

The Impact of Diet on Common Skin Disorders

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Abstract: The role of nutrition in the treatment of common dermatoses is often overlooked. Nevertheless, there is a large amount of evidence suggesting that diet may have an important role in the pathogenesis, as well as in determining the clinical course of common skin disorders; including acne, psoriasis, atopic dermatitis and allergic contact dermatitis. Consequently, diet could have significant preventive or therapeutic impact in these skin conditions. Psoriasis, atopic dermatitis and allergic contact dermatitis are chronic relapsing skin disorders characterised by remissions and flare-ups, requiring long-term maintenance therapy. Although acne occurs most commonly during adolescence, and rarely continues into adulthood, it has a large impact on patients' self-confidence and self-image. For each of these skin conditions, a variety of foods may lead to exacerbation of the disease and may have a significant role in increasing the risk of other comorbidities. The aim of this review is to present current knowledge on the relationship between high-fat and high glycemic index diet and acne and psoriasis. Additionally, possible role of nutritional supplementation in such will also be reviewed. And finally, the role of dietary restriction in patients with atopic dermatitis and low nickel diet, in those who are sensitive to nickel, will be discussed. Although future studies are necessary in order to evaluate the effect of diet in these skin disorders, identifying certain foods as a potential factor that could contribute to exacerbation of the disease or to development of further complications can provide important preventive measure.

Keywords: Psoriasis, acne, atopic dermatitis, allergic contact dermatitis, dietary products, glycemic index, fatty acids, low nickel diet.

INTRODUCTION

Acne, psoriasis, atopic dermatitis and allergic contact dermatitis are among most common skin disorders. Due to its clinical presentation, as well as clinical course of the disease, these conditions significantly decrease health-related quality of life and represent a great psychological burden for the patient. Despite major advances in treatment modalities for these dermatological conditions, psoriasis, atopic dermatitis and allergic contact dermatitis still remain chronic, lifelong diseases for the majority of patients. Although acne occurs mainly during adolescence, it causes significant psychological burden, particularly if more severe clinical form is present. Apart from the current treatment options, the role and the impact of diet in prevention or in therapeutic purposes has been

widely discussed over the past years. A wide variety of food items have been found to be associated with aggravation of acne, psoriasis, atopic dermatitis and allergic contact dermatitis. Consequently, identifying certain foods and adopting new dietary habits may have significant impact on prevention of flare-ups, as well as on the improvement of final treatment outcome.

ACNE

Acne is a common skin disorder affecting 80-90% of adolescents. It causes significant psychological morbidity and stress in a large percentage of adolescents, particularly if presented in more severe clinical forms, including cystic and nodular form, resulting in scarring and cosmetic disfigurement. Although there is high likelihood of a genetic predisposition involved in the development of acne, there is evidence to suggest that environmental factors, such as nutrition, could have a significant impact on acne pathogenesis [1-4]. Possible connection between diet and acne is based upon results of large

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epidemiological studies, that found significantly higher incidence and prevalence of acne in Western industrialized countries, compared to rural areas and traditional societies [1,5]. Population living in non-industrialized countries, such as Papua New Guinea, Paraguay, Kitivan island and Okinawa Island have low acne prevalence rates [6]. This is probably the result of their dietary habits, since their nutrition mainly consists of low glycemic index foods, fruit and fish [6,7]. In addition, migrational studies have shown that when these populations relocated to developed and industrialized areas, and adopted a different lifestyle, including different dietary habits, acne prevalence and incidence increased [2,8]. These results support the hypothesis that a low rate of acne in these societies is primarily the result of the diet rather than genetic or ethnic factors [8]. Furthermore, randomized controlled trials have shown an improvement in clinical course of acne after adopting a low glycemic index and low glycemic load diet [3,4,6,9]. Study conducted by Smith *et al.*, which evaluated the impact of a low-glycemic load diet on the improvement of acne, showed significant reduction in acne lesions, suggesting therapeutic effect of low glycemic index nutrition [6]. In addition, randomized controlled trials demonstrated that low-glycemic-index diet reduced acne risk, suggesting possible preventive benefits of this dietary intervention [6,9]. High glycemic index foods cause complex hormonal changes including; hyperinsulinemia, elevated levels of insulin-like growth factor 1 (IGF-1) and reduction of insulin-like growth factor binding protein 3 levels (IGFBP-3) [10,11]. IGF-1 has been found to be a potent mitogen that enhances keratinocyte hyperproliferation, promoting hyperkeratinisation. IGF-1 is also a strong stimulator of sebaceous lipogenesis [12]. Hyperinsulinemia, on the other hand, stimulates the synthesis of androgens in ovarian and testicular tissue [13]. All of these factors play a major role in the pathogenesis of acne, and contribute to acne development and aggravation of symptoms [2,6,11], indicating that better understanding of dietary effects on endocrine factors that are important in acne development is required. Considering that research indicates that decrease in inflammatory acne lesions is associated with a low glycemic diet, nutrition should be accepted as a preventive measure, as well as an adjunct to current treatment modalities [3,6]. Patients should be educated and encouraged to avoid processed foods, which is typically composed of high glycemic index foods (high in white flour and sugar) including: white bread, pasta, sweets, chocolate

