visits and hospital admissions for AD [21]. Climate and weather conditions are also relevant: low humidity increases transepidermal water loss and promotes skin dryness — a hallmark of AD [22] — while high temperatures and excessive sweating can worsen itching and irritation. Extreme weather, including heat waves and cold periods, may increase healthcare needs among patients with AD [21].

Indoor environmental factors also contribute. Pollutants such as volatile organic compounds (VOCs), formaldehyde and chemicals from building materials, furniture and cleaning products can irritate the skin and trigger inflammation. Biological agents common in homes — mould, bacteria and house-dust mites — can provoke allergic reactions and immune activation in susceptible individuals [23,24].

## 5. IMPLICATIONS FOR PREVENTION AND HEALTH EDUCATION

Effective prevention and health education are crucial components in the management of atopic dermatitis (AD).

### 5.1. Patient Education

Structured educational interventions improve patients' understanding of disease mechanisms, correct use of topical therapies and appropriate skin-care practices. Educational programmes — delivered in person or through digital platforms — produce significant improvements in quality of life, disease control and adherence to treatment protocols [25]. Teaching patients to recognise early warning signs of flare-ups, avoid triggers and adhere to treatment plans supports better long-term control of AD. Visual aids and mobile educational tools enhance understanding, particularly for children and their families, where active caregiver involvement is associated with better paediatric outcomes.

### 5.2. Public Health Programs

Public-health efforts increasingly adopt structured educational programmes for patients and communities. Community-based "eczema schools" and group education sessions integrate multidisciplinary teaching across dermatology, nursing, nutrition and psychology, and have shown benefits in symptom reduction and coping [26]. Public-health campaigns raise awareness, destigmatise chronic skin conditions and normalise engagement with healthcare. Partnerships with schools and community groups extend reach, while culturally sensitive materials ensure messages are accessible across diverse demographic groups.

### 5.3. Role of Primary Care Physicians

Primary care physicians (PCPs) are often the first point of contact for patients with AD. Their role includes early diagnosis, initiation of appropriate treatment, monitoring of disease progression and reinforcement of lifestyle recommendations. Comprehensive education during primary-care visits increases patients' knowledge and engagement in preventive strategies. When needed, PCPs refer patients to dermatology specialists, mental-health providers, dietitians or physiotherapists, supporting a multidisciplinary approach to AD care [27].

### 5.4. Lifestyle Recommendations

Lifestyle modifications are a key component in the prevention and management of AD. Dietary interventions help control systemic inflammation and support skin barrier function. Diets rich in antioxidants, omega-3 fatty acids, vitamins A, C, D and E, and characterised by Mediterranean-style anti-inflammatory foods, may reduce disease severity and improve overall skin health [28]. Diets high in processed foods, sugar and certain additives may exacerbate inflammation and increase the risk of flare-ups. Education should include practical guidance on food choices, portion control and trigger identification while avoiding unnecessary restrictive elimination diets.

Psychological well-being and stress management are crucial in AD. Chronic stress can exacerbate inflammation and disease activity. Patients should be educated about the impact of stress on skin and encouraged to adopt stress-reducing strategies including mindfulness-based interventions, cognitive-behavioural therapy, relaxation techniques and consistent sleep hygiene [29]. Stress-management interventions have been associated with reduced symptom severity and improved quality of life.

Physical activity supports general health, improves circulation and reduces stress, but patients with AD may experience worsening symptoms due to sweating and heat. Education should focus on moderate, consistent exercise routines, pre- and post-exercise skin care, breathable clothing and avoiding prolonged sweating when possible [15]. Environmental factors should be considered alongside lifestyle interventions: patients should be instructed on avoiding irritants and allergens (dust mites, pet dander, harsh detergents, indoor pollutants) and on maintaining optimal indoor humidity and temperature [24]. Lifestyle recommendations should be personalised by age, disease severity, comorbidities and social context, and translated into practical actions (meal planning, relaxation, scheduled activity, home environmental adjustments) that strengthen self-efficacy and adherence.

