e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(11); 1359-1363

Original Research Article

Skin Changes in Pediatric Obesity: Prevalence and Metabolic Correlates

Gindham Harilitha[1], Uday Kiran Tumma[2], Keerthi Neelagiri[3]

[1]Assistant Professor, Department of Dermatology, Venereology and Leprosy (DVL), MGM Hospital/Kakatiya Medical College, Hanamkonda, Telangana

[2]Assistant Professor, Department of Pediatrics, MGM Hospital / Kakatiya Medical College, Hanamkonda, Telangana

[3]Assistant Professor, Department of Pediatrics, MGM Hospital / Kakatiya Medical College, Hanamkonda, Telangana

Received: 03-09-2025 / Revised: 02-10-2025 / Accepted: 03-11-2025

Corresponding Author: Dr. Uday Kiran Tumma

Conflict of interest: Nil

Abstract:

Background: Childhood obesity is increasing globally and is frequently accompanied by dermatological manifestations that reflect underlying metabolic disturbances. Skin changes may serve as early clinical indicators of insulin resistance and cardiometabolic risk.

Aim: To assess the prevalence of dermatological manifestations in overweight and obese children and to evaluate their association with metabolic abnormalities.

Methods: This prospective study was conducted at MGM Hospital, Warangal, from November 2024 to May 2025, and included 115 children aged 5–17 years. Anthropometric measurements, dermatological examination, and metabolic profiling (fasting glucose, insulin, lipid parameters, HOMA-IR) were performed. Dermatological findings were compared between overweight and obese groups, and correlations with insulin resistance were analyzed using appropriate statistical tests.

Results: Obesity was more prevalent (58.3%) than overweight (41.7%). Acanthosis nigricans was the most common manifestation (58.2%), significantly higher among obese participants. Striae distensae, acne, intertrigo, and keratosis pilaris were also frequent. Obese children showed significantly elevated fasting insulin, HOMA-IR, and triglyceride levels, with lower HDL values. Acanthosis nigricans demonstrated the strongest correlation with insulin resistance ($p < 0.001$).

Conclusion: Dermatological markers, particularly acanthosis nigricans, serve as important early indicators of metabolic risk in obese children and support the need for integrated pediatric–dermatology screening.

Keywords: Childhood Obesity; Acanthosis Nigricans; Dermatological Manifestations; Insulin Resistance; Metabolic Risk.

Introduction

Childhood obesity has emerged as a major global health concern, with rising prevalence in both high- and middle-income countries and a growing burden of metabolic and psychosocial complications [1]. Dermatological manifestations such as striae distensae, keratosis pilaris, acanthosis nigricans, acne, intertrigo and plantar hyperkeratosis are increasingly recognised as visible markers of underlying adiposity and insulin resistance in children [2]. These skin changes may precede overt metabolic disease and can significantly affect self-esteem and health-related quality of life, yet are often under-documented in routine pediatric practice [1, 2]. Recent epidemiological data also suggest complex relationships between body mass index (BMI), atopic dermatitis and other immune-mediated skin diseases in adolescents, highlighting the need for an integrated dermatology–pediatrics approach [3,4].

However, there is still limited systematic data on the full spectrum and burden of cutaneous manifestations among children with overweight and obesity, particularly in relation to anthropometric indices and metabolic risk markers. Acanthosis nigricans, for example, is strongly associated with insulin resistance and type 2 diabetes risk, but its predictive value in diverse pediatric populations is not fully defined [5]. The aim of the present study is to characterise the prevalence and pattern of dermatological manifestations in children with overweight and obesity and to correlate these cutaneous findings with BMI, markers of insulin resistance and other metabolic parameters.

Methods

This prospective, observational research study was conducted in the department of Pediatrics and Dermatology, MGM Hospital, Warangal, from November 2024 to May 2025. Children aged 5–17 years who attended the outpatient and inpatient services during the study period were screened for eligibility. Participants were enrolled after obtaining written informed consent from parents or guardians and assent from children older than seven years. The study population included children diagnosed with overweight or obesity based on the Indian Academy of Pediatrics (IAP) BMI-for-age percentile charts [6]. Children with known endocrine disorders (such as hypothyroidism or Cushing syndrome), chronic systemic illnesses, genetic syndromes associated with obesity (e.g., Prader–Willi syndrome), long-term steroid therapy, and dermatological conditions unrelated to obesity such as congenital ichthyosis or hereditary keratinization disorders were excluded. A structured proforma was used to record demographic data, dietary habits, physical activity levels, family history of obesity or diabetes, and relevant medical history.

