

ORIGINAL RESEARCH

Medicine Science 2019;8(3):512-5

Fatty acid profile in patients with seborrheic dermatitis

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Received 04 December 2018; Accepted 11 January 2019

Available online 08.02.2019 with doi:10.5455/medscience.2018.07.8990

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Abstract

Background: Seborrheic dermatitis is characterized by chronic inflammation affecting seborrheic areas. Many factors are responsible for the etiology of disease. Fatty acids play a role in protecting skin structural integrity and functionality. Essential fatty acids and unsaturated fatty acids have a regulatory effect on inflammation. Objectives: In this study, it was aimed to evaluate fatty acid profile in patients with seborrheic dermatitis in the active phase of disease. Thirty seborrheic dermatitis patients with active lesions and 30 healthy controls were included in study. Fatty acid analysis was performed on the serum using 7890/5970c gas chromatography-mass spectrometry (GC/MS) instrument (Agilent, Santa Clara, USA). The percentage of myristic acid, palmitic acid, stearic acid, palmitoleic acid, oleic acid, linoleic acid, linolenic acid and arachidonic acid levels in general fatty acids was determined. In patients with seborrheic dermatitis, essential and unsaturated fatty acids were found to be significantly lower than healthy controls ($p < 0.001$, $p < 0.001$, respectively). Providing normal levels of essential and unsaturated fatty acids in patients with seborrheic dermatitis will contribute to treatment of disease and maintenance of health.

Keywords: Dermatitis, seborrheic; fatty acids, essential; fatty acids, unsaturated

Introduction

Seborrheic dermatitis is a chronic inflammatory disease characterized by red, itchy, scaly, inflame plaques affecting seborrheic areas. The incidence of seborrheic dermatitis ranges from 3% to 10%. The disease that can be seen in every age group is characterized by remissions and attacks. Inflammation against lipid-dependent *Malassezia* fungi is implicated in pathogenesis of disease [1]. Apart from this, increased sebaceous gland activity, Parkinson's disease, AIDS disease, drugs and climate are other etiologic factors [2].

Unsaturated fatty acids are found in phospholipid membranes that surround lipoproteins, thrombocytes and cells. Some unsaturated fatty acids are substrates for the production of intracellular markers

such as prostaglandins and thromboxanes [3]. Anti-inflammatory, immunomodulatory and antibacterial properties of fatty acids have been demonstrated [4]. Fatty acids are also vital for maintaining the structure and function of the skin [5]. In affected areas of patients with seborrheic dermatitis, the balance of sebum changes and the *Malassezia* species become colonized [6]. The role of fatty acids in development of skin pruritus and atopic dermatitis has been investigated and healing effect of unsaturated fatty acid supplements has been shown [7,8]. In this study, it was aimed to evaluate the fatty acid profile including myristic acid, palmitic acid, stearic acid, palmitoleic acid, oleic acid, linoleic acid, linolenic acid and arachidonic acid in the patients with seborrheic dermatitis.

Material and Methods

The study was approved by the local ethics committee (Date: 14.02.2018; Decision number: 22; Session: 2018/04) and informed consent forms were obtained from the participants. Thirty patients with clinically diagnosed seborrheic dermatitis, aged over 18 years,

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and 30 healthy controls with no known systemic or dermatological disease were included in the study. Participants' demographic characteristics were recorded. Body mass index (BMI) was calculated from height and weight values. In addition to scalp, patients in which one of the seborrheic areas such as face, ear, chest, and back were also affected were included in the study. It was preferred that patients be in active phase of the disease. Seborrheic dermatitis was distinguished from lichen planopilaris and discoid lupus erythematosus by absence of alopecia. Seborrheic dermatitis was distinguished from psoriasis by the fact that erythema was pale, plaques did not exceed scalp border, and there were no accompanying psoriatic lesions. Those with diabetes, those who use lipid-lowering medication, and those who diet for weight loss, those who use supplements such as fish oil, and those who use isotretinoin were not included in the study. In addition, patients with BMI below 18 and above 30 were not included in the study.

