Received: 19 February 2021 | Revised: 21 April 2021 | Accepted: 10 May 2021

DOI: 10.1111/jocd.14246

ORIGINAL CONTRIBUTIONS

JCD Journal of Cosmetic Dermatology WILEY

Demodex infestation as a cause of sensitive skin in a dermatology outpatient clinic

Rukiye Yasak Guner MD | Mustafa Tosun MD | Melih Akyol MD | Sibel Berksoy Hayta MD

Dermatology Department, Cumhuriyet University School of Medicine, Sivas, Turkey

Correspondence
Rukiye Yasak Guner, Cumhuriyet University School of Medicine, Dermatology Department, Sivas, Turkey.
Email: rky.guner@gmail.com

Abstract

Background: Sensitive skin is subjective cutaneous hyperreactivity to environmental factors. Demodicosis is a skin disorder caused by *Demodex mites*. There may be a link between demodicosis and sensitive skin.

Aim: This study aimed to examine facial *Demodex mites* density and other factors associated with sensitive skin in patients.

Methods and methods: A total of 349 randomly selected patients presented to the dermatology department. The research data were collected using a questionnaire form that included the participants' sociodemographic and lifestyle characteristics, a sensitive skin questionnaire, the Dermatology Life Quality Index (DLQI), and European Health Interview Survey (EHIS). Patients underwent standardized superficial skin surface biopsy of 4 areas of the face. *D. folliculorum* count greater than 5 mites/cm^2 was considered positive.

Results: In relation to *Demodex*, there was an increase in skin sensitivity with higher *Demodex* density ($p = 0.04$). There was a statistically significant, weak positive correlation between skin sensitivity and DLQI score ($r = 0.33$, $p = 0.00$), and there was also a significant but very weak negative correlation between skin sensitivity and EUROHIS ($r = -0.164$, $p = 0.002$). Skin sensitivity was more common in patients with a concomitant dermatological disease ($p = 0.01$) and increased with more frequent cosmetic use ($p = 0.00$).

Conclusion: Alongside other risk factors, for the patients presenting with complaints of sensitive skin, investigating Demodex population density may help alleviate sensitive skin symptoms with appropriate therapies and preventive measures.

KEYWORDS
cosmetic use, demodex, sensitive skin

1 | INTRODUCTION

The skin is the largest organ of the body and acts as a defensive barrier against microorganismal, chemical, and physical attack while protecting homeostasis of the internal environment. Disruption of this barrier plays an important role in the pathogenesis of some dermatoses and sensitive skin. Sensitive skin (cosmetic intolerance syndrome) is a widespread dermatological problem and is used as a universal language in the field of cosmetology. The global prevalence of sensitive skin is around 60%–70% in females and 50%–60% in males.[1-3] Sensitive skin is defined as the emergence of unpleasant sensations (stinging, burning, pain, itching, and tingling sensation) in

response to stimuli that should normally be present, and triggers of these unpleasant sensations include physical (cold, heat, wind, sun, air conditioning, dry air, season, and clothing changes), chemical (cosmetics, hair dye, and other consumer products, water, environmental pollution, smoking), and psychological or hormonal (stress, menstrual cycle) factors.[4]

Demodex folliculorum and *Demodex brevis* are the species most frequently found on human skin. *Demodex* mites, which live inside or near the pilosebaceous unit, usually do not cause symptoms, and most people are not even aware that they harbor these mites. The population density is <5 mites/cm^2 on normal skin, but when this number exceeds 5 mites/cm^2, they can cause problems such as papulopustular and/or acneiform lesions without comedones, seborrheic dermatitis-like eruption, perioral dermatitis-like lesions, telangiectasia, bacterial folliculitis, rosacea, and otitis externa.[5]

The pathogenicity of *Demodex* mites is increased by factors such as neglect of skin cleansing, intensive use and improper cleaning of cosmetic products, and increased sebum production due to perspiration.[2]

Diagnosing sensitive skin requires evaluation of the patient's symptoms, daily habits, and cosmetic use, as well as their personal and family medical history. Questionnaires developed for this purpose are reliable methods for diagnosis.[6] Other than questionnaires, there are also methods involving chemicals such as lactic acid and capsaicin for the diagnosis of sensitive skin.[1]

According to our clinical experience, there may be a link between *Demodex mites* and sensitive skin. However, in our literature search we were unable to find any studies investigating this relationship. Therefore, in the present study we examined facial *Demodex* mites density and other factors associated with sensitive skin in patients presenting with relevant symptoms in order to determine the frequency of sensitive skin and its association with *Demodex* mites in the population.