## 6. DISCUSSION

The findings of this narrative review confirm that AD is a complex disease in which modifiable lifestyle factors play an important role in shaping severity and clinical outcomes. Beyond genetic predisposition and immune dysregulation, behavioural and environmental determinants significantly affect disease expression and variability. Diet appears to be a key factor, acting through inflammation, immune function and the gut–skin axis: fibre-rich, plant-based and omega-3-rich diets may support skin barrier function and reduce inflammation, whereas high intake of processed and high-glycaemic foods may exacerbate symptoms. Data on supplementation remain heterogeneous, indicating the need for further well-designed studies.

Psychological stress is another important factor, contributing to disease exacerbation through neuroendocrine and immunological mechanisms while chronic AD symptoms negatively affect mental health — underscoring the importance of integrating stress management and psychological support into routine care. The relationship between physical activity and AD is complex: while sweating may aggravate symptoms in some patients, regular moderate activity may provide benefits through stress reduction and potential immunomodulation, supporting an individualised approach. Environmental exposures — air pollution, climate conditions and indoor allergens — are consistently associated with increased severity, underlining the value of environmental control.

This review also emphasises the value of patient education and public-health interventions. Structured educational programmes improve adherence, self-management and quality of life, while primary care plays a key role in early diagnosis and care coordination. Limitations include heterogeneity of study designs, differences in measurement of lifestyle factors and difficulty in isolating their independent effects; the narrative design also limits the strength of conclusions. Nevertheless, integrating lifestyle modifications into standard management may improve outcomes in AD, and a multidisciplinary, individualised approach supported by further high-quality research is essential for optimising prevention and long-term disease control.

## 7. CONCLUSIONS

Atopic dermatitis is a complex condition shaped by a mix of factors. Disease severity and progression are influenced not only by genetic predisposition and immune dysregulation, but also by modifiable lifestyle and environmental factors that can be controlled [1–4].

Balanced, nutrient-dense, anti-inflammatory diets — including antioxidants, omega-3 fatty acids and fibre — support skin-barrier integrity, reduce inflammation and may improve outcomes, whereas high intake of processed foods, added sugars and pro-inflammatory protein sources may exacerbate symptoms [5–10].

Chronic stress and sleep problems contribute to flares via HPA-axis dysregulation and impaired skin barrier, with a bidirectional relationship between emotional well-being and dermatological symptoms [11–14].

Moderate aerobic exercise improves overall health, reduces stress and may modulate immune responses, but sweating and increased skin temperature can transiently worsen symptoms; individualised exercise and skin-care strategies are recommended [15–19].

Polluted air, indoor allergens, airborne chemicals, extreme temperature or humidity and other environmental triggers aggravate disease by impairing skin-barrier function and activating inflammatory pathways [20–24].

Structured education, public-health programmes and active involvement of primary care physicians and nurses improve understanding, adherence and long-term outcomes [25–27].

Integrating diet, stress management, physical activity, environmental control and education into individualised care plans supports sustainable control, enhances quality of life and addresses both somatic and psychosocial aspects of AD [4,28,29]. Lifestyle modifications and environmental interventions should be promoted as a shared responsibility among healthcare providers, patients and caregivers [28,29].

## DISCLOSURE

### Author Contributions

Conceptualization: Bort Julia, Syncerz Natalia.

Writing – Abstract: Bort Julia, Syncerz Natalia.

Writing – Review and editing: Bort Julia, Syncerz Natalia, Zadrożna Katarzyna.

Writing – Results, Lifestyle-related factors: Cupryś Kamila, Borodacz Julia, Czajka Katarzyna.

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Writing – Conclusions: Czampiel Martyna, Nawracaj Michał.

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## CRediT Author Contributions (taxonomy)

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- **Investigation (literature search):** JB, NS, KZ, KCup, BW, KC, JBoro, MC, MN, PD
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- **Writing – original draft (Discussion):** MC, MN
- **Writing – original draft (Conclusions):** MC, MN
- **Writing – review & editing:** JB, NS, KZ
- **Supervision:** JB, NS
- **Project administration:** JB, NS
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In preparing this work, the authors used AI tools for the purposes of language editing, translation into English, and improving readability. After using these tools, the authors reviewed and edited the content as necessary and accept full responsibility for the substantive content of the publication.

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