

A Hospital-Based Clinical Study of Cutaneous Changes in Overweight and Obesity

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ABSTRACT

Background: Obesity has been considered as one of the major epidemics of 21st century due to its detrimental effects on homeostatic milieu of the body. Not only internal organ systems but externally our so called external barrier, skin, also gets involved.

Objectives: To present a descriptive study regarding varied cutaneous manifestations in overweight (BMI=25 Kg/m² -29.99 Kg/m²) and obese (BMI=> 30 Kg/m²) population along with their prevalence in both overweight and different grades of obesity.

Materials and methods: A cross-sectional descriptive study was conducted on 300 overweight and obese individuals, enrolled from dermatology outpatient clinic on the basis of BMI. A thorough physical and cutaneous examination of all the enrolled patients was performed by a trained dermatologist and all the cutaneous changes were noted down along with their demographic and clinical details on a set proforma. The study was approved by Institutional Review Board.

Results: Out of 300 patients, 65(21.67%) were males and 235(78.33%) were females. Majority of the patients belonged to grade 1 obesity i.e. 52.67% whereas least no. of patients were of grade 3 obesity (3.33%). Acanthosis nigricans was the most commonest cutaneous change (74.67%) followed by cellulite (68%), and rogenetic alopecia (55.67%), acrochordons (46%), striae distensae (44.33%) and infections (43%). Acanthosis nigricans was leading in all the three grades of obesity with 100% involvement in grade 3 obesity. Similarly, acrochordons, keratosis pilaris, hirsutism, acne vulgaris, androgenetic alopecia, striae distensae, peizogenic pedal papules, cellulite, hidradenitis suppurativa, intertrigo, infections and psoriasis were also more common in grade 3 obesity.

Conclusion: A myriad of cutaneous changes have been seen in obesity. These changes may simply have cosmetic implications for patients, but for a clinician these serve as reflection of metabolic imbalance occurring internally.

Key-words: Obesity, skin, metabolic syndrome.

INTRODUCTION

Obesity is a health problem of substantial enormity which is known to increase the risk of medical problems, including metabolic, cardiovascular and even carcinogenesis. [1,2] In addition, numerous cutaneous conditions and disorders are more common or get worse when the person is overweight or obese. It has been postulated to be because of dysfunction of epidermal barrier along with

alteration in appendageal and vascular structures of skin. Worldwide literature analysis reveals number of review articles tabulating the impact of obesity on skin. [3,4] However, very few descriptive and observational studies exist which have systematically studied the cutaneous conditions in obesity. [5] The present study sought to identify the prevalence of different cutaneous changes occurring in context to both overweight and obesity and their trend

of occurrence with regards to different grades of obesity.

MATERIALS AND METHODS

The present descriptive study was conducted over a period of one year in 300 overweight and obese patients (BMI>24.99kg/m²) visiting the Dermatology out-patient department of SMGS hospital attached to Government Medical College, Jammu, India after seeking approval from institutional ethics committee. About 200-250 patients seek consultation in the dermatology OPD daily. To complete the sample, thrice a week, on alternate days, every patient attending the dermatology OPD was screened for height and weight and accordingly BMI was calculated. To avoid the selection bias, only the first five individuals having BMI >24.99 were included in the study. Pregnant, lactating women and patients with age<18 years and >65 years were excluded from this study. After taking the written informed consent, demographic details with complete cutaneous and systemic complaints were recorded on a set proforma. A thorough clinical work up of all the patients was undertaken and full clinical details including weight, height and waist circumference along with the associated cutaneous changes were noted. The diagnosis was made by dermatology consultant. Relevant routine and special investigations were also carried out. The data was analysed with the help of computer software Microsoft excel for windows and the resultant qualitative values were presented as percentages.