Anthropometric measurements were obtained using standardized procedures. Weight was measured using a calibrated digital scale with the child barefoot and wearing light clothing, while height was measured using a stadiometer with the child standing erect. BMI was calculated as weight in kilograms divided by the square of height in meters, and BMI percentiles and z-scores were determined according to IAP reference charts. Waist circumference, hip circumference, and waist–hip ratio were also recorded to assess central adiposity. Blood pressure was measured using an age-appropriate cuff after the child was seated for at least five minutes. Dermatological examination was performed by a qualified dermatologist who was blinded to the metabolic results. The skin evaluation included assessment for acanthosis nigricans, striae distensae, acne, skin tags, intertrigo, keratosis pilaris, plantar hyperkeratosis, hyperhidrosis, and other obesity-related dermatoses. The severity of acanthosis nigricans was graded using the Burke scale, while acne severity was assessed using standard dermatology grading criteria. All findings were documented photographically after obtaining consent.

For metabolic assessment, fasting blood samples were collected to measure plasma glucose, insulin, lipid profile (total cholesterol, triglycerides, HDL, LDL), and liver enzymes. Insulin resistance was evaluated using the Homeostatic Model Assessment of Insulin Resistance (HOMA-IR). Children with abnormal biochemical findings were referred to the pediatric endocrinology clinic for further evaluation. Data were entered into a predesigned Excel sheet and cross-checked for accuracy. Statistical analysis was carried out using SPSS software version 21.0. Continuous variables were presented as mean ± standard deviation, and categorical variables were expressed as percentages. Independent t-test or Mann–Whitney U test was used to compare continuous variables between overweight and obese groups, while Chi-square test or Fisher's exact test was applied to compare categorical variables. Correlation between dermatological findings and metabolic parameters was assessed using Pearson or Spearman correlation coefficients as appropriate. A p-value <0.05 was considered statistically significant.

Results

A total of 115 children were included in the present study, with a slightly higher proportion of males (53.9%) than females, as shown in Table 1. The mean age of the participants was 11.2 years, and obesity (58.3%) was more prevalent than overweight (41.7%). Children classified as obese demonstrated markedly higher BMI, waist circumference, and blood pressure values compared to their overweight counterparts, confirming greater adiposity and cardiometabolic risk in this group (Table 1). Dermatological manifestations were frequent and varied, with acanthosis nigricans emerging as the most common finding, present in 58.2% of the cohort (Table 2). Its prevalence was considerably higher in obese children (73.1%) than in those who were overweight (37.5%), highlighting its strong association with increased adiposity. Other notable skin changes included striae distensae (35.6%), acne vulgaris (34.7%), intertrigo (23.4%), and keratosis pilaris (22.6%), all of which were more common among obese children (Table 2). Metabolic assessment revealed significantly elevated fasting insulin levels, HOMA-IR values, and triglycerides among obese participants, while HDL cholesterol levels were comparatively lower, indicating greater metabolic derangement (Table 3). When dermatological markers were correlated with insulin resistance, acanthosis nigricans demonstrated the strongest association ($p < 0.001$), followed by striae distensae and intertrigo (Table 4). Acne showed a non-significant trend. Overall, the findings emphasized that dermatological signs—especially acanthosis nigricans closely reflected underlying metabolic abnormalities and could serve as practical, early, non-invasive indicators of insulin resistance in obese children.

Table 1: Baseline characteristics of the study participants	
Variable	**Mean ± SD / n (%)**
Age (years)	11.2 ± 3.1
Male : Female	62 (53.9%): 53 (46.1%)
Overweight	48 (41.7%)
Obesity	67 (58.3%)
Mean BMI (kg/m²)	25.8 ± 3.9
Waist circumference (cm)	82.5 ± 9.8

Table 2: Prevalence of dermatological manifestations among the obese and overweight children			
Dermatological finding	**Overweight**	**Obesity**	**Total**
Acanthosis nigricans	18 (37.5)	49 (73.1)	67 (58.2)
Striae distensae	10 (20.8)	31 (46.3)	41 (35.6)
Acne vulgaris	14 (29.2)	26 (38.8)	40 (34.7)
Intertrigo	6 (12.5)	21 (31.3)	27 (23.4)
Keratosis pilaris	9 (18.7)	17 (25.4)	26 (22.6)