and white rice. Consumption of meat, fish, fruits and vegetables should be advised instead. However, certain fruits and vegetables should be avoided, including melon, pineapple, pumpkin and potatoes, considering that these foods, even not processed, still have a high glycemic index [3,4,6]. Besides association between high glycemic index foods and acne, fatty acids, milk and other dairy products, also seem to have an important role in acne pathogenesis [3,14]. Although the association of dairy products and acne still remains unclear, results of several studies demonstrated an association between the intake of milk and other dairy products with acne [3,15]. This could be explained by the hormonal content of milk, including presence of androgen precursors like androstenedione, dehydroepiandrosterone-sulfate, 5 α -androstenedione, 5 α -pregnenedione, and dihydrotestosterone, which may promote comedogenesis [16]. Moreover, milk has been associated with increased IGF-1 levels, consequently having similar impact as high glycemic index diet on acne [14,15,17]. Some researches indicate that fermented milk products, such as cheese or yogurt, have an even greater impact on hormonal changes, due to the fact that the process of fermentation leads to production of more androgenic hormones from the precursors present in milk [15]. It is also important to note that, considering that both skim and whole milk promote an increase in plasma insulin levels, the addition of whey proteins to products to improve their consistency, may play a role in pathogenesis of acne [15]. Thus, it would be advised, for patient with acne, to limit milk product intake [14]. Consumption of fatty acids has an impact on the development and on the clinical course of acne. It has been shown that omega-6 fatty acids have a pro-inflammatory effect, resulting in acne flare-ups [3,18]. In contrast, omega-3 fatty acids tend to have anti-inflammatory properties and may be associated with decreased risk of acne by decreasing IGF-1 levels and follicle inflammation [3,18]. Epidemiological studies demonstrate that societies that follow such diet have significantly lower acne prevalence [19]. Western diet is deprived of omega-3 fatty acids, and is primarily based on high omega-6 fatty acids intake, which contributes to comedogenesis [20]. Good source of omega-3 fatty acids includes fish and seafood, green leafy vegetables, nuts and seeds [19]. Thus, increased intake of these foods should be advised [20]. Nevertheless, further studies are needed to evaluate the impact of low glycemic index diets, dietary products and fatty acids on acne development.

