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The role of lifestyle and diet in the course of rosacea. A literature review

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ABSTRACT

Acne rosacea is an inflammatory skin disease with a multifactorial etiology. The characteristics of the disease include hyperreactivity of the blood vessels, mediated by the nervous system. Erythema and telangiectasias develop under the influence of several factors. In the course of acne rosacea there occur papules, pustules, and nodules. Dietary acne triggers include products associated with heat, alcohol, capsaicin, and cinnamaldehyde. In addition, researchers demonstrated an association between UV radiation and rosacea exacerbation. Opinions on the effects of alcohol and nicotine on rosacea remain divided, and further research is needed. Studies suggest an association between obesity and rosacea; in addition, patients with rosacea often have coexisting risk factors for cardiovascular disease. Numerous studies emphasize the influence of external factors such as diet, UV radiation, alcohol, and smoking on the course and pathophysiology of rosacea. The multifactorial etiology includes neurovascular dysregulation, impaired immune response, and dysregulation of the skin microbiome. Various food substances can regulate rosacea's course by activating the relevant receptors.

Keywords: Rosacea, diet, triggers, inflammation, relationship, solar radiation, nutrition, smoking, alcohol

1. INTRODUCTION

Rosacea is a common, chronic inflammatory dermatosis predominantly impacting women aged between 30 and 50 (Woźniacka et al., 2022). It is estimated to affect 5,46% of the population, primarily holders of skin phototypes I and II (Nguyen et al., 2024). It characterizes centrofacial flushing, erythema, telangiectasia, papules, and pustules. There are four subtypes of rosacea: Erythrotelangiectatic, papulopustular, phymatous, and ocular (Geng et al., 2024). The etiology is multifactorial and still not well understood. The involvement of genetic, environmental, infectious, and immunological factors are in consideration. Lifestyle, including an unhealthy diet, lack of physical activity,

smoking, alcohol, poor sleep hygiene, and inadequate skin care, also plays a significant role. Rosacea significantly impacts patients' quality of life; therefore, it requires a multi-specialist approach, including pharmacological treatment, appropriate skincare, and lifestyle education (Zujko-Kowalska et al., 2024). In the following article, we will focus on the impact of lifestyle on rosacea.

Objective of work

This review aims to summarize the impact of various environmental factors on the pathophysiology and development of rosacea.

2. METHODOLOGY

This article reviews the literature on the role of lifestyle and diet in rosacea and emphasizes the influence of many external factors on the exacerbations and course of rosacea. For this review, we searched databases such as PubMed and Google Scholar using rosacea, diet, triggers, inflammation, relationship, solar radiation, nutrition, smoking, and alcohol. We cited thirty-two articles in this publication. The review covers studies from January 2012 to August 2024.

3. RESULTS AND DISCUSSION

Pathogenesis

The leading cause of the pathogenesis of rosacea is neurovascular dysregulation. Triggers of rosacea activate specific receptors that are upregulated in these patients, causing inflammation (Table 1). Cathelicidins and human cathelicidin antimicrobial peptide (CAMP), with its immunomodulatory and angiogenic effects, are involved in the pathogenesis of rosacea. In addition, in the case of rosacea, elevated levels of kallikrein 5 (KLK-5) are a precursor of IL-37. IL-37 overexpression produces angiogenic growth factors, including vascular endothelial growth factor (VEGF), causing neoangiogenesis and erythema (Geng et al., 2024).

The transient receptor potential (TRP) family of receptors, including the ankyrin receptor (TRP ankyrin 1) and vanilloid receptors (TRP vanilloid - TRPV1, TRPV2, TRPV3, and TRPV4), which, when activated, stimulate the inflammatory process and immune response, play an essential role in the pathogenesis of rosacea (Woźniacka et al., 2022). Despite the demonstrated involvement of proinflammatory pathways in the pathogenesis of rosacea, genetic and environmental factors are critical aspects that may lead to a variable course of the disease and different severity of symptoms in patients (Geng et al., 2024).

Subtypes of rosacea

Four subtypes of rosacea are distinguished: Erythrotelangiectatic (ETT), papulopustular (PPR), phymatous (PhR), and ocular (Zujko-Kowalska et al., 2024). In the erythrotelangiectatic subtype, there are erythema and telangiectasias. Papulopustular rosacea presents with erythema and erythematous papules and pustules. In the phymatous subtype, however, there is an increase in the skin's thickness and the glandular glands' hyperplasia. It often leads to nodular hyperplasia of the nose - rhinophyma. Ocular rosacea manifests as inflammation of the eyelids, conjunctiva, and chalazion (Geng et al., 2024). Ocular ailments such as tearing, burning, and itching may often accompany this (Woźniacka et al., 2022).