2 | MATERIALS AND METHODS

2.1 | Sample and setting

A total of 349 randomly selected patients who presented to the dermatology department with any dermatological complaint between 2018 and 2019 were included in the study. Ethical committee approval for the study was granted by the Local Ethics Committee (2016-09/09). All participants gave their informed consent, and their data were anonymized.

2.2 | Data collection

The data were collected by the researchers. All participants were contacted directly in the outpatient clinic. They were informed in detail about the study, and their informed consent was obtained. Skin examinations were performed by experienced dermatologists. The questionnaires were completed by the patients and collected in a box by the researchers.

2.3 | Instruments

The research data were collected using a questionnaire form that included the participants' sociodemographic and lifestyle characteristics, a sensitive skin questionnaire, the Dermatology Life Quality Index (DLQI), and European Health Interview Survey (EHIS). The first part of the form included general questions about the patients' sociodemographic characteristics, smoking and alcohol use, accompanying dermatological diseases, face-washing habits, soap use, and use of cortisone on the face. The second part of the form was a sensitive skin questionnaire comprising 18 yes/no questions (Table 1). Each response indicating sensitive skin receives 1 point, for a total score ranging from 0 to 18. The questionnaire was adapted from a 13-item questionnaire developed by Guerra-Tapia et al.[6] and a 10-item questionnaire for which Misery et al.[7] conducted a validity and reliability study.

The patients included in the study were divided into three groups according to their clinical presentation: rosacea, facial

TABLE 1 18-item sensitive skin questionnaire of the present study

Is your facial skin easily irritated?
Have you had any irritation or allergic reactions to a cosmetic product?
Do some cosmetic products cause burning or irritation of your skin?
Do some cosmetic products cause itching on your skin within 30 minutes?
Do some cosmetic products cause a burning sensation on your skin within 30 minutes?
Have you had a reaction on your face to any cosmetic product in the past year?
Does the sensitivity of your facial skin increase in the cold?
Does the sensitivity of your facial skin increase in the heat?
Does the sensitivity of your facial skin increase with sun exposure?
Does the sensitivity of your facial skin increase in the wind?
Does the sensitivity of your facial skin increase in dry weather?
Does the sensitivity of your facial skin increase when exposed to water?
Have you ever had complaints of eczema or dermatitis?
Does your face flush easily?
Do you have any problem with your facial skin other than those we asked about?
Have you ever had symptoms of allergic asthma or allergic rhinitis (spring fever)?
Is there allergic rhinitis or allergic asthma in your family (parents, first-degree relatives)?

dermatosis other than rosacea, and dermatosis not affecting the face. Each patient's skin type was grouped as dry, normal, oily, or combination. The skin phototypes of the patients were grouped according to the Fitzpatrick classification (types I to VI).

2.4 | Detection of *Demodex* mites

All 349 patients underwent standardized superficial skin surface biopsy of four areas of the face (cheek, forehead, nose, and chin). The patients were asked to wash their faces with gentle cleanser and water before the test. After drying the skin, a drop (about 0.05 ml) of cyanoacrylate glue was applied to a 1-cm area at one end of the slide and spread to a homogeneous thickness, and then, the slide was applied to the skin. The slide was left in place for about 5 minutes until the cyanoacrylate changed in consistency and then gently removed. Samples were acquired from each region, and the total number of parasites was determined by calculating the number of *D. folliculorum* detected in the samples taken from each region. *D. folliculorum* count greater than 5 mites/cm^2 was considered positive.

2.5 | Statistical analysis

The data were evaluated using the SPSS version 15.0 package program. Data were analyzed by linear regression analysis (enter method) and correlation analysis. P values <0.05 were considered statistically significant.

3 | RESULTS

Of the 349 patients who participated in the study, 276 were women (mean age: 31.1±11.8 years) and 73 were men (mean age: 35.7±16.5 years).

Seventy-eight (22.34%) of the patients had rosacea, 27 (7.73%) had other facial dermatoses, and 244 (69.91%) had other dermatological diseases.

