

## The Cutaneous Manifestations of Obesity in Adults

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### ABSTRACT

**Background:** Obesity has a variety of consequences on the physiology of the skin, including changes in the sebaceous glands and production of sebum, sweat glands, lymphatics, collagen structure and function, wound healing, microcirculation and macrocirculation, and subcutaneous fat. These consequences lead to various skin manifestations associated with obesity, such as acanthosis nigricans, achrochordons, keratosis pilaris, striae distensae, cellulite, and palmoplantar keratoderma-plantar hyperkeratosis and others.

**Aim of the study:** To study the cutaneous manifestations of obesity in adults.

**Methods:** A cross-sectional study was conducted in Al-Mosul Public Hospital and Al-Salam Teaching Hospitals in the Ninevah governorates. Inclusion criteria involved adults > or = 18 and BMI > or = 30 kg/m<sup>2</sup>. At the same time, exclusion criteria involved pregnant women and children.

**Results:** Skin tags were found in 56.1% of class I of obesity classifications, 70.0% of class II obesity, and 100.0% of class III of obesity classifications, the difference was statistically significant at (p=0.037). Cellulite was found in 58.5%, 85.0%, and 100.0%, respectively, with significant differences (p=0.012). Ulcers were found in 7.3%, 5.0%, and 33.3%, respectively, with a significant difference (p=0.042). Intertrigo was found in 43.9%, 25.0%, and 77.8%, respectively, with a significant difference (p=0.028). Excessive sweating was found in 21.9%, 25.0%, and 77.8% of the classes, respectively, with (p=0.003), and the Bonferroni correction was significant only between class I and III.

**Conclusion:** Obesity is linked to a wide range of dermatologic illnesses and is responsible for several pathological changes in the skin.

**Keywords:** Obesity, skin, manifestations, adults.

### المظاهر الجلدية للسمنة عند البالغين

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### الخلاصة

**الخلفية:** للسمنة مجموعة متنوعة من العواقب على فسيولوجيا الجلد، بما في ذلك التغيرات في الغدد الدهنية وإنتاج الزهم، والغدد العرقية، والأوعية للمفاوية، وبنية الكولاجين ووظيفته، والتنام الجروح، ودوران الأوعية الدقيقة ودوران الأوعية الدموية الكبرى، والدهون تحت الجلد. تؤدي هذه العواقب إلى مظاهر جلدية مختلفة مرتبطة بالسمنة، مثل الشواك الأسود، والزوائد الجلدية، والنقرن الشعري، والسطور الممتدة، والسيوليت، وفرط التقرن الجلدي الأحمصي وغيرها.

**الهدف من الدراسة:** دراسة المظاهر الجلدية للسمنة عند البالغين.

**الطريقة:** أجريت دراسة مقطعية لدراسة المظاهر الجلدية للسمنة لدى البالغين في مستشفى الموصل العام ومستشفى السلام التعليمي في محافظة نينوى. أجريت الدراسة بين أكتوبر ٢٠٢٢ إلى ديسمبر ٢٠٢٢. شملت معايير الإدراج أي شخص بالغ يبلغ من العمر أكبر أو يساوي ١٨ عاماً، ومؤشر كتلة الجسم < أو يساوي ٣٠ كجم / م. بينما شملت معايير الاستبعاد النساء الحوامل والأطفال. تم تأليف استبيان منظم في جزأين. يغطي الجزء الأول الخصائص الاجتماعية والديموغرافية للمرضى وتاريخهم العام، بينما يتكون الجزء الثاني من فحص جلدي.

**النتائج:** تم العثور على الزوائد الجلدية في ٥٦.١٪ من الفئة الأولى من تقسيمات السمنة حسب الشدة، و ٧٠.٠٪ من الفئة الثانية من تقسيمات السمنة، و ١٠٠.٠٪ من الفئة الثالثة من تقسيمات السمنة. كان الفرق ذا دلالة إحصائية عند (p = 0.037). تم العثور على السيوليت في ٥٨.٥٪، ٨٥.٠٪، و ١٠٠.٠٪ على التوالي، مع وجود اختلافات ذات دلالة إحصائية (p = 0.012). تم العثور على القرحة في ٢١.٩٪، ٢٥.٠٪، و ٧٧.٨٪ من الفئات، على التوالي، مع اختلاف كبير (p = 0.042). تم العثور

على المدّح في ٤٣.٩٪ و ٢٥.٠٪ و ٧٧.٨٪ على التوالي ، مع وجود فرق كبير ( $p = 0.028$ ). تم العثور على آفات أخرى فقط في السمنة من الدرجة الثالثة. لم يجد تعديل بونفيروني أي أهمية لجميع هذه الأمراض. تم العثور على التعرق المفرط في ٢١.٩٪ و ٢٥.٠٪ و ٧٧.٨٪ من الفئات ، على التوالي ، مع ( $p = 0.003$ ) ، وكان تعديل بونفيروني مهما فقط بين الفئة الأولى والثالثة من تصنيفات السمنة.

