

Dermatological manifestations of obesity

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Abstract *Objective* To determine the frequency of various cutaneous manifestations in patients with obesity and correlate these skin changes with the grades of obesity.

Patients and methods The study was conducted at Departments of Medicine and Dermatology, Sir Syed College of Medical Sciences and Hospital Karachi from 1st January 2014 till 30th June 2014. Patients belonging to both sexes and different age groups having body mass index (BMI) $\geq 25 \text{ kg/m}^2$ with cutaneous manifestations of obesity were enrolled. Patients with skin changes secondary to other systemic illnesses, pregnancy and drugs were excluded. After an informed consent, demographic details, height and weight were documented. A clinical dermatological diagnosis was established after a detailed history and examination. Appropriate investigations were performed where required.

Results 196 patients, 76 males (39%) and 120 females (61%) completed the study. Mean age was 43.6 ± 10.8 years, age range being 19-70 years. Mean BMI $34 \pm 4.73 \text{ kg/m}^2$ (range 25-50), grade I obesity in 75 (38%) and grade II obesity in 121 (62%) cases. The most common finding observed was acanthosis nigricans (49%), followed by striae (17%), fungal infections (15%), acrochordons (12%), viral infections (11%), hirsutism (11%) and bacterial infections (7.5%). Other less common associations included: xanthomas, corns, plantar hyperkeratosis and acne. Acanthosis nigricans and viral infections were significantly more among females; corn and callus among males. Obesity grade II was significantly associated with acanthosis nigricans, viral infections, hirsutism, striae and stasis dermatitis.

Conclusion Obesity is commonly associated with a wide range of dermatological manifestations like acanthosis nigricans, striae, hirsutism, skin infections. Other less common associations include: xanthomas, corns, plantar hyperkeratosis and acne.

Key words

Body mass index, cutaneous manifestations, obesity.

Introduction

Overweight and obesity are defined by WHO as abnormal or excessive fat accumulation that may impair health.¹ Obesity has been accepted as a recognized public health problem internationally with rapidly rising prevalence in several industrialized countries, recorded to be 36% in American population in 2009-2010.² In most of the Asian countries,

prevalence of obesity has increased many folds since last few decades.³ Prevalence in urban Pakistani population has been recorded to be 22-37%.⁴

There are several classifications and definitions of obesity. WHO defines three grades of obesity on the basis of body mass index (BMI) $\geq 30 \text{ kg/m}^2$.⁵ In accordance with the consensus by WHO, as per "Report of WHO Consultation", normal BMI for Asians is 18.5-22 kg/m^2 , overweight (BMI $\geq 23 \text{ kg/m}^2$), at risk (BMI 23-24.9 kg/m^2), obesity I (BMI 25-29.9 kg/m^2), obesity II (BMI $\geq 30 \text{ kg/m}^2$).⁶

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Obesity has a wide range of effects and contributes to the pathogenesis of metabolic, cardiovascular, carcinogenic, musculoskeletal and cutaneous disorders.⁷ Altered physiological functions of skin secondary to obesity include the changes in the barrier function, excessive sweat and sebaceous glands secretion. Furthermore, there is an impaired lymphatic drainage, altered collagen structure and functioning, delayed wound healing, impaired micro and macro-circulation.^{8,9,10} As a result of these changes multiple cutaneous manifestations are observed frequently in obese persons including acanthosis nigricans, acrochordons, manifestations of hyperandrogenism like hirsutism and striae. Other important manifestations are subcutaneous fat deposition, hidradenitis suppurativa, varicose veins and venous insufficiency and lymphedema. Infections including cellulitis, furunculosis, fungal and viral infections are also seen frequently. In addition to these, several preexisting dermatological conditions are also aggravated that includes psoriasis, gouty arthritis and insulin resistance syndrome.

