

ORIGINAL RESEARCH

DERMATOLOGIC FINDINGS IN ADULT OBESE PATIENTS

ERİŞKİN OBEZ HASTALARDA DERMATOLOJİK BULGULAR

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ABSTRACT

Objectives: There are only a few studies about the dermatological findings of obese patients in the literature. However, we aimed to investigate the dermatological findings of obese patients and the relationship of these conditions with age, menopause, number of pregnancies, and insulin resistance in our study.

Material and Methods: This study included 119 patients with a body mass index higher than 30 kg/m² and 122 normal weight individuals as a control group. Also, the insulin resistance was calculated of the patients. The prevalences of dermatoses were compared between the two groups.

Results: The most common dermatologic finding in both groups was striae. But, there was not statistically significant difference between two groups. Plantar hyperkeratosis was found in 47.1% and 7.4% of patients in the study and control groups, respectively and the difference was statistically significant. Also the frequencies of acrochordon, acanthosis nigricans, keratosis pilaris and intertrigo were significantly higher in the obese group. Varicose veins were more common in the control group (36.9%) compared with the obese group (31.9%). There was no statistically significant difference between the patients with and without insulin resistance in terms of frequency of plantar hyperkeratosis, intertrigo, keratosis pilaris, varicose veins, striae, acrochordon and xerosis in the obese group. However, it was striking that there was insulin resistance in 13 of the 14 patients who had acanthosis nigricans.

Conclusions: Our study showed that some dermatological findings were significantly more common in obese patients. So, prevention of obesity is important in terms of prevention of these dermatoses.

Key words: Obesity, skin manifestations, insulin resistance

ÖZET

Amaç: Obez hastalardaki dermatolojik bulgularla ilişkili olarak literatürde çok az sayıda çalışma bulunmaktadır. Bu nedenle çalışmamızda obez hastalardaki deri bulgularını ve bunların yaş, menapoz, gebelik sayısı ve insülin direnci ile ilişkilerinin araştırması amaçlanmıştır.

Gereç ve Yöntemler: Bu çalışma vücut kitle indeksi 30 kg/m²'nin üzerinde olan 119 hastayı ve kontrol grubu olarak normal kiloya sahip 122 bireyi kapsamaktadır. Dematozların görülme sıklıkları iki grup arasında karşılaştırılmıştır.

Bulgular: Her iki grupta da en sık rastlanan dermatolojik bulgu stria idi. Ancak iki grup arasında istatistiksel anlamlı bir farklılık yoktu. Plantar hiperkeratoz çalışma ve kontrol gruplarında sırasıyla % 47,1 ve % 7,4 oranlarında bulundu ve farklılık istatistiksel olarak anlamlıydı. Aynı zamanda akrokordon, akantozis nigrikans, keratozis pilaris ve intertrigo sıklığı obez grupta anlamlı olarak yüksekti. Variköz venler kontrol grubunda (% 36,9) obez grup (% 31,9) ile karşılaştırıldığında daha sık gözlemlendi. Çalışma grubunda insülin direnci olan ve olmayan olgular plantar hiperkeratoz, intertrigo, keratozis pilaris, variköz venler, stria, akrokordon ve kserosis görülme sıklıklarına göre karşılaştırıldığında istatistiksel olarak anlamlı bir farklılık yoktu. Ancak akantozis nigrikans olan 14 olgunun 13'ünde insülin direnci olması çarpıcı bir bulguydu.

Sonuç: Çalışmamız göstermiştir ki bazı dermatolojik bulgular obez hastalarda daha sıktır. Dolayısıyla obezitenin önlenmesi bu dematozların da önlenmesini sağlayacaktır.

Anahtar kelimeler: Obezite, deri bulguları, insülin direnci

Introduction

Obesity is defined as a body mass index (BMI) of 30 kg/ m² or higher¹. It is a growing problem worldwide² and some skin conditions, like acanthosis nigricans, skin tags, hyperandrogenism, striae distensae, plantar hyperkeratosis, and candidal intertrigo, are more prevalent in obese than in normal weight individuals³. Studies of the incidence of dermatological problems and the best treatments for those are warranted³, because recognition and control of the dermatological

complications of obesity play an important role in diminishing the morbidity of obesity⁴. However to our knowledge there are only a few studies on this subject.