**الخلاصة:** ترتبط السمنة بمجموعة واسعة من الأمراض الجلدية وهي مسؤولة عن عدد من التغيرات المرضية في الجلد.

**الكلمات المفتاحية:** السمنة ، الجلد ، مظاهرها ، البالغين.

## INTRODUCTION

Obesity has a substantial impact on skin physiology, which can cause a variety of skin symptoms. Changes in the skin barrier function, which causes dry skin and inadequate skin barrier restoration, are one effect.

Higher transepidermal water loss and erythema in obese people suggest an altered epidermal barrier. Furthermore, obesity impacts collagen synthesis, which reduces mechanical strength and impairs wound healing. Poor wound healing can be attributed to leptin resistance, which is frequently seen in obese people. Obese people also exhibit altered sebaceous gland activity, which raises sebum production and acne risk. Due to thicker skin folds and fewer sweat glands, obesity is also linked to increased sweating.<sup>1-5</sup>

Skin infections like candidiasis, furunculosis, erythrasma, and cellulitis are more common in those who are obese. Adipose tissue's impaired immune system is a factor in its greater susceptibility to infections. Additionally, obesity can impair lymphatic drainage and circulation, resulting in varicosities, venous dermatitis, and lymphatic dysfunction. Obesity-related decreased perfusion can lead to skin problems like dermatosclerosis and ulceration.<sup>3,6,7</sup>

Investigations into the link between obesity and skin cancer are ongoing. While other research has shown contradictory findings, some have linked obesity to basal cell carcinoma and non-melanoma skin malignancies. Comparably, research on the relationship between obesity and malignant melanoma has produced inconsistent results.<sup>8,9</sup>

Therefore, obesity has various adverse effects on the skin, including decreased collagen formation, impaired skin barrier function, increased risk of skin cancer, increased sebaceous gland activity, and decreased sweat gland density. Healthcare providers must know these obesity-related skin manifestations to manage their patients' dermatological difficulties and advance general skin health.

## PATIENTS AND METHODS

A cross-sectional study was conducted to study the cutaneous manifestation of obesity in adults.

The study was conducted in Al-Mosul Public Hospital and Al-Salam Teaching Hospitals in Ninevah government. The study was conducted between October 2022 to December 2022. Formal written consent was taken from all participants after a full explanation of the nature of the present study, and ethical approval was obtained from the Scientific Ethical Committee of Tikrit University/College of Medicine included in the study.

A convenience sampling technique was used to select patients from three public hospitals' outpatients' clinics and private outpatients' clinics. The study included any adult  $> \text{or} = 18$  with a BMI  $> \text{or} = 30 \text{ kg/m}^2$ , excluding pregnant women or children.

A structured questionnaire was composed into two parts. The first part covers the sociodemographic characteristics of the patients and their general history, which included the following elements: Age , gender, marital status, job, height, weight, BMI, Past medical history, menstrual irregularity, obesity duration, physical activities, family history obesity, treatment of obesity, and complications.

The second part consists of a dermatological examination, which includes searching of any dermatological problems like :Infection of the skin and subcutaneous tissue (bacterial, viral, fungal, candidiasis), Atopic dermatitis, Seborrheic dermatitis, Eczema, Psoriasis, Lichen planus, Planter hyperkeratosis, Premature hair greying, Alopecia, Hair falling, Hirsutism, Onychomycosis, Folliculitis, Acanthosis nigricans, Skin tags, Striae, Hidradenitis suppuritiva, Excessive sweating, Lymphedema, Acne, Rosacea, lipoma and lipomatosis ,Adipose Dolorosa, Skin CA, Cellulite, Varicosity, Ulcer, Intertrigo, Tophaceous gout, Xanthomas and others.

Regarding the measurement recording, all the patients were asked to remove all the heavy clothing and objects such as shoes, bags, belts, watches, and head accessories. At the same time, the remaining light weighted objects were estimated and subtracted from the final weight of the patient.