A special diet were not given to patients before the study. Blood samples taken from forearm venules after eight hours of fasting from participants were centrifuged for 30 minutes at 1800 rpm. Serum samples were stored at -80°C until the day of analysis. On the day of analysis, 200 μL of serum samples reaching room temperature were taken. Protein content was precipitated by adding 1 ml of 5% HSO_4 to serum sample. The fatty acids were extracted by vortexing with 3 ml of ethylacetate for 60 seconds. Thereafter, it was centrifuged at 4000 rpm for 10 minutes. The ethyl acetate phase was evaporated under N_2 (nitrogen). The residue was incubated at 62°C for 2 hours after addition of 2 ml of 10% $\text{H}_2\text{SO}_4\text{-CH}_3\text{OH}$. Two ml of saturated NaCl and 2 ml of hexane were added sequentially. Vortexed for 60 seconds to obtain fatty acid methyl esters. The organic phase was evaporated under N_2 gas and analyzed by adding 100 μL of hexane.

7890/5970c gas chromatography-mass spectrometry (GC/MS) instrument (Agilent, Santa Clara, USA) was used for fatty acid analysis. The chromatographic conditions of the device are as follows. A gradual temperature program was run from 120°C to 270°C for a total of 55 minutes. Optima brand 60 m x 0.25 mm column was used. Injection volume 1 μL , solvent delay time 15 minutes, FID detector 280°C , hydrogen gas flow 35 ml/min, dry air gaseous flow 350 ml/min, nitrogen 20.2 ml/min. Split ratio is 10: 1. All samples were studied twice and the results confirmed.

SPSS v.17.0 package program was used for statistical evaluation of obtained data in study (SPSS Inc, Chicago, Illinois, USA). Continuous data were summarized as mean, standard deviation, while categorical data were summarized by number and percentage. The chi-square test was used to evaluate the relationship between the two categorical variables. Pearson's correlation test was used to evaluate the relationship between the two continuous variables. Independent T test was used to compare continuous variables between groups. Statistically p values below 0.05 were considered significant.

Results

A total of 60 case, including 30 patients with seborrheic dermatitis and 30 healthy controls were included in study. Demographic and clinical features of the participants are given in Table 1. Fatty acid percentages of the participants are given in Table 2.

Table 1. Demographic and clinical features of the participants

	Seborrheic dermatitis group (n=30)	Control group (n=30)	p
Gender			
Female	%53.3(n=16)	%60(n=18)	0.271*
Male	%46.7(n=14)	%40(n=12)	
Age	32.6 $\pm$ 10.5	33.5 $\pm$ 9.1	0.734**
BMI	22.1 $\pm$ 2.1	23.2 $\pm$ 2.8	0.072**

BMI:Body mass index

* The chi-square test was used. ** Student t test was used. The statistical significance level was $p < 0.05$.

Table 2. Participants' fatty acid profiles

Fatty acid	Seborrheic dermatitis group (%)	Control group (%)	P
Arachidonic acid (C20: 0)	0.10 $\pm$ 0.32	0.12 $\pm$ 0.44	0.896
Linolenic acid (C18: 3)	3.08 $\pm$ 2.39	0.0 $\pm$ 0.0	0.000
Linoleic acid (C18: 2)	6.15 $\pm$ 4.91	21.72 $\pm$ 9.07	0.000
Oleic acid (C18: 1)	2.43 $\pm$ 2.38	8.99 $\pm$ 3.35	0.000
Myristic acid (C14: 0)	0.33 $\pm$ 0.51	0.0 $\pm$ 0.0	0.001
Stearic acid (C18: 0)	56.99 $\pm$ 25.33	27.26 $\pm$ 7.15	0.000
Palmitoleic acid (C16: 1)	0.06 $\pm$ 0.21	0.36 $\pm$ 0.62	0.013
Palmitic acid (C16: 0)	31.32 $\pm$ 25.71	41.54 $\pm$ 5.63	0.038

* Student t test was used. The statistical significance level was $p < 0.05$.

Arachidonic acid, linolenic acid and linoleic acid are essential fatty acids. The percentage of essential fatty acids in general fatty acids was 9.33 ± 5.70 in seborrheic dermatitis group and 21.84 ± 9.19 in control group. Essential fatty acids were significantly lower in patients with seborrheic dermatitis ($p < 0.001$). The relationship between linoleic acid and linolenic acid was evaluated by Pearson correlation test. There was a statistically significant relationship between them in negative direction ($r = -0.483$, $p < 0.001$).