With a rising incidence of obesity all over the world, few regional studies have been conducted about cutaneous manifestations of obesity. The current study aimed to determine the frequency of various dermatoses related to obesity and the dermatological diseases aggravated by obesity. Moreover, it was targeted to compare these frequencies with previously available figures in local and international studies.

Methods

Current study was carried out in the Outpatient department of Medicine and Dermatology, Sir Syed College of Medical Sciences and Hospital, Karachi from 1st January 2104 till 30th June 2014. Patients aged ≥ 18 years, belonging to both sexes were enrolled after taking an informed consent. Patients with skin

changes secondary to pregnancy, other systemic illnesses and side effects of drugs were excluded.

After a detailed history, a comprehensive general and systemic examination was carried out followed by a detailed skin examination (including hair, scalp and nails). The demographic details of the enrolled patients were also documented. Height (meters) and weight (kg) were measured. BMI was calculated using the formula weight (kg) / height (m²). Patients having BMI ≥ 25 were included in the study. Cases were labeled as obesity grade I and obesity grade II as per classification of BMI by WHO for Asians.⁶

Cutaneous lesions were diagnosed clinically. Relevant laboratory investigations were advised including blood complete picture, renal profile, liver function tests, blood sugar, lipid profile, urine examination and pus for culture and sensitivity as per requirement. Special tests like Wood's lamp examination, scraping for fungus, skin biopsy, Tzanck smear, nail biopsy and nail clippings were performed where required. All the findings were recorded on a predesigned proforma.

The Data recorded was compiled, tabulated and analyzed using the software program SPSS (Statistical package for social sciences) version 17. Mean, median and standard deviation was used to represent quantitative variables like age, body mass index (BMI). Descriptive variables like presence of various skin changes were presented as frequencies and percentages. Chi-square test was applied to determine association of various skin manifestations with gender, age and grades of obesity. *P* value < 0.05 was considered as significant.

Results

A total 196 patients were included in the study. There were 76 (39%) males and 120 (61%) females. Mean age at presentation was

43.6±10.8 years, the age range being 19-70 years. Mean BMI was 34±4.73 kg/m² with a range of 25-50 kg/m² (35±4.8 kg/m² in females and 32±4.0 kg/m² in males). Among the enrolled subjects 75 patients (38%) had grade I obesity and 121 patients (62%) grade II obesity as per WHO criteria.⁶

Table 1 reveals the cutaneous manifestations recorded in our enrolled subjects. The most common finding was acanthosis nigricans in 96 (49%) patients, followed by striae 34 (17%), fungal infections 30 (15%), acrochordons 24 (12%) and viral infections 22 (11%). Bacterial infections, hirsutism, xanthomas, corns, plantar hyperkeratosis and acne followed in a descending frequency. Other rare findings included stasis ulcers, stasis dermatitis, psoriasis, lichen planus,

hidradenitis suppurativa, keloids, adiposis dolorosa, livedo reticularis and decubitus ulcer.

Table 2 correlates the frequencies of dermatological manifestations in obese patients with respect to age groups and grades of obesity. Acanthosis nigricans and viral infections were significantly higher in females ($p < 0.05$); corns and calluses in males ($p < 0.05$).

Obesity grade II (i.e. BMI ≥ 30 kg/m²) was found to be significantly associated with acanthosis nigricans, viral infections, hirsutism, striae and stasis dermatitis ($p < 0.05$). However, no significant difference in bacterial and fungal infections, acrochordons (skin tags), and plantar hyperkeratosis, xanthomas and psoriasis was found with grades of obesity ($p > 0.05$).

Table 1 Frequencies of dermatological manifestations in obese patients with respect to gender (n=196).