PSORIASIS

Psoriasis is a common, chronic relapsing immune-mediated skin disorder, with estimated prevalence of approximately 2%. It occurs worldwide, and depending on the severity and the location of the skin lesions, patients experience significant psychological and psychosocial discomfort. The role of nutrition in the prevention and treatment of psoriasis has been postulated for many years, primarily due to the higher risk of comorbidities associated with psoriasis, including dyslipidemia, insulin resistance, metabolic syndrome and cardiovascular disease [21-23]. Studies evaluating dietary behaviours of patients with psoriasis found that this subset of patients tends to have a higher carbohydrate intake, as well as a higher intake of high-fat foods, saturated fats and polyunsaturated fats [23,24]. This can partly explain higher prevalence of cardiovascular disease and metabolic syndrome in these patients. Considering that these conditions are the leading cause of morbidity and mortality, prevention is the key. Although a low fat diet and low glycemic index diet has not been proven to be beneficial in improvement of psoriatic skin lesions, it can still significantly reduce the risk of associated conditions [25]. Some authors also suggest that a low calorie diet, not only significantly decreases serum lipids, but also improves clinical course of the disease, indicating that change of dietary habits may still have an important role in the prevention and treatment of mild and/or moderate psoriasis [25]. Furthermore, weight loss induced by such diet has benefits, not only through lowering the risk of associated conditions, but, considering that obesity is a risk factor for development of psoriasis, it may have an impact on the severity of clinical symptoms [22]. Number of studies have shown that, not only a low-fat and low glycemic index diet, but also a vegetarian diet and a diet rich in unsaturated fatty acids from fish oils, will lead to clinical improvement of the skin lesions [23,24]. Furthermore, given evidence suggesting that psoriasis occurs more frequently in people with insulin resistance, high glycemic index foods leading to characteristic postprandial insulin response should be avoided [23,24]. Alcohol is another factor that represents a significant risk for psoriasis exacerbations, and it has been identified as a trigger for psoriasis [23,24]. Some researchers suggest that alcohol consumption may contribute to the development of psoriasis in genetically predisposed individuals [26]. Unfortunately, considering high psychological burden and substantial impairment of quality of life in psoriasis patients, they tend to lead

an unhealthy lifestyle including poor dietary habits, and often develop harmful coping mechanisms such as alcohol abuse [27]. This represents a significant risk for psoriasis exacerbations. Several studies have shown that alcohol intake is positively correlated with psoriasis flare-ups, severe clinical presentations and poor therapeutic response [27]. Some studies suggest that certain dietary supplements may have a beneficial effect in psoriasis, these include; fish oils, selenium and oral vitamin D3 [23,24]. Selenium is known to have an inhibitory effect on DNA synthesis, UVA and UVB protective action, and antioxidative and anti-inflammatory effects. Consequently, the association between selenium and psoriasis has been thoroughly investigated [23,24]. One randomized controlled trial included patients with severe forms of psoriasis, such as erythrodermia and arthropathic psoriasis, and demonstrated that selenium supplementation has a beneficial effect on clinical course of the disease, when used in combination with coenzyme Q10 and vitamin E as antioxidant therapy [23,28,29]. In contrast, in patients with moderate clinical forms of psoriasis, beneficial effects were not found [23,29]. Vitamin D is well known for its anti-proliferative and differentiation-inducing effects [23,24]. As a result of these properties, calcitriol, synthetic analogue of 1,25(OH)₂-D₃ is effectively used in the local treatment of mild to moderate psoriasis. Several studies and case reports have shown that oral vitamin D3 leads to moderate improvements, when used for treatment of moderate psoriasis and psoriatic arthritis [28,30,31]. However, caution is advised when taking these supplements, considering that it can be associated with serious adverse events including hypercalcemia, hypercalciuria, and kidney stones when used in large doses for a prolonged period of time [30,31].

Vitamin B12 has a significant role in DNA synthesis, thus there is evidence of beneficial effect on psoriatic lesions, probably due to the immunomodulatory effects on T lymphocytes and cytokines [32]. Clinical trial evaluating therapeutic efficacy of topical B12 cream treatment compared to calcipotriol treatment, showed beneficial effects with both topical agents, although significant improvement in regression of psoriatic lesions was slower to develop when using topical B12 cream [32]. Effect of a gluten free diet on psoriasis is still controversial. Numbers of studies have implied an association between psoriasis and celiac disease, mainly based on similar genetic and inflammatory mechanisms [23,24,32]. Gluten free diet, which is the main treatment modality in celiac disease, seems to