Myristic acid, palmitic acid and stearic acid are saturated fatty acids. Palmitoleic acid, oleic acid, linoleic acid, linolenic acid and arachidonic acid are unsaturated fatty acids. Fatty acids were evaluated according to saturation. Percentage of unsaturated fatty acids in fatty acids was 11.82 ± 6.98 in patient group and 21.20 ± 12.38 in control group. Unsaturated fatty acids were statistically significantly lower in seborrheic dermatitis group ($p < 0.001$).

Discussion

Seborrheic dermatitis is a multifactorial disease in which many factors play a role in etiology. It is known that sebum balance is effective in pathogenesis of disease. The stratum corneum, a semi-permeable layer, forms a physiological barrier against chemical penetration and invasion of microorganisms. Long chain fatty acids and ceramide in the stratum corneum structure are important for skin barrier function. Excessive secretion of lipophilic fungi, sebaceous glands and sweat glands causes an inflammatory reaction by damaging skin protective layer. In case of seborrheic dermatitis, stratum corneum lipid composition changes. This change in the content of sebum permits the proliferation of *Malassezia* yeasts [6]. *Malassezia* species are cutaneous opportunistic pathogens and are associated with various dermatological diseases such as seborrheic dermatitis and atopic dermatitis. Almost all *Malassezia*

species are obligatory lipid-dependent organisms for which they can not synthesize myristic acid. For this reason they live in rich skin region of sebum content [9].

Today, many inflammatory and degenerative diseases are associated with nutrients. Adequate and regular intake of fatty acids is important for prevention of various diseases and maintenance of health. It has been shown that fatty acids, especially unsaturated fatty acids, are effective in prevention and treatment of atopic dermatitis, cardiovascular diseases, diabetes, cancers and rheumatoid arthritis [10]. Fatty acids are separated by the number of bonds between carbon atoms. Those having a single bond are saturated, while those having a double bond are unsaturated fatty acids. Linoleic acid, linolenic acid, arachidonic acid, palmitoleic acid and oleic acid are unsaturated fatty acids. Myristic acid, stearic acid and palmitic acid are saturated fatty acids. Linoleic acid, linolenic acid and arachidonic acid are essential fatty acids. Essential fatty acids are the building blocks of eicosanoids, which consist of prostaglandins, leukotrienes and thromboxanes. These hormone-like substances are effective on coagulation, wound healing and inflammation. It is essential for normal epithelial permeability and is an important component of all cellular membranes. Essential fatty acids are essential for survival of life and can not be synthesized in human body [4]. Squamous eczematous eruption of intertriginous areas, alopecia, and skin tenderness have been reported in essential fatty acid deficiency. Unsaturated fatty acids play a more active role in eczema because they are the precursors of eicosanoids [11].

Linoleic acid is major fatty acid of epidermis and has an important functional roles such as permeability, maturation, and differentiation of stratum corneum. If essential fatty acid intake reduce, accumulation of oleic acid in epidermis increases and this results in a change in appearance and permeability of stratum corneum. It has been shown that oleic acid applied on the epidermis increases transdermal penetration [12]. In a study conducted by Fujii et al. [8] in mice, an itchy skin inflammation similar to atopic dermatitis was induced with a special diet. It was seen that the lesions were regressed with unsaturated fatty acid supplement. According to the authors, dermatitis was associated with linoleic acid deficiency. Similar to literature, in this study, the percentage of unsaturated fatty acids in general fatty acids is lower in patients with seborrheic dermatitis. Alpha-linolenic acid and gamma-linolenic acid are linolenic acid derivatives. Alpha-linolenic acid belongs to the omega-3 family and gamma-linolenic acid belongs to the omega-6 family. Metabolic products of both fatty acids have opposite effects on inflammation [13]. Some of the eicosanoids derived from essential fatty acids are proinflammatory, while others are antiinflammatory. The balance between them is important in maintaining health [4]. In a study, serum concentrations of linolenic acid, arachidonic acid and prostoglandin were found to be lower in patients with atopic dermatitis than in controls. Linoleic acid level was found high in patients with atopic dermatitis. The author's claim that the conversion of linoleic acid to gamma linoleic acid was reduced [14]. Another study conducted by Nagai et al. [15], concluded that oral omega-3 fatty acid supplementation was therapeutic in the treatment of pressure ulcers and stasis dermatitis.