RESULTS

Our study included 300 patients, with 65 males and 235 females. Demographic details have been displayed in [Figure-1]. Out of the total study population, majority of the patients belonged to grade 1 obesity i.e. 52.67% (n=158) whereas least no. of patients were of grade 3 obesity i.e. 3.33% (n=10). Overweight population was also significant at 31.67% (n=95) and 12.33% (n=37) were having grade 2 obesity [Figure-2]. On examination, a wide array of

cutaneous changes were observed in overweight and obese population [Table-1] with acanthosis nigricans predominating in 74.67% (n=224) of sample. This was followed by cellulite, androgenetic alopecia, acrochordons, striae distensae and infections in 68% (n=204), 55.67% (n=167), 46% (n=138), 44.33% (n=133) and 43% (n=129) of patients respectively. Only one patient of chronic venous insufficiency was seen who was having grade 1 obesity. Two patients of lymphoedema, one each in grade 1 and grade 3 obesity were seen. No patient of adiposis dolorosa and tophaceous gout was found in our study. After stratifying diagnoses into different grades of obesity, the following pattern emerged [Table-1]. Acanthosis nigricans was leading in all the three grades of obesity with 100% (n=10) involvement in grade 3 obesity. Similarly, acrochordons, keratosis pilaris, hirsutism, acne vulgaris, androgenetic alopecia, striae distensae, peizogenic pedal papules, cellulite, hidradenitis suppurativa, intertrigo, infections and psoriasis were also more common in grade 3 obesity.

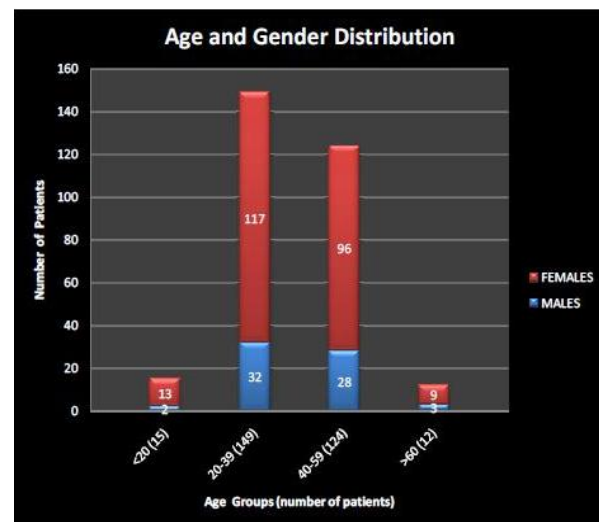


Figure 1: Distribution of overweight & obese patients according to age & gender.

Out of the various cutaneous symptoms [Table-2] associated with overweight and obesity, the most common was dry skin (50.67%) followed by itching (39%). This was followed by hyperpigmentation in 33% patients most commonly on neck followed by axilla, face

and inguinal areas. Increased reporting of hyperpigmentation over neck and axilla corresponded mostly to acanthosis nigricans where as on the face; melasma was the most common cause. Increased sweating was next common in cutaneous symptoms with involvement of 27.33% of patients. Complaints of hair loss and hair thinning were found in 26% of patients. Out of which, two-thirds (2/3) were having androgenetic pattern of alopecia where as rest of the patients with hair loss and diffuse thinning of hair were mostly found to be hypothyroid. Amongst all infections, commonest were of fungal etiology in the order of tinea cruris 17.67% (n=53) followed by candidiasis, tinea corporis, tinea unguium and tinea pedis at 7.33% (n=22), 6.67% (n=20), 5.33% (n=16) and

5.33% (n=16) respectively. Of bacterial infections, commonest was furunculosis which was present in 3.33% (n=10) patients. [Table 2]

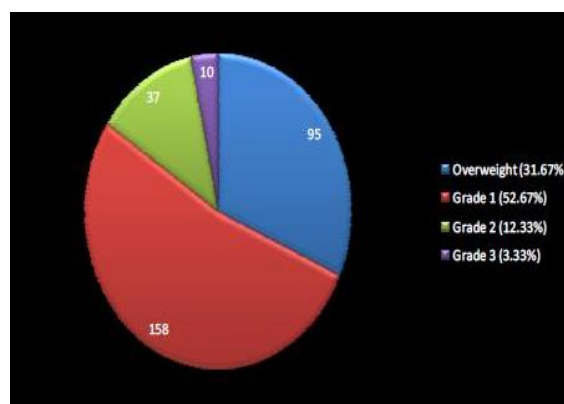


Figure 2: Distribution of patients into overweight & different grades of obesity according to Body Mass Index (BMI).