have beneficial effects in psoriasis patients with elevated serum IgA and/or IgG anti gliadin antibodies [23,33]. There is also evidence to suggest that diet rich in n-3 polyunsaturated fatty acids from fish oils has a beneficial effects, probably due to its anti-inflammatory effect [23,24]. This observation, together with the fact that populations with high intake of n-3 polyunsaturated fatty acids have low rates of heart disease, has increased interest in the use of fish oils for its potential benefits [34]. Diet rich in omega-3 fatty acids such as salmon, sardines, tuna, shellfish, almonds and walnuts can be recommended [24]. Considering a decreased antioxidant capacity and increased oxidative stress in patients with psoriasis, increased intake of fresh fruits and vegetables is also advised, as these foods also have beneficial antioxidative properties [35]. The role of a low-fat, low carbohydrate and gluten free diet, as well as supplementation with selenium, oily fish and fish oil supplements, vitamin D and omega-3 fatty acids is not fully elucidated. Considering inconsistency of the available data and some contradictory results, there is a need for more studies and trials. Dietary interventions in patients with psoriasis should be aimed at risk reduction of related comorbidities such as diabetes and cardiovascular disease [23,24]. The diet that most efficiently reduces cardiovascular risk is Mediterranean diet, which is typically high in fruits, vegetables, whole grains, beans, nuts, seeds and olive oil and low in dairy products and red meats [36]. Furthermore, achieving optimal body weight is an additional valuable preventive and therapeutic measure, considering that obesity is a significant risk factor for psoriasis exacerbation [37].

ATOPIC DERMATITIS

Atopic dermatitis (AD) is a chronic, inflammatory, relapsing and pruritic skin disorder with a very high prevalence, affecting up to 20% of children and 1–3% of adults [38]. It has a significant impact on quality of life of patients as well as their families. Considering that food allergens alter the clinical course of AD in patients who exhibit food sensitivity, dietary intervention may play an important role in the preventive as well as therapeutic approach to the disease. Food allergy is a form of adverse reaction caused by an immunological response to a food item [39]. Although the association between food allergies and atopic dermatitis is not fully elucidated, body of evidence suggests that food can induce and aggravate symptoms of AD in some patients [38,40]. However, contrary to popular beliefs widely accepted by general population and some parents, it should be noted, that not all patients with AD

suffer from food allergies [38]. Clinical manifestation of food allergy includes a broad spectrum of symptoms affecting skin but also gastrointestinal and respiratory systems. It is estimated that approximately 35% of children with moderate to severe AD have food allergy [38,40]. As opposed to children, food hypersensitivity has little, if any, role in adult patients with AD [38]. Foods commonly associated with allergic reactions include eggs, milk, wheat, and soy and these account for almost 75% of all reactions [40]. Other less frequent foods, which tend to have more severe reactions, include peanut, tree nuts, fish, and shellfish [41]. There is a greater risk of aggravating AD with food if a patient suffers from a more severe form of the disease [42]. Furthermore, early onset of AD is positively correlated to higher risk for developing food sensitivity [42]. Type of foods responsible for aggravation of AD symptoms can vary with the age; in younger children eggs, cow's milk, peanut, and soy are the most common ones, and in older children, tree nuts, wheat, fish, and shellfish are the main causative agents [38,43]. Food allergies are rare in adults, but nevertheless, there are some food sensitivities that tend to persist throughout life, including allergy to shellfish, fish, walnuts, almonds, and peanuts. In children, foods high in protein cause 90% of the allergic reactions, most frequently including peanuts, milk, wheat, soy, fish, and eggs [38,43]. For the most types of food sensitivities, patients will gain tolerance over some period of time, and finally outgrow their sensitivities [38,43]. Therefore, previous allergens may not persist as a trigger for patients eczema flare-ups [38,43]. Elimination diet, as a preventive strategy, is recommended only in cases of confirmed food allergy, based on diagnostic testing, including; skin prick tests, food-specific IgE antibodies levels, and/or standardized oral food challenge [38,43]. The need for diagnostic confirmation is essential, considering that elimination diet may cause significant nutrient intake deficiencies, even severe malnutrition, particularly in young children [38,43]. Furthermore, restriction diets may lead to a decreased intake of antioxidants, which can result in an increased risk of AD or asthma flare-ups [44], and it should only be conducted if indicated. As such, in cases where patients exhibit significant clinical improvement during the elimination diet trial, intake of offending foods items should be avoided completely or at least minimised [38,43]. However, if the clinical symptoms of atopic dermatitis are only mild to moderate and develop after consumption of larger amounts of offending foods, there is no need to pursue a full elimination diet [41,45]. The decision to institute an elimination diet, as a therapeutic option, should be