The statistical analysis was performed by using IBM-SPSS 20. The data collected during the study

were summarised in Microsoft Excel 2007. The normality of these data was tested by the Shapiro-Wilk test, and the nonparametric tests were chosen. Mean & standard deviations were calculated. Freeman-Halton Exact test was used to find the differences among the study groups in addition to the Bonferroni correction, which was used to counteract the problem of Type I Error that occurred after the multiple comparisons. The p-value  $\leq 0.05$  is considered significant.

**RESULTS**

The study sample included 70 obese adults; the mean age was 36.55 years, with a mean height of 161.74 cm. The mean body weight was 90.89 kg. While the mean BMI was 34.78. The socio-demographic characteristics of the study sample are shown in Table 1. The most frequent age interval was 30-39 years, constituting 42.9%, followed by 40-49 years, constituting 24.3% of the study sample. Females represented 71.4% in comparison to 28.6% of males. Concerning the occupations, the employers were 20 (28.6%) & non employers were (71.4) . Moreover, 51 (72.9%) of the study sample was married, and the most frequent duration of obesity was 5-10 years, representing 24 (34.3%).

Table 1 Socio-demographic characteristics of the study sample.

Socio-demographic characteristics		Frequency	Percentage
Age / Years	18_20	1	1.4
	20-29	12	17.1
	30-39	30	42.9
	40-49	17	24.3
	50-60	10	14.3
Gender	Males	20	28.6
	Females	50	71.4
Occupations	Non Employer	50	71.4
	Employer	20	28.6
Marital status	Single	19	27.1
	Married	51	72.9
	Others (divorced & widows)	0	0
Obesity duration / Years	< 1	5	7.1
	1-5	21	30
	6-10	24	34.3
	11-15	10	14.3
	16-20	4	5.7
	>= 20	6	8.6

The distribution of Dermatological diseases among the study sample is demonstrated in Table 2. The most frequent conditions were Striae 84.3%, Cellulite 71.4%, Varicosity 68.6%, Skin tag 65.7%, skin infection 58.5%, and Acanthosis nigricans 50.0%.

Table 2 Distribution of Dermatological diseases among the study sample.

Dermatological diseases		Frequency	%
Infection (bacterial, viral, and fungal)		41	58.5
Atopic dermatitis		10	14.3
Seborrheic dermatitis		11	15.7
Eczema		20	28.6
Papulosquamous disorders	Psoriasis	2	2.9
	Lichen planus	3	4.3
disorders of skin appendages	Alopecia areata	2	2.9
	Folliculitis	3	4.3
	Hair falling	17	24.3
	Onychomycosis	13	18.6
	Premature hair greying	6	8.6
Hirsutism		2	2.9
Acanthosis nigricans		35	50.0
Skin tag		46	65.7
Striae		59	84.3
Hidradenitis suppurativa		5	7.1
Excessive sweating		23	32.85
Lymphedema		5	7.1
Acne		17	24.3
Rosacea		3	4.3
Lipoma, lipomatosis & Adipose dolorosa		7	10.0
Cellulite		50	71.4
Varicosity		48	68.6
Ulcer		7	10.0
Intertrigo		33	47.1
Tophaceous gout		2	2.9
Xanthomas		20	28.6
Other	Vitiligo	1	1.4
	Melasma	1	1.4

The comparison of study parameters among the obesity classification was demonstrated in Table 3. The physical activities and past medical history showed statistically significant differences among the classification of obesity at (p=0.024); the Bonferroni correction found no significance. The past medical also showed a statistically significant difference at (p=0.025), but the Bonferroni correction found no significance. All the other parameters showed insignificant statistical differences.

Table 3 Comparison of the presence of study parameters among the obesity

Presence of study parameters	Obesity Class I (n=41)	Obesity Class II (n=20)	Obesity Class III (n=9)	p-value *	Obesity in total	
Physical activities	10(24.4)	12(60.0)	3(33.3)	0.024	25(35.7)	
Treatment of obesity	2(4.9)	1(5.0)	1(11.1)	0.756	4 (5.7)	
Complications of obesity	8(19.5)	9(45.0)	2(22.2)	0.103	19(27.1)	
Drug intake	21(51.2)	5(25.0)	4(44.4)	0.150	30(42.9)	
Smoking	3(7.3)	3(15.0)	0(0.0)	0.371	6(8.6)	
Drinking	2(4.9)	2(10.0)	1(11.1)	0.678	5(7.1)	
Past medical history	9(21.9)	8(40.0)	6(66.7)	0.025	23(32.8)	
Menstrual irregularity in female	Irregular	7(17.1)	2(10.0)	3(33.3)	0.304	12(24.0)
	No menses	6(14.6)	1(5.0)	2(22.2)	0.623	9(18.0)
	Regular	18(43.9)	8(40.0)	3(33.3)	0.833	29(58.0)
Family history of obesity	35(85.4)	17(85.0)	9(100.0)	0.466	61(87.1)	