The purpose of this article is to describe the common skin conditions in obese patients and the relationship of these conditions with age, period of menopause, the number of pregnancies, and insulin resistance.

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Material and Methods

Our study group consisted of the patients who applied to the obesity clinic with BMI higher than 30 between February and March 2007. The BMI was calculated by dividing the weight (kg) by the square of height (m²). After obtaining a medical history and written consent from each patient, we performed a complete dermatological examination. After dermatological examinations; the results of complete blood count, hepatic, renal, thyroid function tests, glucose tolerance test, fasting plasma glucose, serum insulin, lipids, ACTH, and cortisol levels were recorded. The insulin resistance of the patients was evaluated with HOMA value formula.

The control group consisted of the cases who had a BMI lower than 30. The prevalences of dermatoses were compared between the two groups.

Individuals who use systemic or topical corticosteroids, or have diabetes mellitus or an endocrine disease, pregnant women and users of drugs that are shown to be linked to obesity were excluded from the study.

Statistical evaluation of the results

The data were evaluated using SPSS version 13.0 for Windows (SPSS Inc., Chicago, USA). The comparisons between obese and control group were made using Chi-square tests and Independent Samples Test. Also, Mann-Whitney U test was used for non-normally disturbed variables such as age, the number of previous pregnancies for comparisons between two groups. In the description of the study, samples of the prevalence of striae, plantar hyperkeratosis, acrochordon, acanthosis nigricans, keratosis pilaris, varicose veins, xerosis, intertrigo and skin infection were given in percentages (%). Levels of significance were expressed as $p < 0.05$.

Results

The study group included 119 patients all of which were older than 18; 17 of these were male and 102 were female. The control group included 122 normal weight individuals (BMI < 30); 13 of these were male and 109 were female. There were no differences between the study and control groups in terms of age and gender (Table 1).

Table 1. Demographic features and body mass indexes of study and control groups

	Obese (n: 119)	Control (n: 122)	p-values*
Female/Male	102 / 17	109 / 13	0.728
Age (year)	42.16±12.23	42.97±10.29	0.520
BMI (kg/m ²)	39.78 ± 7.49	24.1 ± 2.58	$p = 0.000$

* Chi-Square test

When the women patients in both study group and control groups were compared according to the period of menopause and the number of previous pregnancies, no significant difference was determined ($p > 0.05$).

The most common dermatologic finding in both groups was striae, but the difference in the frequencies of striae was not statistically significant ($p = 0.09$). The second most common dermatological finding seen in obese patients was plantar hyperkeratosis. While plantar hyperkeratosis was determined in 56 (47.1%) patients of study group, it was found in 9 (7.4%) cases in the control group. The difference between two groups was statistically significant ($p = 0.00$). Also, the frequencies of acrochordon, acanthosis nigricans, keratosis pilaris and intertrigo were significantly higher in the obese. Intertrigo was seen in 19 patients (16.0%) and acanthosis nigricans was seen in 15 patients (12.7%); and all of these patients were obese. Varicose veins was more common in the control group (36.9%) compared with the obese group (31.9%), but the difference was not statistically significant ($p = 0.419$). Frequencies of tinea pedis, onychomycosis, and xerosis in two groups were close to each other. On the other hand, senile angioma was found in 46 cases (37.7%) in the control group and in 29 patients (24.4%) in the obese group and the difference was statistically significant. Prevalence of dermatoses in two groups is shown in Table 2 (Table 2).