Exposure to solar radiation

The literature shows that UV radiation is an essential factor associated with acne rosacea. Skin lesions in the course of rosacea are located mainly in the convex regions of the face. In contrast, the orbital area, protected from radiation, is usually free of skin lesions, proving the connection between rosacea and solar radiation (Morgado-Carrasco et al., 2021). UVB radiation with wavelengths in the range 315-280 nm and short-wave UVA 2 reaches the papillary layer of the dermis, while long-wave UVA 1 radiation with wavelengths in the range 400-340 nm reaches deeper into the dermis (Passeron et al., 2020). Due to its angiogenic properties, UVB radiation induces neo-angiogenesis and, consequently, the formation of telangiectasias and inflammatory lesions.

UV radiation causes the synthesis of reactive oxygen species and the release of proinflammatory cytokines, generating an inflammatory response. Furthermore, UVA radiation modulates the overexpression of MMP-1, leading to collagen degeneration (Morgado-Carrasco et al., 2021). Literature indicates that UVB is one of the most frequent triggers of rosacea. In treating rosacea, adequate protection against UVB and UVA radiation is very important, so broad-spectrum sunscreens are necessary (Placek and

Wolska, 2016). Patients with rosacea demonstrated overexpression of LL-37, an antimicrobial peptide with proinflammatory and vasoactive properties. An increase in LL-37 expression may cause a greater sensitivity to UVB damage (Salzer et al., 2014).

Smoking

The relationship between smoking and rosacea has been the subject of many studies. Some report that smoking is an essential factor in causing rosacea, while others report that smoking reduces the risk of rosacea (Wang and Zhang, 2024). Li et al., (2017a) reported an increased risk of rosacea in former smokers and a decreased risk in current smokers. In addition, they noted an increased risk of rosacea in past smokers compared to never smokers (Li et al., 2017a). A meta-analysis by Yuan and Yin, (2021) suggests that cigarette smoking may raise the incidence of papulopustular and phymatous rosacea.

The reduced risk of rosacea in smokers may be due to nicotine's effect on vasoconstriction and anti-inflammatory properties as the vessels re-dilate after quitting cigarettes. Nicotine can also cause rosacea due to its angiogenic effect (Yuan and Yin, 2021). Kucukunal et al., (2016) found that cigarette smoking increases the risk of rosacea. Cigarette smoking stimulates the destruction of collagen and elastin. Cigarettes affect the skin through exposure to cigarette smoke but also through the numerous substances they contain. Volatile substances in cigarette smoke can cause erythema (Kucukunal et al., 2016).

Alcohol

Alcohol intake is a known trigger of erythema in rosacea, but investigations into its effect on the development of rosacea are currently underway (Alinia et al., 2018). Alcohol can aggravate rosacea through its vasodilatory effect. It also contributes to the disruption of the intestinal microbiota (Liu and Chen, 2023). Found no correlation between alcohol consumption and the occurrence of rosacea. A study by Li et al., (2017b) involving women in the US revealed a significant relationship between alcohol consumption and increased risk of rosacea.

Whereas a UK study suggests that alcohol intake is associated with a low increase in the risk of rosacea (Spoendlin et al., 2012). During the breakdown of alcohol metabolites, the organism releases histamine, which contributes to facial flushing (Searle et al., 2021). A meta-analysis by Liu et al., (2022) found an association between alcohol consumption and the occurrence of phymatous rosacea. Studies indicate that alcohol consumption may accelerate the progression of the disease (Alia and Feng, 2022). The increase in the risk of rosacea development in alcohol users appears to be dose-dependent (Li et al., 2017b).

Triggering factors

Certain environmental factors contribute to the course of rosacea through immune system dysfunction (Table 1). Many nutritional factors can trigger rosacea, including spicy, hot foods, alcohol, caffeine, vanilla, cinnamon, niacin, dairy products, and marinated meat (Alia and Feng, 2022). Exposure to temperature changes, heat, cold, wind, UV radiation, emotional stress, and exercise can also trigger rosacea (Buddenkotte and Steinhoff, 2018). Cinnamaldehyde products, such as tomatoes, chocolate, and citrus, are rosacea triggers (Weiss and Katta, 2017).

Table 1 Triggering factors and their mechanism of action impacting rosacea

Factors	Mechanism of action
UV radiation	Synthesis of reactive oxygen species and the release of pro-inflammatory cytokines, modulating the overexpression of MMP-1, leading to collagen degeneration, induces neo-angiogenesis
Smoking	Stimulating the destruction of collagen and elastin, volatile substances in cigarette smoke can cause erythema.
Alcohol	Vasodilatory effect, production of

	histamine, contributing to facial flushing.
Capsaicin-rich products	Activation of the TRPV1 ion channel and releasing vasodilating and heat-producing substances.
Histamine-rich products	Vasodilation
Hot beverages	Sympathetic activation and vasodilation.