Table 3: Metabolic parameters among the study children (Mean ± SD)		
Parameter	**Overweight**	**Obesity**
Fasting glucose (mg/dL)	89.6 ± 11.2	97.8 ± 14.1
Fasting insulin (µIU/mL)	14.3 ± 4.7	22.9 ± 7.6
HOMA-IR	3.1 ± 0.9	5.5 ± 1.8
Triglycerides (mg/dL)	122.4 ± 31.5	158.9 ± 44.2
HDL (mg/dL)	46.2 ± 7.3	41.5 ± 6.8

Table 4: Association between dermatological findings and insulin resistance (HOMA-IR > 3.5)			
Skin manifestation	**Present (n=74)**	**Absent (n=41)**	**p-value**
Acanthosis nigricans	58 (78.4)	9 (21.9)	<0.001
Striae distensae	33 (44.6)	8 (19.5)	0.004
Intertrigo	22 (29.7)	5 (12.1)	0.018
Acne	30 (40.5)	10 (24.3)	0.072

Discussion

Childhood obesity is now recognized as one of the most significant pediatric public health challenges, with rising prevalence in both developing and developed countries. The findings of the present study, involving 115 children, reinforce this growing concern by demonstrating that obesity was more prevalent than overweight, particularly among preadolescent and adolescent age groups. Similar demographic patterns have been reported in recent Indian and international studies, where mid-childhood to adolescence has been identified as the period of greatest vulnerability for weight gain and metabolic dysregulation [7]. The higher BMI, waist circumference, and blood pressure values observed among obese children in this study further emphasize the transition from simple obesity to cardiometabolic risk. Waist circumference, in particular, has been shown to correlate strongly with visceral adiposity and is considered a better predictor of metabolic syndrome than BMI alone [8]. The clustering of obesity-related systemic risk factors in our cohort highlights the need for early screening and integrated pediatric care.

Dermatological manifestations in childhood obesity emerged as a clinically significant component of the findings, with acanthosis nigricans being the most prevalent skin change. Its occurrence in 58.2% of the total population and 73.1% among obese children reflects strong pathophysiological ties to hyperinsulinemia. Acanthosis nigricans is widely regarded as an early external marker of insulin resistance and often precedes overt metabolic dysfunction [9]. Striae distensae, acne vulgaris, and keratosis pilaris were also common and were more frequently observed among obese children, in accordance with earlier studies demonstrating high rates of dermatological abnormalities associated with increased adiposity [10]. Intertrigo, noted in nearly a quarter of the participants, underscores the mechanical and microbial consequences of excess skin folds in obese children. The pattern of dermatological findings in our study aligns with existing literature, which emphasizes that skin changes in childhood obesity are not merely cosmetic issues but reflect deeper metabolic and endocrine disturbances [11]. These manifestations,

therefore, offer an important clinical window for early detection of systemic risk.

The metabolic profiling in this study revealed significantly elevated fasting insulin, HOMA-IR, and triglyceride levels among obese children, along with lower HDL cholesterol levels. These trends are consistent with the pathophysiology of insulin resistance, wherein chronic hyperinsulinemia promotes lipid dysregulation, adipocyte hypertrophy, and systemic inflammation. Several pediatric studies have shown that insulin resistance begins early in obese children and progresses silently, contributing to long-term metabolic complications such as type 2 diabetes and non-alcoholic fatty liver disease [12]. The strong association between dermatological manifestations and insulin resistance, particularly for acanthosis nigricans and striae distensae, further validates their role as early external indicators. Our findings demonstrated statistically significant correlations between HOMA-IR and acanthosis nigricans ($p < 0.001$), supporting previous research that recommends routine evaluation of insulin resistance in children presenting with this skin condition [13]. Acne and keratosis pilaris showed weaker correlations, suggesting that these conditions may be influenced by obesity but are not reliable predictors of metabolic dysfunction. The consistent association of skin markers with biochemical parameters highlights the importance of incorporating dermatological assessment into routine pediatric obesity clinics.