Table 2. Prevalence of dermatoses in obese patients and control subjects

Dermatoses	Obese n:119 (%)	Control n: 122 (%)	p-values*
Striae	75 (63.0%)	64 (46.0%)	0.097
Plantar hyperkeratosis	56 (47.1%)	9 (7.4%)	0.000
Varicose veins	38 (31.9%)	45 (36.9%)	0.419
Acrochordon	31 (26.1%)	9 (7.4%)	0.000
Acanthosis nigricans	15 (12.7%)	0 -	0.000
Keratosis pilaris	17 (14.3%)	8 (6.6%)	0.049
Intertrigo	19 (16.0%)	0 -	0.000
Xerosis	8 (6.7%)	10 (8.2%)	0.663
Senile angioma	29 (24.4%)	46 (37.7%)	0.025
Onychomycoses	21 (17.6%)	11 (34.4%)	0.054
Tinea pedis	17 (14.3%)	17 (14.0%)	0.958

* Chi-Square test

The relationship of dermatologic findings with insulin resistance was evaluated only in obese patients (Table 3). Insulin resistance could be performed in 104 of obese patient group and was determined in total of 80 patients. There was no statistically significant differences between the "with" and "without" insulin resistance in terms of frequency of plantar hyperkeratosis, intertrigo, keratosis pilaris, varis, striae, acrochordon, xerosis, and superficial fungal infections; however, the fact that there was insulin resistance in 13 of the 14 patients who had acanthosis nigricans were highly striking (Table 3).

Table 3. The relationship of dermatologic findings with insulin resistance in obese patients.

Dermatoses	Insulin resistance (+) (n: 80)	Insulin resistance (-) (n:24)	p-values*
Plantar hyperkeratosis	37 (46.3%)	11 (45.8%)	0.971
Intertrigo	14 (17.5%)	3 (12.5%)	0.790
Keratosis pilaris	13 (16.3%)	2 (8.3%)	0.524
Acanthosis nigricans**	13 (16.3%)	1 (4.2%)	0.238
Varicose veins	26 (32.5%)	10 (41.7%)	0.408
Striae	49 (61.3%)	18 (75.0%)	0.217
Acrochordon	19 (23.8%)	7 (29.2%)	0.591
Xerosis	5 (6.3%)	3 (12.5%)	0.568
Onychomycoses	11 (13.8%)	6 (25.0%)	0.321
Tinea pedis	8 (10.0%)	5 (20.8%)	0.291

*Chi-square test

**Note: Insulin resistance could not be evaluated in one patient.

In the control group the frequency of striae increased with the number of previous pregnancies and this was statistically significant ($p = 0.005$). The incidence of striae showed an increase in proportion to the number of pregnancies in the obese group. However, this was not statistically significant ($p = 0.32$). Also the frequency of varicose veins increased with number of pregnancies in both groups; however, this was not statistically significant ($p = 0.14$). In addition, the frequency of acrochordon increased with the number of pregnancies in the obese group, and this finding was statistically significant ($p = 0.005$) (Table 4).

When we compared the mean age of the cases with varicose veins in study and control groups, it was found that their frequency increased in accordance with age in two groups. The differences were statistically significant ($p = 0.018$, $p = 0.021$, respectively). When the patients with and without plantar hyperkeratosis were compared according to the mean age in the study and control groups, we did not find a statistically significant difference ($p > 0.05$) (Table 5). On the other hand, when the patients with and without acrochordon were compared according to the mean age in the study and control groups, it was found that the mean age of patients with acrochordon was higher than those without acrochordon in both groups. But, this was not statistically significant ($p > 0.05$) (Table 5).

The frequencies of plantar hyperkeratosis, intertrigo and keratosis pilaris were not related with the time of having menopause in two groups. Whereas, it was found that the frequency of xerosis increased in accordance with the time since having menopause in all women patients. This finding was statistically significant ($p = 0.04$). When the study and control groups were assessed separately, it was seen that the frequency of xerosis increased with the time of having menopause in obese patients, but there was no such finding in the control group. On the contrary, it was found that the frequency of acanthosis nigricans decreased in both groups (Table 6).

Table 4: Comparison of the number of previous pregnancies with the prevalence of some dermatoses in women of the study and control groups.

