

## Original Research Article

# Cutaneous manifestations in overweight and obese children and adolescent

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**Received:** 04 July 2021

**Revised:** 11 August 2021

**Accepted:** 17 August 2021

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### ABSTRACT

**Background:** Obesity currently is regarded as universal disease of epidemic prevalence and known as the evil of the twentieth century. The last 3 decades we have seen an unprecedented increase in the prevalence of obesity throughout the world including India. Overweight and obesity are the fifth leading risks of global deaths worldwide. However, despite all above mentioned problems, the impact of obesity on the skin has received minimal attention though it can be a window for obesity markers.

**Methods:** It was a cross-sectional descriptive observational study. A total of 131 patients of age 5 to 18 years with BMI greater than 85 percentiles for age and sex and those willing to give consent for participation in the study were selected.

**Results:** Maximum number of patients were obese with their BMI (body mass index) range falling between 95-99 percentile; according to IAP guidelines obese were 83 (63.35%), followed by overweight 27 (20.61%) and 21(16.03%) patients were severely obese. Acanthosis nigricans was the major cutaneous finding seen in 100% cases. Other common manifestations were striae distensae, acrocordons, hyperhidrosis, miliaria, frictional dermatitis and intertrigo, acne vulgaris, atopic dermatitis and hypertrichosis.

**Conclusions:** Obesity is associated significantly with certain dermatoses in children as well as in adults. Skin care of obese patients deserves particular attention, not only because of the high prevalence of cutaneous alteration but mainly because many of these disorders are preventable and could be treated which may improve patient's quality of life.

**Keywords:** BMI, Acanthosis nigricans, Striae distensae

### INTRODUCTION

Obesity once considered as adult problem now has become one of the most alarming public health issues facing the world today. Childhood obesity can also lead to many more systemic complications, poor self-esteem and depression. Obesity currently, is regarded as universal disease of epidemic prevalence and known as the evil of the twentieth century, has been recognized worldwide as a major health problem.<sup>1</sup>

Overweight and obesity are defined by the WHO as abnormal or excessive fat accumulation that may impair health. The prevalence of childhood obesity has increased manifold over the last few years in both the developed and developing nations and has reached to epidemic proportions. According to the WHO, 20% of children and adolescents in Europe are overweight, and of these, one-third are obese.<sup>1</sup> In adults obesity is clearly classified on the basis of BMI but in children it depends on BMI percentiles. Overweight is defined as a BMI at or above the 85th percentile and below the 95th percentile for children and teens of the same age and sex. Obesity is

defined as a BMI at or above the 95th percentile for children and teens of the same age and sex.<sup>1,2</sup> Obesity can be graded on the basis of various parameters.<sup>1</sup> Among all the parameters BMI was widely used for obesity gradation (Table 1).

**Table 1: Classification of obesity and distribution of patients according to BMI.<sup>1,2</sup>**

BMI	Frequency	Percentage (%)
<b>Underweight (&lt;5th percentile)</b>	00	00.00
<b>Normal (5th to 85th percentile)</b>	00	00.00
<b>Overweight (85-95th percentile)</b>	27	20.61
<b>Obese (95-99 percentile)</b>	83	63.35
<b>Severely obese (&gt;99th percentile)</b>	21	16.03
<b>Total</b>	131	100.00

Obesity affects skin physiology by altering skin barrier function, sebum production, sweat gland function, lymphatics, collagen structure, wound healing, subcutaneous fat, microcirculation and microcirculation.<sup>3</sup> It has been implicated in many skin diseases such as acanthosis nigricans, acrochordon, keratosis pilaris, hyperandrogenism, hirsutism, striae cutis distensae, adiposis dolorosa, fat redistribution, lymphedema, plantar hyperkeratosis, cellulite, skin infections, hidradenitis suppurativa, psoriasis and insulin resistance syndrome and conditions that are aggravated by obesity.<sup>4,5</sup>

Aims and objectives of the study were to correlate skin manifestation with different grades of obesity and to study the prevalence of skin manifestation of obesity in children and adolescent age groups. We undertook this study to observe the cutaneous manifestations of obesity in pediatric population and to analyze the relation with BMI.

## METHODS

This was a cross-sectional descriptive observational study carried out over a period of 18 months from May 2018 to November 2019 in a tertiary care hospital situated in western part of India Seth G S medical college and KEM hospital, Mumbai. Present study was conducted after obtaining institutional ethics committee approval.

### Inclusion criteria

A total of 131 children aged 5-18 years with BMI greater than 85 percentiles for age and sex and those willing to give consent for participation in the study were included in the study.

### Exclusion criteria

Children on systemic steroid therapy, mentally challenged children and those who refused to give informed consent were excluded from the study.