Table 1: Distribution of cutaneous Changes in Overweight and different Grades of Obesity

	Dermatosis	Total no. of Patients (% of 300)	Overweight (% of 95)	Grade 1 Obesity (% of 158)	Grade 2 Obesity (% of 37)	Grade 3 Obesity (% of 10)
1	Acanthosis Nigricans	224 (74.67)	59 (62.1)	122 (77.21)	33 (89.19)	10 (100)
2	Cellulite	204 (68)	69 (72.63)	105 (66.46)	22 (59.46)	8 (80)
3	Androgenic Alopecia	167 (55.67)	51 (53.68)	85 (53.80)	24 (64.86)	7 (70)
4	Acrochordons	138 (46)	28 (29.47)	76 (48.10)	26 (70.27)	8 (80)
5	Striae Distensae	133 (44.33)	46 (48.42)	67 (42.40)	15 (40.54)	5 (50)
6	Infections	129 (43)	40 (42.10)	67 (42.40)	17 (45.95)	5 (50)
7	Planter Hyperkeratosis	106 (35.33)	23 (24.21)	54 (34.18)	23 (62.16)	6 (60)
8	Acne Vulgaris	86 (28.67)	30 (31.58)	39 (24.68)	13 (35.13)	4 (40)
9	Keratosis Pilaris	71 (23.67)	18 (18.95)	31 (19.62)	14 (37.84)	8 (80)
10	Intertrigo	64 (21.33)	12 (12.63)	36 (22.78)	11 (29.73)	5 (50)
11	Hirsutism	50 (16.67)	18 (18.95)	25 (15.82)	5 (13.51)	2 (20)
12	Peizogenic Pedal Papules	41 (13.67)	11 (11.58)	20 (12.66)	6 (16.22)	4 (40)
13	Hidradenitis Suppurativa	18 (6)	5 (5.26)	7 (4.43)	4 (10.81)	2 (20)
14	Psoriasis	17 (5.67)	2 (2.10)	5 (3.16)	7 (18.92)	3 (30)

Table 2: Distribution of infections and cutaneous symptoms in overweight and obese patients

S.No	Infections	Number of patients (% of n)	S.No	Cutaneous Symptoms	Number of patients (% of n)
	Fungal				
1	Tinea Cruris	53 (17.67)	1	Dry skin	152 (50.67)
2	Candidiasis	22 (7.33)	2	Itching	117 (39)
3	Tinea Corporis	20 (6.67)	3	Hyperpigmentation	99 (33)
4	Tinea Pedis	16 (5.33)	4	Increased sweating	82 (27.33)
5	Tinea Unguium	16 (5.33)	5	Hair loss and/or thinning	78 (26)
6	Tinea Mannum	7 (2.33)	6	Swelling of feet	68 (22.67)
7	Pityriasis Versicolor	6 (2)	7	Cutaneous infections	67 (22.33)
8	Candida Folliculitis	4 (1.33)	8	Acne	37 (12.33)
9	Onychomycosis	4 (1.33)	9	Burning pain legs and feet	26 (8.67)
	Bacterial		10	Delayed wound healing	20 (6.67)
10	Furunculosis	10 (3.33)	11	Unwanted hair growth	17 (5.66)
11	Folliculitis	4 (1.33)	12	Leg ulceration	14 (4.67)
12	Erysipelas	3 (1)	13	Painful subcutaneous swellings	6 (2)
13	Erythrasma	2 (0.66)			
	Other infections				
14	Warts	3 (1)			
15	Lupus Vulgaris	2 (0.67)			
16	Herpes Labialis	2 (0.67)			

As far as co-morbidity profile is concerned, hypertension was the commonest co-morbidity associated with obesity; seen in 18% (n=54). Hypothyroidism and diabetes mellitus were also common at 10% (n=30) and 7% (n=21) respectively. Of 30 patients of hypothyroidism, 46.67% patients (14) were hitherto undetected for hypothyroidism whose diagnoses were confirmed on thyroid profile.