Dermatological manifestations	Total (n=196)	Male (n=76)	Female (n=120)	p value
Acanthosis nigricans	96 (49%)	20 (26%)	76 (63%)	0.0001*
Striae	34 (17%)	12 (16%)	22 (18%)	0.647
Fungal infections	30 (15%)	16 (21%)	14 (11.7%)	0.075
Bacterial infections	26 (7.5%)	14 (18%)	11 (9%)	0.058
Acrochordons	24 (12%)	6 (8%)	18 (15%)	0.139
Viral infections	22 (11%)	4 (5%)	18 (15%)	0.035*
Hirsutism	22 (11%)	0 (0%)	22 (18%)	-
Xanthoma	16 (8%)	8 (10.5%)	8 (6.7%)	0.336
Corn	15 (7.7%)	11 (14.5%)	4 (3.3%)	0.004*
Plantar hyperkeratosis	11 (5.6%)	4 (5%)	7 (5.8%)	0.866
Acne	10 (5%)	2 (2.6%)	8 (6.7%)	0.211
Varicosities	8 (4%)	2 (2.6%)	6 (5%)	0.414
Delayed wound healing	6 (3%)	3 (4%)	3 (2.5%)	0.567
Psoriasis	6 (3%)	2 (2.6%)	4 (3%)	0.781
Stasis dermatitis	6 (3%)	0 (0%)	6 (5%)	0.048*
Callus	5 (2.6%)	5 (6.6%)	0 (0%)	0.004*
Lichen planus	3 (1.5%)	3 (4%)	0 (0%)	0.028*
Hidradenitis suppurativa	2 (1%)	2 (2.6%)	0 (0%)	0.074
Stasis ulcer	1 (0.5%)	0 (0%)	1 (0.8%)	0.425
Adiposis dolorosa	1 (0.5%)	0 (0%)	1 (0.8%)	0.425
Decubitus ulcer	1 (0.5%)	0 (0%)	1 (0.8%)	0.425
Livedo reticularis	1 (0.5%)	1 (1.3%)	0 (0%)	0.208*
Keloids	1 (0.5%)	0 (0%)	1 (0.8%)	0.425
Malignant melanoma	0 (0%)	0 (0%)	0 (0%)	-
Keratosis pilaris	0 (0%)	0 (0%)	0 (0%)	-
Scleredema	0 (0%)	0 (0%)	0 (0%)	-
Cutis verticis gyrata	0 (0%)	0 (0%)	0 (0%)	-
Pilonidal sinus	0 (0%)	0 (0%)	0 (0%)	-
Lymphoedema	0 (0%)	0 (0%)	0 (0%)	-

*significant p value <0.05

Table 2 Frequencies of dermatological manifestations in obese patients with respect to age groups and grades of obesity (n=196).

