

Dermatological Manifestations of Overweight and Obesity among Adult Nepalese Population in a Tertiary Care Centre: A Case-Control Study

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Abstract

Introduction: Overweight and obesity are significant global public health concerns, with prevalence rising alarmingly in recent decades. However, few studies have investigated the association between overweight/obesity and skin conditions.

Objectives: This study aimed to assess the frequency of dermatological manifestations among overweight and obese adults attending a dermatology department and compare these findings with normal-weight, age- and sex-matched controls.

Materials and Methods: The study included 184 cases (BMI ≥ 25 kg/m²) and 184 controls (BMI 18.5–24.99 kg/m²) attending the dermatology outpatient department. Data were collected using a pre-designed pro forma, including clinical details and laboratory parameters. Skin conditions were categorized into overweight, Grade I, II, and III obesity. Univariate and multivariate logistic regressions were conducted to determine associations between BMI categories and skin diseases.

Results: Among the cases, 60.3% were overweight, 21% were Grade I obese, and 8.7% were Grade II obese. Compared to controls, overweight and obese participants had a higher prevalence of skin conditions, including dermatophyte infections (29.3%), acanthosis nigricans (21.2%), and acrochordons (16.3%).

Conclusion: Overweight and obesity are linked to various skin conditions, with most patients presenting at least one dermatological manifestation. These findings highlight the need for specialized dermatological care in this population.

Keywords: Acanthosis nigricans; Acrochordon; Body Mass Index; Dermatophytes; Obesity

Introduction

Overweight and obesity are characterized by excessive fat accumulation due to genetic, behavioural, environmental, physiological, social, and cultural factors.^{1,2} They pose a significant public health concern, with prevalence rising globally and reaching epidemic levels.³ In 2022, the World Health Organisation (WHO) reported that 43% of adults were overweight and 16% obese.⁴ A 2016 survey in Nepal found underweight at 17.27% and overweight/obesity at 31.16%.⁵

Obesity impacts the skin through changes in barrier function, sebaceous glands, sweat glands,

collagen, circulation, and subcutaneous fat.⁶ Despite their significance, these skin conditions are often underreported. While studies from countries like Brazil, India, Pakistan, and Saudi Arabia^{7–11} have addressed these effects, none have been conducted in Nepal. Although often excluded, overweight individuals (Body Mass Index (BMI) 25–29.9 kg/m²), show notable links

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to skin issues in available studies.¹²⁻¹⁴

This study aimed to assess the frequency of dermatological manifestations among overweight and obese adults attending the dermatology department at a tertiary care hospital, comparing them with age- and sex-matched individuals with normal BMI. A secondary goal was to evaluate the relationship between these skin conditions and overweight/obesity while identifying associated risk factors in Nepal. By addressing gaps in prior research, this study seeks to assist clinicians in the early diagnosis and management of comorbidities. Including the "Overweight" category enhances opportunities for timely interventions, potentially preventing complications and halting disease progression.

Materials and Methods

Study population

This hospital-based, case-control study was approved by the Institutional Ethics Committee (IRC/1888/020) and conducted per the Declaration of Helsinki. Participants under 18, unwilling to participate, pregnant or lactating mothers, severely ill, and immunocompromised individuals were excluded. Over 12 months (September 2020–August 2021), 184 participants with a BMI ≥ 25 kg/m² and 184 age- and sex-matched controls with a BMI of 18.5–24.99 kg/m² were evaluated at the Dermatology Out Patient Department of B.P. Koirala Institute of Health Sciences.

Methodology

Stage 1: A total of 896 OPD attendees provided demographic details and underwent anthropometric measurements. Cases included attendees with a BMI ≥ 25 kg/m², while controls had BMI between 18.5–24.9 kg/m².

Stage 2: Eligible participants meeting the criteria were enrolled after informed consent. Clinical details, patient history, dermatological exams, blood pressure, waist measurements, and photographs were recorded. Laboratory tests, including fasting blood sugar and lipid profiles, were conducted.

Stage 3: Skin manifestations were categorized into overweight and grade I, II, and III obesity groups.

Sample size estimation

Based on the study conducted by Rawal et al., in 20185 in a Nationwide survey among the Nepalese adult population, the prevalence of overweight and obese was 31.6% (95% CI:30.38-38.94) with a relative precision of 10% and a confidence interval of 95%, a total 896 attendees of the OPD were needed to screen for 30% overweight and obese dermatological patients for the study. Then 184 cases (BMI of ≥ 25 kg/m²) and 184 controls (18.5- 24.99 kg/m²) were calculated based on the case-control study done by Boza et al.,⁷ the expected proportion of the striae (the most common cutaneous manifestations) in obese

and the non-obese control group was 44% and 30% respectively. The difference in proportion was 14%, the anticipated odds ratio was 1.84, a level of significance of 0.05, the power was 80%, 2-sided, and an allocation ratio of 1:1.