DISCUSSION

The age of the patients in our study ranged from 18 to 65 years with maximum number of patients belonging to the age group of 20 to 39 years (49.67%) followed by 41.33% in the age group of 40-59 years. Patients younger than 20 years and older than 59 years were less (5% and 4% respectively) consequent to the cut off ranges of the sample. In our study endeavour, there were 65 (21.67%) males and 235 (78.33%) females with a male to female ratio of 1: 3.61. The higher percentage of female patients in this study can be explained on the basis of certain studies revealing that females are more concerned about their physical appearance.^[6] Also, this observation may be due to the increased sedentary lifestyle of females which predisposes them to obesity and its associated complications.^[7] Moreover, if we take into consideration the data from North India, obese females outnumber males in both urban slums as well as urban population.^[8] In addition, a decreasing trend in the percentage of female patients was observed with increase in age. This may be due to the reason that young females are more concerned about their appearance and body image than their elder counterparts.^[9]

Out of all the dermatoses, acanthosis nigricans was the commonest one, found in 74.67% of the total study population. This is in agreement with studies conducted by Hud JA et al and Araujo MB et al who found 74% and 76 % prevalence of acanthosis nigricans in obese adults respectively.^[10,11] A slightly less prevalence of acanthosis

nigricans (64.2%) was observed in one observational study although the results are still comparable.^[5] The proposed mechanism how obesity leads to this epidermal change begins at the cellular level. Obesity has been considered as a hyperinsulinemic state in which increased levels of circulating insulin leads to decreased numbers of functional/classic insulin receptors which are involved in glucose uptake, cell growth, DNA synthesis and protein and fat metabolism via tyrosine kinase activity.^[12] Decreased numbers of functional insulin receptors cause a shift towards increased binding with insulin-like growth factor (IGF) receptors, expressed over the surface of keratinocytes and fibroblasts, contributing to the development of acanthosis nigricans due to growth promoting effects.^[13] Another observation was the prevalence of acanthosis nigricans in overweight and obese diabetics which came out to be 90.48%, much higher than the prevalence of acanthosis nigricans in diabetics irrespective of their weight status (35%) as studied by Kong AS et al.^[14] Regarding their site, commonest was posterior neck (63%) followed by axilla (45.33%). The least common site was face with only 7.33% patients having acanthosis nigricans on their face.

Cellulite was the next most common cutaneous change (68%) seen after acanthosis nigricans. However, almost whole of this figure is dominated by the female population, only one male was having cellulite as compared to 203 females. This is in agreement with the general population study reviews, documenting 85% to 98% prevalence in Caucasian females.^[15] The pathogenesis of cellulite begins in adolescence, when the oestrogen hormone begins to trigger the laying down of fat in the body particularly on the thighs and hips. Gradually, the sub-cutaneous fat cells start enlarging in size and the lymph fluid that passes through these tissues start to accumulate, leading to compression of fat cells which later on harden into lumps resulting into cellulite.^[16] Another view is

that the makeup of the strands of fibrous tissue in women and men are different. In man, fibrous tissue in skin forms a net that is perpendicular in shape whereas a woman's net of fibrous tissue is formed by X's. It is also proposed that the fibrous tissue of women is woven tighter; this is why the dimpling effects are so much worse in women than they are in men. [17]