Number	Pregnancy		Striae		Varicose veins		Acrochordon	
	Obese (%) (n:101) ^a	Control (%) (n:109)	Obese (%) (n: 67)	Control (%) (n: 64)	Obese (%) (n: 35)	Control (%) (n: 42)	Obese (%) (n: 25)	Control (%) (n: 8)
0	25 (53.2)	22 (46.8)	15 (60)	5 (22.7)	8 (32)	5 (22.7)	3 (12.0)	1 (4.5)
1	9 (56.3)	7 (43.7)	5 (55.6)	4 (57.1)	3 (33.3)	2 (28.6)	2 (22.2)	0
2	28 (37.3)	47 (62.7)	19 (67.9)	36 (76.6)	7 (25)	21 (44.7)	6 (21.4)	6 (12.8)
3	20 (50.0)	20 (50.0)	13 (65)	8 (40)	9 (45)	9 (45)	6 (30)	1 (5.0)
4	12 (54.5)	10 (45.5)	11 (91.7)	9 (90)	4 (33.3)	3 (30)	4 (33.3)	0
5	5 (71.4)	2 (28.6)	3 (60)	1 (50)	2 (40)	1 (50)	2 (40)	0
7	1 (100)	0	0	0	1 (100)	0	1 (100)	0
9	1 (50)	1 (50)	1 (100)	1 (100)	1 (100)	1 (100)	1 (100)	0
P-values*	0.644		0.324	0.005	0.149	0.093	0.005	0.769

*Mann-Whitney U test

^aOne patient in obese group is missing value**Table 5:** The mean age of the patients with and without varicose veins, plantar hyperkeratosis and acrochordon.

		Obese patients	Control	Total
Varicose veins (mean ± SD)		n:38	n: 45	n: 83
	Presence	46.08 ± 9.89	46.42 ± 8.37	46.27 ± 9.04
	Absence	40.32 ± 12.84	40.95 ± 10.81	40.63 ± 11.86
	p - values*	0.018	0.021	0.001
Plantar hyperkeratosis (mean ± SD)		n:56	n: 9	n: 65
	Presence	45.45 ± 11.03	39.33 ± 7.41	44.60 ± 10.7
	Absence	39.27 ± 12.59	43.26 ± 10.41	41.82 ± 11.40
	p - values*	0.105	0.276	0.424
Acrochordon (mean ± SD)		n:31	n: 9	n: 40
	Presence	45.55 ± 10.70	45.56 ± 9.46	45.56 ± 9.46
	Absence	40.97 ± 12.57	42.76 ± 10.37	41.98 ± 11.39
	p - values*	0.073	0.757	0.180

*Independent samples test

Table 6. The comparison of various dermatologic findings with the period of menopause in all women of the study and control group.

		The period of menopause (year \pm SD)	p - values*
Xerosis (n:18)	Presence	7.87 \pm 6.79	0.040
	Absence	1.81 \pm 3.85	
Plantar hyperkeratosis (n: 65)	Presence	2.66 \pm 4.71	0.431
	Absence	1.96 \pm 4.16	
Acanthosis nigricans (n: 15)	Presence	0.30 \pm 1.10	0.000
	Absence	2.62 \pm 4.67	
Intertrigo (n: 19)	Presence	3.47 \pm 6.04	0.368
	Absence	2.05 \pm 4.03	
Keratosis pilaris (n: 25)	Presence	1.76 \pm 4.85	0.619
	Absence	2.40 \pm 4.36	

*Mann-Whitney U test

Conclusion

It is widely recognized that obesity increases the risk of coronary heart disease, hypertension, hyperlipidemia, osteoarthritis and diabetes¹. Moreover obesity is responsible for changes in skin barrier function, sebaceous glands and sebum production, sweat glands, lymphatics, collagen structure and function, wound healing, microcirculation and macrocirculation and subcutaneous fat tissue. So, obesity is implicated in a wide spectrum of dermatologic diseases including acanthosis nigricans, acrochordons, keratosis pilaris, hyperandrogenism and hirsutism, striae distansae, adiposis dolorosa and fat redistribution, lymphedema, chronic venous insufficiency, plantar hyperkeratosis, cellulites, skin infections and etc.¹.

To our knowledge, there are only a few studies about the dermatological findings of obese patients. For this reason, the dermatological conditions in obese patients and in controls, and the relationship of these conditions with age, period of menopause, the number of pregnancies, and insulin resistance were evaluated in our study.