After taking informed consent from the parents/attendants, demographic details, height, weight and systemic examination were done. A detailed cutaneous examination was performed, and all the findings were noted on a predesigned proforma. Relevant investigations were carried out, wherever necessary.

The statistical software SPSS version 23.0 was used for the analysis of the data and Microsoft word and excel was used to generate graphs, tables. Open Epi software version 2.3 was used for calculating frequency, percentage and cross-tabulations between various parameters. Association among various study parameters within study group (overweight and obese) were assessed with the help of chi square test.  $P < 0.05$  was taken as level of significance.

## RESULTS

A Total number of 131 children were studied between age group of 5 to 18 years. Mean age of the study group was 9.10 years and males were more than females (male:female was 80:51).

Maximum number of patients were obese with their BMI range falling between 95-99 percentile; according to IAP guidelines obese were 83 (63.35%), followed by overweight 27 (20.61%) and 21 (16.03%) patients were severely obese.

**Table 2: Distribution of patients according to obesity related cutaneous finding.**

Cutaneous findings	Frequency	Percentage (%)
<b>Acanthosis nigricans</b>	131	100.00
<b>Striae cutis distensae</b>	49	37.40
<b>Acne</b>	27	20.61
<b>Hyperhidrosis</b>	21	16.03
<b>Miliaria</b>	14	10.68
<b>Folliculitis</b>	11	08.39
<b>Frictional dermatitis+intertrigo</b>	10	07.63
<b>Acrochordons</b>	9	06.87
<b>Atopic dermatitis</b>	9	06.87
<b>Hypertrichosis</b>	8	06.10
<b>Psoriasis</b>	2	01.52

Acanthosis nigricans was the major cutaneous finding seen in 100% (N=131) cases. Second most common manifestation was striae distensae (37.40%), followed by

these less common findings acne vulgaris (20.61%), hyperhidrosis (16.03%), miliaria (10.68%), acrocordons (6.87%), frictional dermatitis and intertrigo (7.63%), atopic dermatitis (6.87%) and hypertrichosis (6.10%) (Table 2). In our study majority of patients that is 74

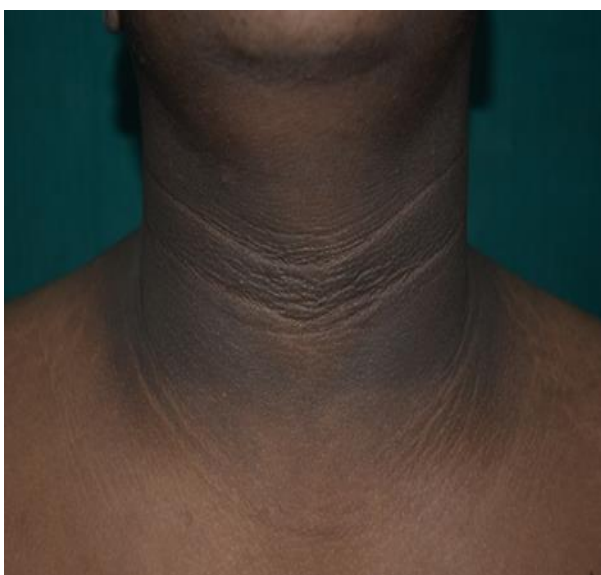
cases (56.48%) presented with infection and infestation. Amongst these 34 cases had fungal infection and 11 cases had viral infection. Eczema/dermatitis was seen in 16 cases (12.21%), and 11 cases (8.39%) were diagnosed under autoimmune diseases such as alopecia areata, lichen planus and vitiligo (Table 3 and 4).

**Table 3: Distribution of patients according to diagnosis.**

Diagnosis category	Frequency	Percentage (%)
<b>Infection and infestation</b>		
Fungal	34	56.48
Viral	11	
Bacterial	05	
Infestation	06	
<b>Autoimmune conditions</b>	11	8.39
<b>Conditions directly related to obesity</b>	15	11.45
<b>Nevoid conditions</b>	01	0.76
<b>Eczema/dermatitis</b>	16	12.21
<b>Nutritional dermatoses</b>	04	03.05
<b>Other</b>	27	20.61

**Table 4: Distribution of common skin conditions according to grade of obesity.**

Common skin conditions	Overweight (N=27) (%)	Obese (N=83) (%)	Severely obese (N=21) (%)
<b>Acanthosis nigricans</b>	27 (100)	83 (100)	21 (100)
<b>Acrocordons</b>	0	6 (7.22)	3 (14.28)
<b>Striae</b>	6 (22.22)	30 (36.14)	13 (61.90)
<b>Hypertrichosis</b>	2 (7.40)	4 (4.81)	0
<b>Fungal infection</b>	11 (40.74)	15 (18.07)	8 (38.09)
<b>Viral infection</b>	5 (18.51)	4 (4.81)	2 (9.52)
<b>Eczema/dermatitis</b>	8 (29.62)	6 (7.22)	2 (9.52)
<b>Nutritional</b>	1 (3.70)	2 (2.40)	1 (4.76)