The overall implications of this study stress the need for early identification and multidisciplinary management of childhood obesity. Pediatricians and dermatologists must collaborate to identify cutaneous warning signs that serve as non-invasive, cost-effective indicators of underlying metabolic risk. As demonstrated in the results, children with visible skin markers such as acanthosis nigricans or extensive striae distensae warrant metabolic screening even in the absence of overt symptoms. Lifestyle interventions, including dietary modifications, increased physical activity, and behavioral counseling, remain the cornerstone of management, but early detection of risk is essential to prevent long-term complications. Moreover, public health measures targeting schools and communities are necessary to address the rising prevalence of pediatric obesity. The findings of this study contribute to the growing body of evidence that dermatological markers offer a valuable adjunct in the early diagnosis of metabolic syndrome in children. Future studies with larger sample sizes and longitudinal follow-up would help clarify the predictive value of individual skin conditions and guide targeted prevention strategies [14].

Conclusion

The present study demonstrated a high prevalence of dermatological manifestations among overweight and obese children, with acanthosis nigricans emerging as the most prominent marker closely linked to insulin resistance. Obese children showed significantly greater metabolic derangement, reflected by elevated fasting insulin, HOMA-IR, and triglyceride levels. The strong association between cutaneous findings and biochemical abnormalities highlights the value of dermatological assessment as an early, non-invasive tool for identifying children at metabolic risk. Integrating routine skin evaluation into pediatric obesity screening programs may facilitate earlier diagnosis, timely intervention, and prevention of long-term cardiometabolic complications.

References

1. Güven M, Anık A, Ünüvar T, İlgün Gürel D, Şendur N. Cutaneous manifestations of obesity in Turkish children: A comparative study. Pediatr Dermatol. 2022; 39(4): 513 – 9.
2. Epstein S, Shah SD. Evaluating the cutaneous manifestations and associated comorbidities of childhood obesity. Pediatr Dermatol. 2025; 42(4): 800 – 2.
3. Lim JH, Jang YS, Kim DB, Jang SY, Park EC. Association between body mass index and atopic dermatitis among adolescents: Findings from a national cross-sectional study in Korea. PLoS One. 2024; 19(7): e0307140.
4. Kim SR, Koh SJ, Park H. Childhood Obesity, Weight Change, and Pediatric Immune-Mediated Skin Diseases. J Invest Dermatol. 2024: S0022-202X(24)00257-4.
5. Pollock S, Swamy MR, Tremblay ES, Shen L. Acanthosis nigricans in the pediatric population: a narrative review of the current approach to management in primary care. Pediatr Med. 2022; 5: 42.
6. Indian Academy of Pediatrics Growth Charts Committee, Khadilkar V, Yadav S, Agrawal KK, et al. Revised IAP growth charts for height, weight and body mass index for 5- to 18-year-old Indian children. Indian Pediatr. 2015; 52(1): 47 – 55.
7. Jacob JJ. Tackling the Rising Tide: Understanding the Prevalence of Childhood Obesity in India. Indian J Endocrinol Metab. 2024; 28(2): 101 – 3.
8. Avalos C, Díaz C, Martínez A, et al Waist circumference percentiles in children and adolescents between 6 and 14 years from Santiago, Chile. Endocrinol Nutr. 2012; 59(5): 296 - 303.
9. Videira-Silva A, Albuquerque C, Fonseca H. Acanthosis nigricans as a clinical marker of insulin resistance among overweight

adolescents. Ann Pediatr Endocrinol Metab. 2019; 24(2): 99 – 103.
10. Hasse L, Jamiolkowski D, Reschke F, et al. Pediatric obesity and skin disease: cutaneous findings and associated quality-of-life impairments in 103 children and adolescents with obesity. Endocr Connect. 2023; 12(9): e230235.
11. Umano GR, Bellone S, Buganza R, et al. Early Roots of Childhood Obesity: Risk Factors, Mechanisms, and Prevention Strategies. International Journal of Molecular Sciences. 2025; 26(15):7388.
12. Salama M, Balagopal B, Fennoy I, Kumar S. Childhood Obesity, Diabetes. and Cardiovascular Disease Risk. J Clin Endocrinol Metab. 2023; 108(12): 3051 – 66.
13. Daisy Ahluwalia, Niti Khunger, Abhishek Lachyan, et al. The correlation between severity of Acanthosis Nigricans and metabolic syndrome. Journal of Complementary and Alternative Medical Research. 2024; 25 (6): 52 – 8.
14. Higgins V, Adeli K. Pediatric Metabolic Syndrome: Pathophysiology and Laboratory Assessment. EJIFCC. 2017; 28(1): 25 – 42.