Skin type was evaluated as normal in 135 patients, dry in 77 patients, oily in 98 patients, and combination in 39 patients. Skin phototypes I, II, III, and IV were observed in 6 patients (1.7%), 141 patients (40.4%), 189 patients (54.2%), and 13 patients (3.7%), respectively.

The results of the statistical analysis of factors associated with sensitive skin are shown in Table 2, and Figure 1 shows the

TABLE 2 The results of the statistical analysis of factors associated with sensitive skin

Model	β	Signification *p*	95% confidence interval	
			Lower bound	Upper bound
Constant		0.00	4.51	12.12
Age (years)	−0.14	**0.01**	−0.073	−0.007
Gender[a]	−0.18	**0.00**	−3.049	−0.617
Accompanying dermatologic disease[b]	0.14	**0.01**	0.163	1.191
Skin type[c]	−0.01	0.76	−0.518	0.379
Skin phototype	0.00	0.94	−0.684	0.734
Body mass index	0.03	0.49	−0.018	0.038
Topical steroid use on face[d]	−0.06	0.21	−1.274	0.293
Smoking[e]	−0.09	0.17	−1.224	0.224
Alcohol use[f]	0.07	0.23	−0.355	1.448
Frequency of face washing[g]	0.08	0.12	−0.078	0.653
Frequency of soap use[h]	0.01	0.80	−0.405	0.519
Frequency of cosmetic use[i]	0.16	**0.00**	0.216	1.298
Total *Demodex spp.* count	0.11	**0.04**	0.000	0.025

The *p* values are taken as less than .05. Bold values indicates that $p < .05$.

[a]Female (1), male (2).

[b]Dermatosis except facial region (1), facial dermatosis except rosacea (2), rosacea (3).

[c]Dry (1), normal (2), combination (3), oily (4).

[d]No (1), yes (2).

[e]Never-smoker (1), ex-smoker (2), active smoker (3).

[f]Never-drinker (1), former drinker (2), social drinker (3).

[g]Twice a day or more (1), once a day (2).

[h]Twice a day or more (1), once a day (2).

[i]Never (1), occasionally (2), often (3).

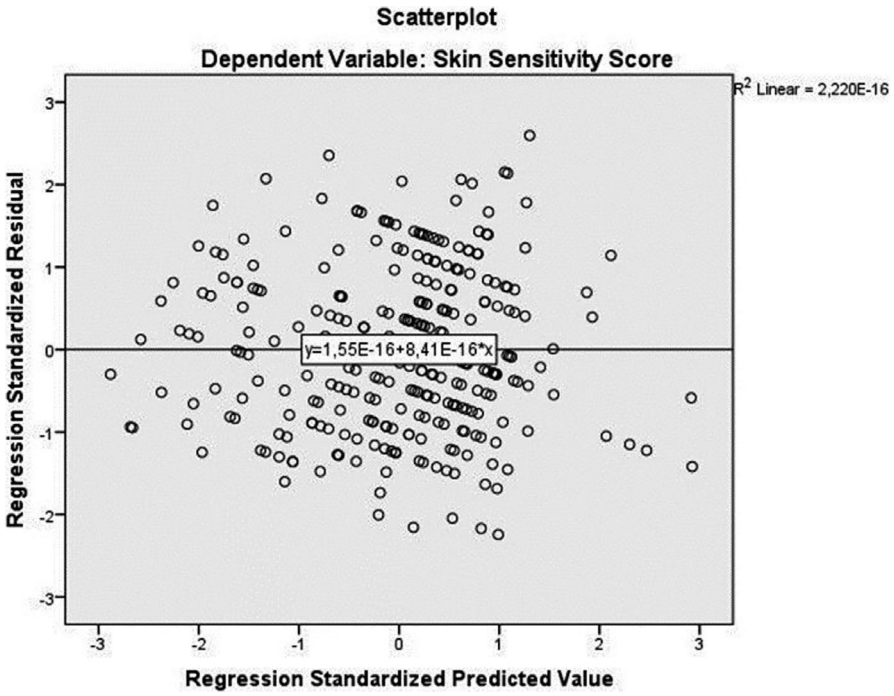

FIGURE 1 The relationship between sensitive skin and predictive values according to linear regression analysis

relationship between sensitive skin and predictive values according to linear regression analysis.