Dermatological manifestations	Age (years)		p value	BMI (kg/m ²)		p-value
	18-44 (n=97)	≥45 (n=99)		25-29.9 (n=75)	≥30 (n=121)	
Acanthosis nigricans	52 (52%)	44 (44%)	0.199	25 (33%)	71 (59%)	0.001*
Striae	22 (22%)	12 (12%)	0.050*	6 (8%)	28 (23%)	0.007*
Fungal infections	19 (19%)	11 (11%)	0.099	16 (21%)	14 (11.6%)	0.065
Bacterial infections	13 (13%)	12 (12%)	0.788	13 (17%)	12 (10%)	0.130
Acrochordons	10 (10%)	14 (14%)	0.413	8 (11%)	16 (13%)	0.596
Viral infections	7 (7%)	15 (15%)	0.078	2 (3%)	20 (16.5%)	0.003*
Histiocytosis	12 (12%)	10 (10%)	0.615	4 (5.3%)	18 (15%)	0.040*
Xanthoma	6 (6%)	10 (10%)	0.317	8 (11%)	8 (6.6%)	0.314
Corn	3 (3%)	12 (12%)	0.17	9 (12%)	6 (5%)	0.072
Plantar hyperkeratosis	5 (5%)	6 (6%)	0.783	2 (2.7%)	9 (7.4%)	0.158
Acne	8 (8%)	2 (2%)	0.048*	4 (5%)	6 (5%)	0.908
Varicosities	3 (3%)	5 (5%)	0.489	2 (2.7%)	6 (5%)	0.431
Delayed wound healing	2 (2%)	4 (4%)	0.421	4 (5.3%)	2 (1.5%)	0.146
Psoriasis	0 (0%)	6 (6%)	0.014*	2 (2.7%)	4 (3.3%)	0.801
Stasis dermatitis	0 (0%)	6 (6%)	0.014*	0 (0%)	6 (5%)	0.05*
Callus	2 (2%)	3 (3%)	0.667	5 (6.7%)	0 (0%)	0.004*
Lichen planus	0 (0%)	3 (3%)	0.084	1 (1.3%)	2 (1.7%)	0.859
Hidradenitis suppurativa	2 (2%)	0 (0%)	0.151	0 (0%)	2 (1.7%)	0.263
Stasis ulcer	0 (0%)	1 (1%)	0.321	0 (0%)	1 (0.8%)	0.430
Adiposis dolorosa	0 (0%)	1 (1%)	0.321	0 (0%)	1 (0.8%)	0.430
Decubitus ulcer	1 (1%)	0 (0%)	0.311	0 (0%)	1 (0.8%)	0.430
Livedo reticularis	1 (1%)	0 (0%)	0.311	0 (0%)	1 (0.8%)	0.430
Keloids	1 (1%)	0 (0%)	0.311	1 (1.3%)	0 (0%)	0.203
Malignant melanoma	0 (0%)	0 (0%)	-	0 (0%)	0 (0%)	-
Keratosis pilaris	0 (0%)	0 (0%)	-	0 (0%)	0 (0%)	-
Scleredema	0 (0%)	0 (0%)	-	0 (0%)	0 (0%)	-
Cutis verticis gyrata	0 (0%)	0 (0%)	-	0 (0%)	0 (0%)	-
Pilonidal sinus	0 (0%)	0 (0%)	-	0 (0%)	0 (0%)	-
Lymphoedema	0 (0%)	0 (0%)	-	0 (0%)	0 (0%)	-

*significant p value <0.05

With respect to age, patients from 18-44 years age had more acne and striae ($p<0.05$); however, patients aged ≥ 45 years had a higher frequency of stasis dermatitis and psoriasis ($p<0.05$), (**Table 2**).

Discussion

Obesity, previously considered as a health problem of industrialized and developed countries, has been accepted and recognized as an emerging public health problem of developing countries like Pakistan now. The factors responsible include rising urbanization, dietary habits and changing life style. Cutaneous manifestations of obesity show statistically significant relationship with increasing BMI.

In this study, we used the criteria by WHO for Asians that sets a lower cut-off point of BMI ≥ 25 kg/m² as compared to cut-off point of BMI ≥ 30 kg/m² for rest of the world.⁶ The lower cut of points will lead to more accurate estimation of health problems associated with obesity, as those people who were previously considered as having normal weight are now labelled as obese.

The mean BMI recorded in our patients was 34 kg/m². Hermanns *et al.*¹¹ in their study of 126 patients, reported mean BMI to be 37.4 kg/m². Therefore, it can be appreciated that the finding in our study is comparable to the study aforementioned.¹¹ As per health survey conducted in 2004, prevalence of obesity in urban population of Pakistan has been documented to be 55% for men and 62% for

women (with the BMI cut off ≥ 25 kg/m²). Flegal *et al.*² have reported a higher mean BMI in females as compared to males. In our study the frequency of dermatological problems was higher in females. This in turn is consistent with the study by Flegal *et al.*²