In this study, arachidonic acid level did not make a significant difference between groups when essential fatty acids were

examined. The linoleic acid level was significantly lower in the seborrheic dermatitis group and the linolenic acid level was significantly higher in the group with seborrheic dermatitis. However, alpha and gamma fractions of linolenic acid were not analyzed in this study. Therefore, it has not been determined which fraction is associated with the disease. This is the limitation of our study.

In a study by Katan et al. [16], serum fatty acids have been shown to reflect oral intake in recent weeks. Seborrheic dermatitis is a disease with remission and attacks. In this study serum fatty acids of patients in active phase were investigated. In this direction, it can be said that the fatty acids that are changed in relation to the taken foods affect the course of seborrheic dermatitis. Investigation of fatty acids in patients with seborrheic dermatitis in active phase and in remission phase will shed light on the link between fatty acids and seborrheic dermatitis. In this study, the proportion of unsaturated fatty acids and essential fatty acids was low in patients with seborrheic dermatitis. Exposing pathologies causing deficiency of fatty acids and eliminating deficiencies can improve patients' complaints.

Competing interests

The authors declare that they have no competing interest.

Financial Disclosure

All authors declare no financial support.

Ethical approval

Local ethics committee approval for the study was obtained.

References

1. Clark GW, Pope SM, Jaboori KA. Diagnosis and treatment of seborrheic dermatitis. *Am Fam Physician*. 2015;91:185-90.
2. Saçar T, Saçar H. Comparison of the distributions of seborrheic dermatitis, herpes zoster and pityriasis rosea according to seasons. *Turkderm*. 2010;44:65-8.
3. Murakami M. Lipid mediators in life science. *Exp Anim*. 2011;60:7-20.
4. Chung BY, Kim JH, Cho SI, et al. Dose-dependent effects of evening primrose oil in children and adolescents with atopic dermatitis. *Ann Dermatol*. 2013;25:285-91.
5. Nicolaou A. Eicosanoids in skin inflammation. *Prostaglandins Leukot Essent Fatty Acids*. 2013;88:131-8.
6. Plewing G, Jansen T. Cutaneous changes in disorders of altered reactivity. In: Freedberg IM, Eisen AZ, Wolff K, Austen KF, Goldsmith LA, Katz SI, eds, *Fitzpatrick's Dermatology in General Medicine*. 6th edition. Newyork: The McGraw-Hill. 2003. p. 1309-30.
7. Barcelos RC, de Mello-Sampayo C, Antoniazzi CT, et al. Oral supplementation with fish oil reduces dryness and pruritus in the acetone-induced dry skin rat model. *J Dermatol Sci*. 2015;79:298-304.
8. Fujii M, Shimazaki Y, Muto Y, et al. Dietary deficiencies of unsaturated fatty acids and starch cause atopic dermatitis-like pruritus in hairless mice. *Exp Dermatol*. 2015;24:108-13.
9. Lee YW, Lee SY, Lee Y, et al. Evaluation of expression of lipases and phospholipases of *Malassezia restricta* in patients with seborrheic dermatitis. *Ann Dermatol*. 2013;25:310-4.
10. Białek M, Rutkowska J. The importance of γ -linolenic acid in the prevention and treatment. *Postepy Hig Med Dosw*. 2015;69:892-904

11. Lakdawala N, Grant-Kels JM. Acrodermatitis enteropathica and other nutritional diseases of the folds (intertriginous areas). *Clin Dermatol*. 2015;33:414-9.
12. Rodrigues HG, Vinolo MA, Magdalon J, et al. Oral administration of oleic or linoleic acid accelerates the inflammatory phase of wound healing. *J Invest Dermatol*. 2012;132:208-15.
13. Greenly LW. A nutrition primer: Fat and cholesterol. *J Chiropr Med*. 2002;1:201-6.
14. Horrobin DF. Essential fatty acid metabolism and its modification in atopic eczema. *Am J Clin Nutr*. 2000;71:367–372.
15. Nagai K, Matsumaru K, Hirai I, et al. New therapy using omega-3-Acid ethyl esters for decubitus ulcers and stasis dermatitis: a case report. *Iran Red Crescent Med J*. 2014;16:19500.
16. Katan MB, Deslypere JP, van Birgelen AP, et al. Kinetics of the incorporation of dietary fatty acids into serum cholesteryl esters, erythrocyte membranes, and adipose tissue: an 18-month controlled study. *J Lipid Res*. 1997;38):2012-22.