Skin sensitivity decreased with older age ($p = 0.01$). When evaluated by gender, the prevalence of skin sensitivity was higher among women ($p = 0.00$). Skin sensitivity was more common in patients with a facial dermatoses and rosacea ($p = 0.01$) and increased with more frequent cosmetic use ($p = 0.00$). In relation to *Demodex*, there was an increase in skin sensitivity with higher *Demodex* density ($p = 0.04$).

Sensitive skin was not associated with skin type, body mass index, topical steroid use on the face, smoking, alcohol use, frequency of face washing, or frequency of soap use ($p > 0.05$).

There was a statistically significant, weak positive correlation between skin sensitivity and DLQI score ($r = 0.33$, $p = 0.00$). As skin sensitivity increased, DLQI scores also increased. There was also a significant but very weak negative correlation between skin sensitivity and EUROHIS ($r = -0.164$, $p = 0.002$). A decrease in EUROHIS was detected as skin sensitivity increased.

4 | DISCUSSION

Although the mechanism underlying sensitive skin is still unclear, it is described as vascular and neural hyperreactivity due to increased permeability of the stratum corneum resulting from skin barrier impairment.[1]

Sensitive skin is more common in women compared with men, with an average prevalence of 45% versus 33%, respectively, due to reasons such as thinner skin and more frequent use of cosmetics in women and the effect of hormonal factors on skin hydration.[3] Although the recent increase in cosmetic use among men, sensitive skin may be detected at a higher rate in women than men such as those in our study.[8]

The use of cosmetic products is becoming more widespread among both men and women. Given the enormous sales volume and range of products available, cosmetic-related adverse events are inevitable, so these products can be regarded as triggering factors for sensitive skin. Lipid organization and lipid metabolism in the skin require an acidic environment (pH 5.5). Alterations in skin pH due to cosmetic products lead to impaired skin barrier function and moisture imbalance.[9] In the present study, the prevalence of sensitive skin increased with the frequency of cosmetic use.

Sensitive skin is expected in older adults due to age-related factors such as reduction in epidermal and dermal thickness; flattening and increased permeability of the epidermal-dermal junction; and reductions in skin hydration, elasticity, and dermis vascularity. However, the exact opposite is observed, with the rate of sensitive skin actually declining with age.[10] A decrease in sensitive skin with older age was also detected in the present study.

Dermatological diseases characterized by skin barrier dysfunction (atopic dermatitis, rosacea, seborrheic dermatitis, eczema, psoriasis, acne, etc.) can also be accompanied by sensitive skin.[11] Consistent with the literature, sensitive skin was associated with other dermatological diseases in our study, particularly rosacea as expected.

Uninformed and inappropriate use of topical steroids can lead to sensitive skin by increasing skin fragility and intolerance to cosmetic products.[12] However, we did not observe any change in sensitive skin based on the use of topical steroids. This finding may be related to the fact that the patients to whom we prescribed topical steroids for dermatological diseases were informed in detail about its use and duration.

Obesity can predispose individuals to a number of diseases, especially cardiovascular disease. High body mass index (BMI) is known to be related to dermatological diseases. Obesity-related changes in the epidermal barrier, increased transepidermal water loss (TEWL), and dry skin result in susceptibility to dermatological diseases.[13,14] There is no study in the literature investigating the relationship between BMI and sensitive skin. In our study, there was no connection between BMI and sensitive skin.

Studies have shown that smoking and alcohol have an adverse impact on dermatological diseases.[15,16] Although there have been a few studies investigating the relationship between smoking and sensitive skin, there has been no research on the effect of alcohol use.[17,18] In the present study, we were unable to establish a link between sensitive skin and smoking status (never-smoker, ex-smoker, and active smoker) or alcohol use.

Washing the face too frequently can irritate sensitive or dry skin. Despite the common view that frequent face washing with water and soap disrupts the epidermal barrier and leads to dry skin and sensitive skin.[19] However, there is no significant relation between sensitive skin and the frequency of face washing and soap use in our study. This result may be due to the habits of the patients included in the study to use skin barrier creams after face washing.

Sensitive skin is often believed to be associated with dry skin and phototype, but such a relationship was not detected in the present study.[17,20]

Symptoms related to sensitive skin may adversely affect quality of life.[21] We observed that DLQI values increased and EUROHIS score decreased as skin sensitivity increased.