The most common finding in our study was acanthosis nigricans (49%), that was significantly more in females as compared to males ($p=0.0001$). Also it was significantly associated with grade II obesity ($p=0.001$). Ahsan *et al.*¹³ have reported a higher frequency of acanthosis nigricans. However, the frequency can vary from one study to another depending upon the setting and design. Hermanns *et al.*¹¹ documented that acanthosis nigricans is associated with obesity, endocrine disorders including diabetes mellitus, hyperinsulinaemia, insulin resistance and metabolic syndrome. Boza *et al.*¹² also reported the association of obesity and acanthosis nigricans. Boza *et al.*¹² did not mention any association of acanthosis nigricans with diabetes or insulin resistance and claimed that obesity is an independent factor for acanthosis nigricans. This could be because of racial and genetic differences.¹²

Striae had a frequency of 17% in our study and were significantly associated with grade II obesity ($p=0.007$) and age group of 18-44 years ($p=0.05$). The frequency of striae was not statistically significant gender wise. Boza *et al.*¹² reported an association between striae and increasing grades of obesity. Ahsan *et al.*¹³ mentioned a higher frequency of striae. However, the frequency can vary from one study to another depending upon the setting and design.

Acrochordons were a feature in 12% of the enrolled subjects. The frequency in accordance with gender, severity of obesity and age was not different statistically. Ahsan *et al.*¹³ mentioned a significantly higher frequency of acrochordons (52%). Boza *et al.*¹² reported the frequency to be twice as compared to our

studies. The difference in frequency in turn may also be influenced by the sampling technique. Jowkar *et al.*¹⁴ already documented an association between acrochordons and hyperinsulinaemia in non-diabetics. Therefore, the association of acrochordons and obesity is in agreement with the reports in literature.¹⁴

Several factors like greater surface area, friction and moisture predispose obese people to infections. Among the skin infections (35%), fungal infections were the most frequent (15%), followed by viral infections (11%) and bacterial infections (7.5%). Ahsan *et al.*¹³ noted a frequency of infections that is comparable to our study (33%). In the current study, there was a significant association between viral infections and grades of obesity ($p=0.003$). On the contrary, Ahsan *et al.*¹³ were not able to correlate the frequency of infections with the grades of obesity. However, the frequency of bacterial and fungal infections was not influenced by the grades of obesity. Boza *et al.*¹² have also found a significant association between obesity and various infections. Therefore, it can be appreciated that the findings in the current study are consistent with the past studies.^{12,13}

In our study, hirsutism (18%) had a significant association with obesity grade II ($p=0.04$). Ahsan *et al.*¹³ have reported an equivalent frequency of 16% in a similar set of patients. Hirsutism has already been reported to be associated with hyperinsulinaemia and hyperandrogenism in the past.^{12,15}

Plantar hyperkeratosis (6%) was also a feature in our series of patients. Ahsan *et al.*¹³ reported a significantly higher frequency of plantar hyperkeratosis as compared to our study. However, the findings can differ in different studies depending upon the study design, setting and the sample size. There are reports of similar association in the literature.^{14,15}

Corns (7.7%) were significantly associated with male gender ($p=0.004$). Acne (5%) was

significantly associated with the younger age group (18-45 years, $p=0.048$). Ahsan *et al.*¹³ did not report the association in their study.

Psoriasis has been found to be associated with and aggravated by obesity in several studies.^{10,11} In the current study, psoriasis was seen in 3% of the enrolled subjects. On the other hand, Ahsan *et al.*¹³ have reported a frequency of 10% as far as psoriasis is concerned. Obesity has also been studied in association with psoriasis area and severity index (PASI) in several studies.¹⁶⁻¹⁸

The frequency of other cutaneous manifestations in our study was low and relevant figures were not reported in the comparative studies. However, these rare findings like gout, keloids, livedo reticularis, lymphedema etc. have been reported in association with obesity in the past.⁷⁻¹⁰

Skin care in obese patients demands particular attention because of morbidity, associated systemic diseases and susceptibility to infections.^{19,20} Limited work has been done on this subject in our part of the world. This study adds to currently available literature from Pakistan and allows us comparison with international studies.

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