made based upon the benefit-risk ratio, taking into account that majority of food allergens provide valuable nutrients to the patient. Nevertheless, if elimination diet is absolutely necessary, consumption of alternative foods containing similar nutrient properties should be provided in order to prevent nutritional deficiencies [38,43]. It is important to note that AD patients also exhibit pollen–plant food syndromes; a cross-reactivity between inhaled pollen and ingested food allergens. As an example; allergy to birch tree pollen and allergy to apples, carrots, celery, potatoes, oranges and tomatoes [39]. In summary, recognition of potential food allergens as causative agents responsible for exacerbations of the disease is important in order to minimize exacerbation and prolong periods of remission.

CONTACT ALLERGIC DERMATITIS

Contact allergic dermatitis (CAD) is a hypersensitive reaction caused by contact with an allergen presenting as eczema or papules and blisters, depending on the causative substance. CAD represents significant distress for the patient, particularly considering the fact that once the individual has developed a skin reaction to a certain substance, it is most likely to reoccur [46]. For the majority of patients it has chronic and relapsing course, causing significant discomfort and having a negative impact on a daily life. In general, females are affected more commonly than males [47]. Nickel is the leading cause of allergic contact dermatitis worldwide, with increasing incidence in Western industrialized countries [47,48]. The metal is frequently used for jewellery and clothes (buttons, clasps, zippers), as well as coins, which can partly explain the high rate of this skin disorder [47]. Avoidance of further exposure to all possible sources of nickel is crucial in order to minimise exacerbation [47,48].

One of the key aspects of prevention is limiting consumption of foods high in nickel [47]. This is of particular importance for patients presenting with severe clinical forms and with a chronic course of the disease [47]. Systemic contact dermatitis develops following oral nickel exposure from water or consumption of high-nickel diet [49,50]. Even though any body part can be affected, the hands are most commonly involved in nickel-sensitive individuals [46]. Foods containing considerable amount of nickel include: dried fruits, nuts, cocoa, chocolate, soy products, wheat flour, green vegetables, cereals, potatoes, poultry, fish, eggs, fats, green tea, black tea, garlic, lentils, vitamin supplements and canned foods [47,51].

Apart from the foods, there are number of other factors that can contribute to high levels of nickel content in the food, including soil composition, which is dependent on the region, or equipment used for food processing [46,47]. In addition, it should be taken into consideration that cooking and food preparation methods can also affect nickel content in the food. For instance, cooking acidic food, such as, vinegar or lemon in stainless steel may cause nickel leaching from cookware [46]. Another important factor that may affect the ingestion and metabolism of dietary nickel are levels of vitamin C or iron, which decrease absorption of nickel [46,47]. Consequently, possible underlying iron deficiency or anemia could contribute to clinical improvement and prevent eczema flare-ups. Nickel contact allergy is a life-long condition for the majority of patients, and is characterised by high relapse rates, making preventive measures, including dietary interventions a necessary component of therapy.

CONCLUSION

The role of diet as a preventive and/or treatment tool in common skin disorders including; acne, psoriasis, atopic dermatitis and contact allergies, is yet to be established. Nevertheless, evidence thus far clearly demonstrates huge impact of diet on clinical course and aggravation of symptoms in these disorders. Acne is associated with increased intake of high glycemyc index food, omega-6 fatty acids and dietary products. The role of nutrition in psoriasis and its effect on improvement of skin lesions is still controversial, but considering higher incidence of comorbidites associated with psoriasis, dietary interventions should be instituted to lower cardiovascular risk and risk of metabolic syndrome. In atopic dermatitis, elimination diet should be conducted rationally, only in cases of confirmed food allergy and in severe clinical forms. Nickel allergy is one of the most frequent causes of contact allergic dermatitis. Considering that nickel is present in majority of dietary items, diet low in nickel plays an important role in prevention of eczema flares up.

CONFLICT OF INTEREST STATEMENT

None declared.

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