Skin barrier impairment results in inadequate protection of cutaneous nerve endings, which leads to sensitive skin symptoms such as burning, stinging, and tingling. Transient receptor potential (TRP) channels (especially TRPV1) play a particularly central role in the pathophysiology of sensitive skin because they can be activated by chemical or thermal stimuli.[22] *Demodex* spp. secrete lytic enzymes (proteases) before feeding to digest the epithelial cells of the host skin. They disrupt the skin barrier, penetrate the dermis, and stimulate Toll-like receptors (TLRs), causing proinflammatory cytokine release. While *Demodex* mites can stimulate TRP channels through this local skin irritation, they can also cause inflammation via TLR2.[23]

Sebum is important in the habitats of *Demodex* parasites. Free fatty acids and triglycerides contribute to skin acidity. Although this acidic environment is protective against microorganisms, it is believed to have no effect on parasites or even facilitate their presence.[24]

Vascular hyperactivity involved in the pathogenesis of sensitive skin may lead to an increase in *Demodex* density. Furthermore, molecular studies have shown that *Demodex* collaborates with vascular endothelial growth factor (VEGF) to support its own proliferation.[25] Impaired skin barrier function together with the vascular effects contributed by *Demodex* may facilitate invasion and thus promote parasitic infestation. In our study, there was a positive correlation between *Demodex* count and sensitive skin. This indicates that Demodex mites increase sensitivity by causing skin damage.

A limitation of this study is that patients with sensitive skin who were found to have excessive amounts of *Demodex mites* were not re-evaluated for sensitive skin symptoms after receiving *Demodex* treatment.

5 | CONCLUSION

For patients presenting with complaints of sensitive skin, in addition to other risk factors, *Demodex* population density should also be taken into account.

ETHICS STATEMENT

The authors corfirm that the ethical policies of the journal as noted on the jornal's author guidelines pageshave been adhered to and the appropriate review committee approval has been received.

CONFLICT INTEREST

The authors declare that they have no conflicts of interest.

ORCID

Rukiye Yasak Guner https://orcid.org/0000-0002-5154-4652

REFERENCES

1. Misery L, Weisshaar E, Brenaut E, et al. Pathophysiology and management of sensitive skin: position paper from the special interest group on sensitive skin of the International Forum for the Study of Itch (IFSI). *JEADV*. 2020;34(2):222-229. https://doi.org/10.2340/00015555-2397
2. Farage MA. The prevalence of sensitive skin. *Front Med*. 2019;6:1-13. https://doi.org/10.3389/fmed.2019.00098
3. Duarte I, Silveira JEPS, Hafner MFS, Toyata R, Pedrosa DMMP. Sensitive skin: review of an ascending concept. *An Bras Dermatol*. 2017;92(4):521-525. https://doi.org/10.1590/abd1806-4841.20176111
4. Brenaut E. Triggering factors in sensitive skin from the worldwide patients' point of view: A systematic literature review and meta-analysis. *JEADV*. 2020;34:230-238. https://doi.org/10.1111/jdv.15985
5. Rather PA, Hassan I. Human demodex mite: the versatile mite of dermatological importance. *Indian J Dermatol*. 2014;59(1):60-66. https://doi.org/10.4103/0019-5154.123498
6. Guerra-Tapia A, Serra-Baldrich E, Prieto Cabezas L, González-Guerra E, López-Estebaranz L. Diagnosis and treatment of sensitive skin syndrome: an algorithm for clinical practice. *Actas Dermosifiliogr*. 2019;110(10):800-808. https://doi.org/10.1016/j.ad.2018.10.021
7. Misery L, Jean-Decoster C, Mery S, Georgescu V, Sibaud V. New Ten-item questionnaire for assessing sensitive skin: The sensitive scale-10. *Acta Derm Venereol*. 2014;94(6):635-639. https://doi.org/10.2340/00015555-1870
8. Misery L, Sibaud V, Merial-Kieny C, Taieb C. Sensitive skin in the American population: prevalence, clinical data, and role of the dermatologist. *Int J Dermatol*. 2011;50(8):961-967. https://doi.org/10.1111/j.1365-4632.2011.04884.x