**Figure 1: Grade 4 acanthosis nigricans over neck in a 13 year male child.**



**Figure 2: Grade 3 acanthosis nigricans over axilla in a 12 year male child.**



**Figure 3: Striae distensae over cubital fossa and over abdomen in severely obese 15 year male child.**



**Figure 4: Well defined annular lesion of tinea over axilla and underlying acanthosis nigricans in a 10 year female child.**



**Figure 5: Single patch of focal vitiligo over left axilla with underlying acanthosis nigricans grade 1 in a 6 year old male child.**

## DISCUSSION

Mean age of the study group was 9.10 years, this distribution of patients points towards early onset of

obesity in children. Common cutaneous manifestations related to obesity were acanthosis nigricans (100%), striae distensae (37.40%), acrocordons (6.87%), hyperhidrosis (16.03%), miliaria (10.68%), frictional dermatitis and intertrigo (7.63%), acne vulgaris (20.61%), atopic dermatitis (6.87%) and hypertrichosis (6.10%).

Acanthosis nigricans was the major finding in our study population with frequency of 131, that is, 100% cases had acanthosis nigricans involving one or more sites. Most patients had acanthosis nigricans over neck (100%) and axilla (80.91%) however we also found few patients with facial acanthosis (19.84%), acanthosis nigricans over dorsum of hand (knuckles) in 11.45%, acanthosis nigricans over cubital fossa area in 8.39%. Hud et al observed that 74% of obese population showed acanthosis nigricans along with elevated plasma insulin levels.<sup>6</sup> Gupta study on children also mentioned that acanthosis nigricans was the most common dermatosis seen in 42% of the children in her study.<sup>7</sup>

The above mentioned results indicate that acanthosis nigricans in overweight and obese children was a consistent cutaneous finding with neck ( $p=0.001$ ) being the most common site affected followed by axilla ( $p=0.007$ ). Nithun et al in his study mentioned that most common site involved was neck (90%), which has been found to be affected in more than 90% of cases of AN in several studies.<sup>8</sup>

The second most common cutaneous finding of our study population was striae distensae observed in 49 patients (37.40%) and maximum of these patients 61.90% belonged to severely obese category (Table 4). Striae were distributed more over abdomen followed by shoulder and thighs. Patients with striae belonged to obese or severely obese categories and were also having higher grade of acanthosis nigricans (grade 3 and 4). Hsu et al found striae in 40% of children with moderate to severe obesity, and incidence was higher in those with a longer duration of obesity.<sup>9</sup>

Amongst skin infections maximum number of patients had superficial fungal infection (34 in number, 25.9%) such as tinea cruris (N=8), tinea corporis (N=17), tinea capitis (N=3) and pityriasis versicolor (N=6). Similar findings are recorded by Gupta in a prospective study with fungal infections and intertrigo being 16%. Another population based study done by Mirmirani et al has given significant association with bacterial and fungal skin infections with p value being  $<0.001$ , amongst these they had more number of patients with dermatophytosis and candidiasis.<sup>10</sup> Out of these 34 cases of fungal infection 18 patients reported to have recurrent tinea infection. Recurrence of fungal infection in obese people has known association and explained by Shipman et al.<sup>11</sup> As per our study 45.80% patients were having symptoms lasting from 1 month to 1 year and 32.82% patients were having symptoms for more than a year.



Exceeding number of tinea cruris in obese children can be explained by high perspiration, sagging skin folds, friction at the flexures in such patients.

Serum fasting insulin level was done in total of 30 (23.66%) patients and it was found to be in normal range, between 5 to 25 uU/l. Nithun et al mentioned that fasting insulin was raised in 23.3% (N=14) of cases.<sup>8</sup> There was a highly significant association between the presence of AN and higher insulin levels unlike to our study where fasting insulin levels were within normal limits.

### **Limitation**

Limited follow up period and restricted data available for analysis contributed to the shortcomings of our study.

### **CONCLUSION**

Obesity is strongly related to several skin alterations that could be considered as markers of excessive weight in children as well as in adults. Skin care of obese children deserves particular attention, not only because of the high prevalence of cutaneous alteration but mainly because many of these disorders are preventable and could be treated which may improve quality of life in adulthood. As the prevalence of obesity is increasing each day, understanding of these dermatoses is necessary for both the pediatricians as well as for dermatologists for early diagnosis and management. This article serves to outline the many consequences of obesity related dermatoses and will hopefully aid the clinician in diagnosing and treating the dermatologic manifestations of obesity.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Sunkwad A, Mahajan S. Cutaneous manifestations in overweight and obese children and adolescent. Int J Contemp Pediatr 2021;8:1662-6.