\*Freeman-Halton Exact test

The comparison of the presence of dermatological diseases among the obesity classification was demonstrated in Table 4. Skin tags were found in 56.1% of class I, 70.0% of class II, and 100.0% of class III; the difference was statistically significant at (p=0.037). Cellulite was found in 58.5%, 85.0%, and 100.0%, respectively, with significant differences (p=0.012). Ulcers were found in 7.3%, 5.0%, and 33.3%, respectively, with a significant difference (p=0.042). Intertrigo was found in 43.9%, 25.0%, and 77.8%, respectively, with a significant difference (p=0.028). Other lesions were found only in class III obesity; the Bonferroni correction found no significance for all these diseases. Excessive sweating was found in 21.9%, 25.0%, and 77.8% of the classes, respectively, with (p=0.003), and the Bonferroni correction was significant only between class I and III.

Table 4 Comparison of the Presence of dermatological diseases among the obesity classification.

Presence of dermatological diseases	Obesity Class I (n=41)	Obesity Class II (n=20)	Obesity Class III (n=9)	p-value *
Infection (bacterial, viral, and fungal)	25(60.9)	9(45.0)	7(77.8)	0.225
Atopic dermatitis	3(7.3)	5(25.0)	2(22.2)	0.137
Seborrheic dermatitis	7(17.1)	3(15.5)	1(11.1)	0.901
Eczema	12(29.3)	5(25.0)	3(33.3)	0.889
Papulosquamous disorders	3(7.3)	1(5.0)	2(22.2)	0.279
Disorders of skin appendages	19(46.3)	9(45.0)	5(55.6)	0.859
Acanthosis nigricans	19(46.3)	9(45.0)	7(77.8)	0.202
Skin tag	23(56.1)	14(70.0)	9(100.0)	0.037
Striae	34(82.9)	16(80.0)	9(100.0)	0.365
Hidradenitis suppuritiva	4(9.6)	1(5.0)	0(0.0)	0.534
excessive sweating	9(21.9)	5(25.0)	7(77.8)	0.003
Lymphedema	3(7.3)	1(5.0)	0(0.0)	0.684
Acne	11(26.8)	2(10.0)	3(33.3)	0.246
Rosacea	2(4.9)	1(5.0)	0(0.0)	0.793
Lipoma, lipomatosis & Adipose dolorosa	2(4.9)	3(15.0)	2(22.2)	0.197
Cellulite	24(58.5)	17(85.0)	9(100.0)	0.012
Varicosity	24(58.5)	12(60.0)	9(100.0)	0.056
Ulcer	3(7.3)	1(5.0)	3(33.3)	0.042
Intertrigo	18(43.9)	5(25.0)	7(77.8)	0.028
Tophaceous gout	0(0.0)	1(5.0)	0(0.0)	0.281
Xanthomas	13(31.7)	1(5.0)	3(33.3)	0.058
Others	0(0.0)	0(0.0)	2(22.2)	0.000

\*Freeman-Halton Exact test

## DISCUSSION

At least 300 million people are believed to be obese worldwide, making obesity an epidemic spreading across the globe. This has repercussions for dermatologists and other medical practitioners. There are several mucocutaneous symptoms of obesity. Increasing BMI statistically correlates with several of these signs<sup>10</sup>.