Dermatological manifestations of hyperandrogenism i.e., androgenetic alopecia, acne and hirsutism were found in 55.67% (n=167), 28.67% (n=86) and 16.67% (n=50) of the total study population. Hyperandrogenism in obesity is attributed to adipose tissue, which converts testosterone to its active form dihydrotestosterone, and hyperinsulinemia which is commonly seen with obesity. Hyperinsulinemia leads to increased production of ovarian androgens and Insulin also inhibits the synthesis of sex hormone binding globulins, thereby, increasing the free testosterone levels in the blood leading to a more severe form of hyperandrogenism. [18,19] This increase of testosterone may lead to male pattern baldness, hirsutism and acne in obese women. Out of 167 cases of androgenetic alopecia, 46 were males and 121 were females. This formulates a prevalence of 70.77% in males and 51.49% in females which is much higher than the general population prevalence of androgenetic alopecia in the corresponding sexes, i.e. 58% in males and 39.6% in females. [20,21] Also, slender increase was seen in prevalence of androgenetic alopecia with increase in BMI which was highest (70%) in grade 3 obesity as compared to 53.68% in overweight individuals. The prevalence of acne vulgaris in our study stood at 28.67% which is comparable to the study done by Garcia HL et al who found acne to be prevalent in 25.1% of obese individuals. [5] No discernable increase in the prevalence of acne with the increase in BMI was observed. Hirsutism was present in 16.67% (n=50) of study sample, much higher as compared to that of the general population

prevalence of hirsutism i.e. 5 -10% of females. [22]

Acrochordons or skin tags were present in 46% of patients, commonest site being neck (43%) followed by axilla (20.33%) and groin (6.67%). The prevalence of acrochordons increased with the increase of BMI and was maximum in grade 3 obese at 80%. Similar findings have been reported by earlier studies. [5,10] These changes appear to be associated with impaired carbohydrate metabolism and increased atherosclerosis. [23] Some studies suggest that acrochordons are linked to the presence of diabetes, which itself is a risk factor for obesity, rather than being independently associated with obesity. [24] Similar to acanthosis nigricans, co-morbidity robustly associated with acrochordons and obesity was diabetes mellitus. In our study, the prevalence of acrochordons in overweight and obese diabetics was 71.43% analogous to the figures reported by Hud JA et al. [10]

Striae distensae were present in 44.33% of the overweight and obese individuals. This statistic for striae distensae is highly comparable with other studies who found striae in 42.94% and 40% of their subjects and were present most commonly in breast (36%) and abdomen (34%) followed by thighs (28.67%) and buttocks (20%). [5,25]

Intertrigo was present in 21.33% of individuals. Like many of the above mentioned disorders the prevalence of intertrigo also increased with the increase in BMI; being 12.63% in overweight and 50% in Grade 3 obese. This linear trend between severity of obesity and intertrigo has been reported earlier also. [5] 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 components. The macerated erythematous plaques developing within skin folds, such as inframammary, genitocrural, axillary and abdominal folds are due to both increased friction and moisture within these areas. [5]

The commonest superadded infection with intertrigo was found to be candida, present in 25% cases of intertrigo which was confirmed by KOH examination.

Infections were seen in 43% of whole study population which was slightly less as compared to the study done by Swiney J who found 50.42% of obese individuals to be harbouring one or the other infection.^[26] Out of all the infections, fungal infections were commonest with tinea cruris prevalent in 17.67% of study population which is comparable to the results (22.8%) obtained in a study conducted by Lecerf JM et al.^[27]

Planter hyperkeratosis was another significant finding in our study present in 35.33% of the patients. Hyperkeratosis of the soles in obesity was first described by Garcia HL et al.^[6] It was observed in 34.61% of obese in their study which is relatively comparable to our findings. The plantar hyperkeratosis was positively related to grades of obesity in our analysis of overweight and obese which was 60% in patients with grade 3 obesity and only 24.21% in overweight individuals. The plantar hyperkeratosis that develops may be regarded as a physiologic response to mechanical trauma as obese patients have higher plantar pressures during walking and standing and increased forefoot width. There is also an abnormal transference of weight during walking that alters the alignment of the foot, causing increased stress over bony prominences.^[28]

Keratosis pilaris was present in 23.67% patients and this figure is quite comparable to that of earlier studies (21.15%).^[6] Later on, many studies suggesting an association of keratosis pilaris with higher BMI were reproduced.^[29,30] Most of the patients of keratosis pilaris were having Diabetes Mellitus as co-morbidity. This suggests that insulin resistance may also play a role in the development of keratosis pilaris as elucidated by earlier studies.^[30] An excess formation and/or buildup of keratin around individual hair follicles traps the growing hairs because of

which hair is unable to reach the surface leading to individual follicular bumps.^[31]

13.67% (n=41) patients were found to be having piezogenic pedal papules, thought to be caused by herniation of fat through connective tissue defects. Again the prevalence of piezogenic pedal papules increased with increase in BMI. This increasing trend can be explained as these are known to occur when excessive weight is placed on foot.