Diet

Modification of the diet can significantly affect the course of acne rosacea. Dietary triggers include the ones related to heat, alcohol, capsaicin, and cinnamaldehyde (Weiss and Katta, 2017). A Chinese study found a significant association between frequent consumption of fatty foods, tea, and rosacea, whereas dairy products did not show such a correlation. In addition, consumption of fatty foods was associated with the erythematous and atrophic subtypes (Yuan et al., 2019). Consumption of fatty foods such as lard and fried foods is associated with rosacea, particularly PhR and ETT rosacea (Searle et al., 2021). Li et al., (2017c) studied the association of obesity with the occurrence of rosacea and noted a higher risk of rosacea in people with larger waist and hip circumferences.

Fatty food can lead to chronic skin inflammation and subsequent fibrosis. Therefore, patients with rosacea, especially those with ETT and PhR type, should limit fatty foods (Yuan et al., 2019). In addition, it can lead to a deficiency of low-fatty acids in the skin and impair the production of ceramides, contributing to a disrupted hydrolipid barrier (Searle et al., 2021). A low glycaemic index diet can reduce the number of skin lesions in rosacea. Furthermore, it can reduce sebum production and inflammation, positively affecting rosacea. The researchers found that people following such a diet have a lower severity of rosacea (Joshi et al., 2024). A diet high in fats also contributes to increased androgen levels. Dairy products may benefit rosacea through their anti-inflammatory properties acting on the gut microbiota, but more research is needed.

Researchers link intestinal inflammation to rosacea and dairy products, which may positively affect the severity of rosacea (Yuan et al., 2019). On the other hand, dairy products increase insulin-like growth factor-1 (IGF-1), which promotes 5-alpha reductase, contributing to sebocyte proliferation and sebum production. Some studies suggest that milk consumption is associated with an increase in the likelihood and severity of rosacea (Joshi et al., 2024). The authors observed a positive effect of omega-3 fatty acid consumption on dry eyes in patients with ocular symptoms of rosacea (Bhargava et al., 2016). Capsaicin-rich products such as red chili, cayenne, and jalapeño pepper cause activation of the TRPV1 ion channel and release vasodilating and heat-producing substances (Alia and Feng, 2022, Yang and Zheng, 2017). It can also stimulate C-filaments, leading to erythema and promoting inflammation in the skin (Joshi et al., 2024).

Foods containing significant amounts of histamine, such as ripe cheese, wine, dried fruit, sauerkraut, avocados, bananas, pineapple, papaya, tomatoes, spinach, smoked fish, processed meat, and chocolate, can be triggers of rosacea and cause redness of the skin through vasodilation (Alia and Feng, 2022, Joshi et al., 2024, Ashina et al., 2015). The authors suggested that hot beverages contribute to erythema and telangiectasia through sympathetic activation and vasodilation (Joshi et al., 2024). Patients with skin diseases should follow a diet rich in dietary fiber to support the intestinal microbiome (Alia and Feng, 2022). Products positively affecting inflammatory skin diseases, including rosacea, can be included in the Mediterranean diet, characterized by a high proportion of vegetables, oily fish, and olive oil. There was a negative correlation between the Mediterranean diet and rosacea (Guertler et al., 2023).

Comorbidities

A study by Xia et al., (2024) showed a notable association between greater BMI and the incidence of rosacea. The study's results by Li et al., (2017c) show that central obesity and weight gain from early adulthood are associated with an increased risk of rosacea. Another study by Duman et al., (2014) reported high fasting blood glucose, total cholesterol, systolic blood pressure, and diastolic blood pressure levels in patients with rosacea. Another study showed that patients with rosacea had a higher incidence of dyslipidemia and hypertension (Hua et al., 2015). Rainer et al., (2015) found an association of higher severity of rosacea with metabolic disease, hypertension, hyperlipidemia, and gastro-oesophageal reflux disease.

4. CONCLUSIONS

Acne rosacea, an inflammatory dermatosis, significantly affects patients' quality of life. In managing rosacea, a multi-specialist approach, including pharmacological treatment, treatment of comorbidities, a balanced diet to avoid triggering substances, and appropriate patient education on the impact of lifestyle on the course of the disease, are essential. Patients must be aware of dietary products that exacerbate the disease. Numerous studies have shown that patients with rosacea often have obesity, insulin resistance, and abnormal cholesterol levels. Adequate UV protection and avoidance of exposure are critical in preventing disease progression. Rosacea is a multifactorial dermatosis with an incompletely understood etiology, and further research into the influence of many extrinsic factors on the course of the disease is needed.

Authors' Contribution

Sandra Ważniewicz: Conceptualization, writing- rough preparation, investigation, methodology, project administration, writing - review and editing

Aleksandra Anioła: Formal analysis, supervision, visualization, data curation, writing- rough preparation, writing - review and editing

Magdalena Płotast: Conceptualization, data curation, formal analysis, data curation, methodology, resources

All authors have read and agreed to the published version of the manuscript.

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Ethical approval

Not applicable.

Informed consent

Not applicable.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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