Regarding the age intervals of our study group, the majority fell in the 30-39 age interval, which is different from the results found by Divyashree, R. A. et al., where the majority 30% fall in the 41-50 year age group, while only 15% belonged to the 31-40 year age group<sup>11</sup>. This difference might be due to the difference in the socio-characteristic features of the two populations. In another study conducted by Ibuki, et al., a total of 37 Japanese participants were included, 16 of whom were controls (mean age, 46.31 ± 10.3 years), and 21 were obese-diabetic (mean age, 49.00 ± 9.5 years). Their ages didn't differ significantly from one another but from our mean age of 36.55 ± 11.40 years. This difference might also be due to the difference in the socio-characteristic features of the different populations<sup>12</sup>. A study conducted by Hussein, A. N., et al. on 398 Iraqis in Baghdad city aimed to evaluate the prevalent trends of excess weight found that 120 (30.2%) of the population had a male BMI of (31.3 ± 8.5), whereas 278 (69.8%) of the people had a female BMI of (29.8 ± 8.4). These results differ from our results, where the mean BMI of our result was 34.78. Although both populations are Iraqi people, the difference could be due to the difference in the sample size<sup>13</sup>. A sample of 566 people who appeared to be in good health participated in a cross-sectional analytical investigation conducted by Ismael, S. A. et al. in the city of Erbil that found a mean weight of 76.6 kg and a mean height of 165.05 cm. These results differ from ours, where the mean weight was 90.89 kg, and the mean height was 161.74 cm which could be due to the large difference in the sample size between the two studies<sup>14</sup>.

Regarding gender distribution, this study's results were almost identical to Chekuri R and Mohamed T.; 62% were females, and 38% were males. In comparison, in our research, Females represented 71.4% and males 28.6%<sup>15</sup>. In our study, the majority had a family history of obesity (87.1%), and most had obesity class I, compared to Chekuri and Mohamed study, on 200 cases where only 21.5% had a family history. Also, more than a quarter of our study group had a past medical history. In Chekuri and Mohamed study, among 200 cases, 16 had abnormal lipid profiles. Sixty-one had abnormal blood sugar levels, and 35 had high blood pressure<sup>16</sup>.

The different prevalence of obesity in India and Iraq might explain the difference in the family Hx of obesity between the two study groups.<sup>16,17</sup>

For skin manifestations, our study showed that the most common skin manifestations observed in obese patients were striae 84.3%, cellulite 71.4%, varicosity 68.6%, skin tags 65.7%, and acanthosis nigricans 50.0%. These results were in some parts like a study conducted by Ahsan U, Jamil A, and Rashid S. on a total of 93 obese (BMI >30kg/m<sup>2</sup>) and 93 normal weight (BMI 18.5-24.9 kg/m<sup>2</sup>) where Acanthosis nigricans (AN) was observed in 63%, skin tags in 52%. At the same time, striae, on the contrary, were seen in only 40%<sup>18</sup>.

While a study by Boza, et al. on 76 obese patients [body mass index (BMI) ≥30 kg/m<sup>2</sup>] and 73 with normal-weight volunteers (BMI 18.5–24.9 kg/m<sup>2</sup>) had striae as the most common skin manifestation observed in the study with 68.4% compared to our research<sup>19,20</sup>. These differences might result from the difference between the study sample sizes. Our research on cellulite support the evidence for the most frequently hypothesized causes for its genesis, including decreased local blood flow, fibrous septa or thickening subcutaneous adipose tissue (SAT), structural differences in fibrous tissue, abundance of adipose tissue, and persistent inflammation<sup>21</sup>.

These results regarding striae, varicosity, skin tags and acanthosis nigricans support the literature that confirms the association of striae with obesity and its widespread in obese children and adults. Also, our results go with the pathogenesis of a larger abdomen hindering blood flow from the lower limbs, dilating the veins and impairing valve performance, causing fluid and erythrocytes to flow into the subcutaneous tissue, giving stasis pigmentation its distinctive appearance<sup>20,22</sup>.

The results of this study confirm that skin tags may be caused by obesity, which frequently coexists with it. And our results showed that acanthosis nigricans, a skin condition, may indicate insulin resistance in obese people where a vital link between obesity, acanthosis nigricans, and diabetes mellitus exists. The treatment of hyperinsulinemia through weight loss and calorie restriction improves the symptoms of acanthosis<sup>22</sup>.

On the other hand, the metabolic syndrome, which includes central obesity, hypertension, insulin resistance, and an unfavourable lipid profile, is more prevalent in psoriasis patients which, confirmed by several studies have been conducted to find the association of psoriasis with obesity, yet, in Boza, et al. study, psoriasis had 2.7% compared to 2.9% in our research results; these two results were unable to determine an association of this skin disorder with obesity, possibly because of the small sample size<sup>19</sup>.

Acne, folliculitis, and alopecia were among the skin problems in our study that were found to have no statistical significance difference between the obesity classification in contrast to a survey conducted by Al-Saeed, et al. on 2239 female school children which found these skin conditions were statistically significantly associated with obesity<sup>23</sup>. Our results are limited to a small sample size which might affect the difference from other studies.