9. Schmid-Wendtner M-H, Korting HC. The pH of the skin surface and its impact on the barrier function. *Skin Pharmacol Physiol*. 2006;19(6):296-302. https://doi.org/10.1159/000094670
10. Farage MA. Perceptions of Sensitive Skin with Age. In: Farage MA, Miller KW, Maibach IH, eds. *Textbook of Aging Skin*, 1st edn. Berlin, Heidelberg: Springer; 2010:1027-1046.
11. Chen L, Zheng J. Does sensitive skin represent a skin condition or manifestations of other disorders? *JCD*. 2020;18:1221-1227. https://doi.org/10.1111/jocd.13829
12. Pons-Guiraud A. Sensitive skin: a complex and multifactorial syndrome. *J Cosmet Dermatol*. 2004;3:145-148. https://doi.org/10.1111/j.1473-2130.2004.00082.x
13. Hirt PA, Castillo DE, Yosipovitch G, Keri JE. Skin changes in the obese patient. *JAAD*. 2019;81(5):1037-1057. https://doi.org/10.1016/j.jaad.2018.12.070
14. Löffler H, Aramaki JUN, Effendy I. The influence of body mass index on skin susceptibility to sodium lauryl sulphate. *Skin Res Technol*. 2002;8(1):19-22. https://doi.org/10.1046/j.0909-752x
15. Freiman A, Bird G, Metelitsa AI, Baranki B, Lauzon GJ. Cutaneous effects of smoking. *J Cutan Med Surg*. 2004;8(6):415-423. https://doi.org/10.1007/s10227-005-0020-8
16. Kazakevich N, Moody MN, Landau JM, Goldberg LH. Alcohol and skin disorders: with a focus on Psoriasis. *Skin Ther*. 2011;16(4):5-6. PMID: 21611681
17. Falcone D, Richters RJH, Uzunbajakava NE, et al. Risk factors associated with sensitive skin and potential role of lifestyle habits: a cross-sectional study. *Clin Exp Dermatol*. 2017;42(6):656-658. https://doi.org/10.1111/ced.13133
18. Sandby-Møller J, Poulsen T, Wulf HC. Epidermal thickness at different body sites: relationship to age, gender, pigmentation, blood content, skin type and smoking habits. *Acta Derm Venereol*. 2003;83(6):410-413. https://doi.org/10.1080/00015550310015419
19. Eo J, Seo YK, Baek JH, Choi AR, Koh JS. Facial skin physiology recovery kinetics during 180 min post-washing with a cleanser. *Skin Res Technol*. 2016;22:148-151. https://doi.org/10.1111/srt.12241
20. Chen W, Dai R, Li L. The prevalence of self-declared sensitive skin: a systematic review and meta-analysis. *JEADV*. 2020;34(8):1779-1778. https://doi.org/10.1111/jdv.16166
21. Georgieva F, Velevska J, Kalinova T, et al. The impact of sensitive skin on the quality of life. *Script Sci Med*. 2019;51(2):30-34. https://doi.org/10.14748/ssm.v51i1.5911
22. Ehnis-Perez A, Torres-Alvarez B, Cortes-Garcıa D, et al. Relationship between transient receptor potential vanilloid-1 expression and the intensity of sensitive skin symptoms. *JCD*. 2015;15:231-237. https://doi.org/10.1111/jocd.12204
23. Jarmuda S, O'Reilly N, Zaba R, et al. Potential role of Demodex mites and bacteria in the induction of rosacea. *J Med Microbiol*. 2012;61(11):1504-1510. https://doi.org/10.1099/jmm.0.048090-0
24. Demirdag HG, Ozcan H, Gursoy S, Beker Akbulut G. The effects of sebum configuration on Demodex spp. Density. *Turk J Med Sci*. 2016;46(5):1415-1421. https://doi.org/10.3906/sag-1504-1577
25. Forton FMN. The pathogenic role of demodex mites in rosacea: a potential therapeutic target already in erythematotelangiectatic Rosacea? *Dermatol Ther*. 2020;10(6):1229-1253. https://doi.org/10.1007/s13555-020-00458-9

How to cite this article: Yasak Guner R, Tosun M, Akyol M, Hayta SB. Demodex infestation as a cause of sensitive skin in a dermatology outpatient clinic. *J Cosmet Dermatol*. 2022;21:1610–1615. https://doi.org/10.1111/jocd.14246