Our study group (M/F=17/102) and control group (M/F=13/109) consisted of more female patients. This may be because women seek medical help due to obesity more than men. However, obesity (BMI \geq 30 kg/m²) was reported by 8.9% of men and 12.4% of women respondents in similar study from Netherlands⁵.

We used BMI as a measure for obesity and are calculated by dividing the weight (kg) by the square of height (m²). The index gives body mass connected for height for a wide range of heights and is a good approximate estimate of the fat content of the body. The current diagnostic criteria of obesity for adults is based on epidemiologic data and are set at a round number of BMI= 30 kg/ m²⁶. The respondents are accepted obese when his/her BMI is above 30 in our study.

The most common dermatosis in both obese patients and the control group was striae, and the difference in the incidences of striae was not statistically significant. However the occurrence of striae correlates closely with obesity in literature^{7,8}. A correlation between obesity and prevalence of striae was not detected in our study. The frequency of striae increased with the number of pregnancies and this was

statistically significant in the control group. In the obese group the incidence of striae showed an increase in proportion to the number of pregnancies, but this was not statistically significant. Accordingly, we have considered that the number of pregnancies is the most important factor affecting the incidence of striae. But, it was concluded that pregnancy was not an additional risk factor in the formation of striae in obese patients.

The plantar hyperkeratosis may be regarded as a physiologic response to mechanical trauma⁹ and hyperkeratosis of the soles in obesity was first described by Garcia-Hidalgo et al. in 1999¹⁰. It was reported that obese patients showed increased forefoot width and higher plantar pressures during standing and walking in study of Hills et al.¹¹ Because of this, we think that plantar hyperkeratosis is an expected finding in obesity. In our study, plantar hyperkeratosis was detected as a second most common dermatologic disorder in obese patients. In addition, we found that the incidence of plantar hyperkeratosis was statistically higher in study group than control group. It was reported that the symptoms of the disease known as keratoderma climacterium beginning at about the time of the menopause¹² aggravate with obesity and dry winter climates¹³. It was also reported that hyperkeratosis of feet commonly occurs in menopausal women as well as diabetic patients due to corneocyte accumulation¹⁴. But in our study, the frequency of plantar hyperkeratosis was not related with the period menopause in study and control groups. We have considered that obesity has a more important role in etiopathogenesis of plantar hyperkeratosis. In addition, when the patients with and without plantar hyperkeratosis were compared according to the mean age, we did not find a statistically significant difference in study and control groups.

Obesity is a recognized risk factor for the development of chronic venous insufficiency and multipl studies have documented this association in both women and men¹. Beebe-Dimmer et al.¹⁵ reported that established risk factors include older age, female gender, pregnancy, family history of venous diseases, obesity, and occupations associated with orthostasis for chronic venous insufficiency and varicose veins. Carpentier et al.¹⁶ reported that main risk factors for varicose veins were age and family history in both sexes and pregnancy in women. Similarly, Fowkes et al.¹⁷ reported that the prevalence of venous diseases increases with age. On the other hand, obesity and previous pregnancy has been associated with the presence of varicose veins but the evidence is inconsistent¹⁷. Varicose veins were a commonly seen finding in both obese patients and control group in our study. In addition, the incidence of varicose veins increased with number of pregnancies in female patients of two groups. But, statistically significant difference was not detected between control and obese patients in accordance with the number of pregnancy. The frequency of varicose veins increased with age in both groups and this was statistically significant. So our results support the results of Beebe-Dimer, Carpentier and Fowkes et al.¹⁵⁻¹⁷.

Acrochordons are pedunculated soft-brown papules most commonly seen on the neck and in axillae and groin and their incidence increases with age¹⁸. In a study of 156 obese

patients the percentage of acrochordons increased with the severity of obesity¹⁰. On the other hand, Kahana *et al.*¹⁹ did not find an increased incidence with obesity but they reported that those patients with acrochordons had greater impairment of carbohydrate metabolism. Muscelli *et al.*²⁰ reported an association between acrochordons and insulin resistance. In our study, the frequency of acrochordon was significantly higher in obese patients, but there was no statistically significant difference between patients with and without insulin resistance. Thus, our results do not support the findings of Kahana *et al.*¹⁹, but they support the findings of Garcia-Hidalgo *et al.*¹⁰. In addition, we found that the mean age of patients with acrochordon was higher in both groups, although there was no significant difference. This result may be support that the incidence of acrochordon increases with age.