In Ahsan U, Jamil A, and Rashid S.'s study results, the skin manifestations which did not prove a relationship with obesity were acne, plantar keratoderma, and lymphedema ( $p>0.05$ ), which are the same as in our research results<sup>18</sup>.

Regarding Hidradenitis suppurativa, although with a 1-2 times higher risk of developing the condition in obese people, only 7.1% of the study group had this skin manifestation, which is considered half the percentage compared to a study conducted by Kromann et al 2014. on 249 Danish and Dutch obese valid respondents, 45 (18.1%) suffered from HS. This difference may be due to the number of study group differences<sup>24</sup>.

Intertrigo was found in almost half of the patients in our study. A significant difference in the prevalence of intertrigo was observed between different groups of obesity, but the association was not measured. This result did not aligns with that of Gabriel, S. et al. on 223 subjects of which 16.7% had intertrigo but no association with obesity. Even though numerous personal and environmental factors have been linked to this illness, people who are obese are thought to be at significant risk. Still, these results do not support these facts and need more studies to explore this variation.<sup>25</sup>

While a history of skin infection was demonstrated in 58.5% of the patients, a much higher percentage than in Boza, et al. results, where only 11.8% of the 76 obese people were included in the study. Still, both studies did not obtain a statistically significant difference in the prevalence of skin infections between different groups of obesity<sup>26</sup>. This needs further evaluation regarding each type of infection (bacterial, viral, and fungal).

Through several immunological mediators, obesity has a clear but not yet wholly defined effect on the immune response, which increases vulnerability to infections. However, a review of the numerous facets of the link between infection and obesity has not been done. So further studies are needed<sup>6</sup>.

Obese patients, like all patients, are susceptible to pressure ulcers. Pressure ulcers generally form on bony prominences or soft tissue subjected to persistent, unbearable pressure.

Although necrosis may occur elsewhere other than the tissue covering bone prominences in the obese patient, the prevalence of ulcers in our study was only 10% but with statically significant differences between obesity groups. Our results differ from Cai, S. et al., where pressure ulcers were found in 18.7% of nursing homes obese people with BMI  $\geq 30$  kg/m<sup>2</sup>,  $< 35$  kg/m<sup>2</sup>, and 24.03% in obese people with BMI  $\geq 35$  kg/m<sup>2</sup>. This difference might be due to Cai, et al.; the study group were already in nursing homes conditions that might increase the risk of infection<sup>27,28</sup>.

Although obesity is among other causes of excessive sweating, such as menopause, cancer, infection, problems of the central nervous system, or specific medications, our results showed that only 32.6% of obese people had excessive sweating, with the increased percentage in class III obesity and statistically significant difference between the different groups<sup>29</sup>.

For atopic eczema, our results showed that a little bit higher than a quarter of the study group had eczema but with no significant difference between obesity classes, which differs from the results found by Ascott, A et al. in the UK, where both groups of people with atopic eczema (56%) and those without (55%) had similar percentages of overweight or obese individuals. Atopic eczema patients had 10% greater chance (OR 1/10, 95% CI 1/10-1/11) of being overweight or obese than control subjects after age was taken into account. It is still unknown what causes this minor relationship<sup>30</sup>.

While Xanthomas were present in only 28.6% of the patients. These results align with Y. Hata et al. which showed the absence of marked obesity in xanthomas patients. However, xanthomas are signs of complicated conditions, such as the aggravation of insulin resistance and decompensation of type 2 diabetes mellitus. Still, the direct relationship between xanthomas needs more investigation<sup>31</sup>.

The other skin manifestations detected in the study group were manifested in less than a quarter of the patients, with no statistically significant differences between obesity classes. Thus, further studies are needed to understand these skin conditions and obesity better.

This study has several significant limitations, including the inability to study the relationship between skin diseases and obesity; the relatively small study group may overestimate the strength of a link or yield false-positive results. Also, the possibility of an information bias, such as observer bias and reporting bias, are not excluded.

## CONCLUSION

Obesity is linked to a wide range of dermatologic illnesses and is responsible for a number of pathological changes in the skin. A better course of therapy and the prevention of sequelae of skin diseases will be made possible by understanding these clinical signs and the underlying systemic illnesses. The number of patients visiting dermatologists will rise due to diseases brought on by or made worse by weight gain.

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