Hidradenitis suppurativa was detected in 6% of overweight and obese individuals recruited for our study. Obesity has not been consistently found to be associated with this suppurative disease but still it has been found to be a predisposing factor for hidradenitis suppurativa.^[32,33] Hidradenitis suppurativa was observed mainly in abdominal region as recurrent abscesses. The etiology of hidradenitis suppurativa is still poorly understood; however, it appears to be caused primarily by follicular occlusion with secondary involvement of the apocrine glands.^[34]

Recent data from a number of studies demonstrate a significantly higher prevalence of overweight and obesity among psoriasis patients than in the general population.^[35-37] The chronic low-level inflammation, as seen in obesity, may contribute to the extent of psoriatic lesions in obese patients. A network of pro-inflammatory cytokines (especially tumour necrosis factor alpha {TNF- α }) is believed to play an important role in the pathophysiology of both obesity and psoriasis. TNF- α in obesity is presumed to be derived from inflammatory cells (macrophages) in the adipose tissue and in psoriasis from activated T cells. Furthermore, changes in levels of metabolic hormones as ghrelin and leptin in obesity may also play a role in the pathogenesis of deterioration of psoriasis by their potency to release pro-inflammatory mediators like interleukin 6 (IL-6) and TNF- α .^[38] In our study, 5.67% (n=17) of overweight and obese patients were diagnosed with psoriasis. Though a number of reports are

there with findings of increased prevalence of obesity in psoriasis, but studies of increased prevalence of psoriasis in obesity are largely lacking. Owing to this paucity, comparing our data with general population prevalence of psoriasis in North India i.e., 5.67% v/s 0.8% respectively makes our reporting of psoriasis a significant finding in obese and overweight individuals. [39] Out of the 17 patients with psoriasis, 64.71% (n=11) were having inverse psoriasis corroborating with the previous reports that inverse psoriasis appears to be particularly associated with obesity. [40] Also a positive correlation of BMI with psoriasis was observed which was 2.10% in overweight and 30% in grade 3 obese which is in accordance with the findings of study done in Sicily population. [37]

The commonest medical co-morbidity found in our study population was hypertension (18%) and simultaneously its prevalence increased in higher grades of obesity i.e., 35.13% in grade 2 and 50% patients in grade 3 obesity. This is comparable to the figures observed by earlier researches. [41,42] Diabetes mellitus was also co-morbid with obesity being present in 7% of individuals, with its prevalence again more in grade 2 and grade 3 obesity. 50% of grade 3 obese patients were diabetic. Headaches, mainly migrainous type, were seen in 4.67% of overweight and obese patients. Association of migraine with obesity has also been suggested by many studies. [43]

Though every attempt was made to capture the quintessence of the cutaneous changes in overweight and obesity, still few lacunae were observed during the course of our study. Firstly, certain special investigations like serum insulin levels, free testosterone, LH/FSH ratio and sex hormone binding globulin levels could not be done because it was not available in our institution. Secondly, because our study was carried out in dermatology clinic so certain disorders like necrotising skin infections, adiposidolosa, tophaceous gout were not encountered, primarily, because of their

surgical and medical management. For the same reason very few cases of lymphedema and chronic venous insufficiency were encountered

CONCLUSION

Even though the prevalence of obesity is increasing by epidemic proportions, dermatological effects of obesity have garnered little attention. Skin changes in obesity may simply be a cosmetic aberration or they may be an indicators of certain systemic disorders associated with altered carbohydrate metabolism like Diabetes Mellitus, hypertension. Given the growing numbers of obese patients, a multidisciplinary approach is needed involving dermatologists as a pivot to reduce the injurious effects of obesity on skin.

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