Acanthosis nigricans is closely associated with all features of the insulin resistance syndrome, especially obesity^{21,22}. The mechanisms by which insulin resistance causes acanthosis nigricans are complex²³. Also defects in the insulin receptor gene causing insulin resistance and acanthosis nigricans are well recognized and the mechanism of acanthosis nigricans due to insulin resistance is most probably direct or indirect activation of the insulin-like growth factor 1 receptor by high levels of circulating insulin²⁴. Hud *et al.*²⁵ found that 74% of obese patients exhibited acanthosis nigricans along with elevated plasma insulin levels. Obese children with acanthosis nigricans have also shown to have insulin resistance²⁶. Similarly, acanthosis nigricans was significantly higher in the obese patients in our study. But, we did not find a statistically significant difference between with and without insulin resistance groups in terms of frequency of acanthosis nigricans in obese group. However, insulin resistance detected in 13 of the 14 patients with acanthosis nigricans as highly striking.

Keratosis pilaris is often associated with atopic dermatitis. But, this benign dermatosis also manifests in those with greater BMI. It has been suggested that insulin resistance may play a role in the development of keratosis pilaris²⁷. In our study the frequency of keratosis pilaris was significantly higher in the obese patients. However, there was no statistically significant difference in the frequency of keratosis pilaris between the groups with and without insulin resistance.

Intertrigo is particularly common in obese patients with diabetes who are exposed to high heat and humidity, but it can occur in anyone²⁸. The individuals who have diabetes mellitus were excluded in our study, so we can't comment on the role of diabetes mellitus in the development of intertrigo in obese patients. But, intertrigo was detected in 16% of obese patients and a statistical significance was found when we compared with the control group. Because, obese patients have larger skin folds, and sweat more profusely after becoming overheated because of thick layers of subcutaneous fat, thus increasing both frictional and moisture components⁴.

Obese individuals demonstrated significantly increased transepidermal water loss compared with control subjects²⁹. It was reported that morbidly obese patients have dry skin and impaired skin barrier repair¹. In addition, it was also

reported that xerosis of feet commonly occurs in menopausal women as well as diabetic patients due to corneocyte accumulation¹⁴. In our study, the incidence of xerosis in two groups was close to each other. But, the frequency of xerosis increased in accordance with the time since having menopause in obese and control groups and these finding was found statistically significant. However, the patients having diabetes mellitus were excluded in our study. To our knowledge, there is no study about xerosis and obesity in literature.

Another finding in our study, senile angioma was significantly less in obese patients than the control group. However, any study about senile angioma and obesity was not found in literature.

As a result of, obesity is recognized as a major public health problem and is commonly seen all over the world. The development of some dermatological diseases are eased due to metabolic causes or simply by causing maceration and occlusion, or making skin care difficult in obese patients³⁰. These diseases are striae, plantar hyperkeratosis, acanthosis nigricans, acrochordon, superficial skin infection, etc. Similarly, we found that the frequencies of striae, plantar hyperkeratosis, acrochordon, acanthosis nigricans, keratosis pilaris and intertrigo were significantly higher in the obese patients in our study. In addition, statistically significant differences between the with and without insulin resistance groups in terms of frequencies of plantar hyperkeratosis, intertrigo, keratosis pilaris, varicose vein, striae, acrochordon and xerosis was not detected except acanthosis nigricans. The frequencies of plantar hyperkeratosis, intertrigo and keratosis pilaris were not related with the time of having menopause in both groups. Despite these, it was seen that frequency of xerosis increased with increasing the period of menopause in obese patients.

Because of these reasons, prevention of obesity is important in terms of prevention of these dermatoses and dermatologist must work with primary care physicians and patients to reduce the harmful effects of obesity on the skin.

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