Statistical Analysis

Baseline characteristics of study participants were recorded and analysed using Microsoft Excel 2010 and SPSS version 10.5. Epidemiological data were presented graphically and in tables. The Chi-square test with Yate's correction, t-test, or Mann-Whitney test compared age and sex-matched cases and controls. Univariate and multivariate logistic regressions assessed the association between overweight/obesity and skin diseases. Odds ratios (OR) and standard errors were calculated, with OR significance determined by the Wald Chi-squared test. Predictors with $P < 0.20$ were included in multivariate analysis, with $P < 0.05$ considered significant.

Results

Out of 896 screened patients, 611 (68.2%) had a normal BMI, while 31.8% were classified as overweight or obese. 174 (19.4%) were overweight, 85 (9.5%) were



Figure 1: Extensive Tinea corporis in an overweight patient



Figure 2: Acanthosis Nigricans seen in an Overweight patient

Cutaneous Manifestation (n)	Overweight n(%)	Grade I Obese n(%)	Grade II Obese n(%)
Dermatitis and Dermatoses			
Acanthosis nigricans (39)	20(18)	13(22.8)	6(37.5)
Acrochordon (30)	13(11.7)	11(19.3)	6(37.5)
Atopic Dermatitis (04)	0(0)	2(3.5)	2(12.5)
Psoriasis (21)	13(11.7)	8(14)	0(0)
Seborrheic dermatitis (02)	0(0)	2(3.5)	0(0)
Striae Distensae (04)	2(1.8)	2(3.5)	0(0)
Urticaria (01)	0(0)	1(1.8)	0(0)
Sweat and Sebaceous gland disorder			
Acne (19)	17(15.3)	0(0)	2(12.5)
Pigmentary Disorder			
Melasma (16)	11(9.9)	5(8.8)	0(0)
Vitiligo (01)	0(0)	1(1.8)	0(0)
Infections-			
Bacterial infection			
Superficial folliculitis (04)	4(3.4)	0(0)	0(0)
Fungal infection			
Candidiasis (13)	7(6.3)	6(10.5)	0(0)
Dermatophytosis (54)	29(26.1)	18(31.6)	7(43.8)
Pityriasis versicolor (01)	1(0.9)	0(0)	0(0)
Parasitic Infestation			
Scabies (04)	0(0)	4(7)	0(0)
Viral infection	2(1.8)	0(0)	0(0)
Herpes Zoster (02)			
Vesicobullous disorder			
Pemphigus Vulgaris (02)	2(1.8)	0(0)	0(0)
Other Cutaneous Manifestations			
Generalized Pruritus (02)	2(1.8)	0(0)	0(0)
Tophi (04)	4(3.6)	0(0)	0(0)
Xanthoma (04)	2(1.8)	2(3.5)	0(0)
Palms and Soles			
Hand and feet eczema (09)	8(7.2)	1(1.8)	0(0)
Palmoplantar psoriasis (04)	2(1.8)	2(3.5)	0(0)

Table 1: Classifying individual skin manifestations in Overweight, Grade I, Grade II and Grade III Obese

	Case n(%)	Control n(%)	Total n(%)	OR	CI	P-value
Dermatitis and Dermatoses						
Acanthosis nigricans	39(21.2)	6(3.3)	45(12.2)	7.98	3.29-19.37	0.000
Acrochordon	30(16.3)	14(7.6)	44(12)	2.37	1.2- 4.6	0.012
Seborrheic dermatitis	2(1.1)	6(3.3)	8(2.2)	0.33	0.06-1.64	0.173
Striae Distensae	4(2.2)	2(1.1)	6(1.6)	2.02	0.36-11.18	0.42
Sweat and Sebaceous gland disorder						
Acne	19(10.3)	16(8.7)	35(9.5)	1.21	0.6-2.43	0.594
Pigmentary Disorder						
Melasma	16(8.7%)	22(12)	38(10.3)	0.7	0.36-1.38	0.306
Infections-						
Fungal infection						
Dermatophytosis	54(29.3)	4(2.2)	58(15.8)	18.70	6.6-52.9	0.000
Pityriasis versicolor	1(0.5)	4(2.2)	5(1.4)	0.25	0.03-2.22	0.212
Parasitic Infestation						
Scabies	4 (2.2)	4(2.2)	8(2.17)	1.00	0.25-4.06	1.000

Table 2: Univariate analysis of case and control for the skin manifestations

Category	Unadjusted Odds Ratio (95% CI)	P value	Adjusted Odds Ratio (95% CI)	P value
Religion				
Others	(ref)	(ref)	(ref)	
Hindu	0.33(0.13-0.86)	0.023	0.37(0.08-1.67)	0.196
Marital status				
Married	(ref)	(ref)	(ref)	
Unmarried	2.88(1.84-4.5)	0.000	1.7(0.77-3.75)	0.19
History of alcohol intake				
No	(ref)	(ref)	(ref)	
Yes	5.16(2.33-11.48)	0.000	2.73(0.86-8.68)	0.088
Fasting blood sugar				
Normal (<126mg/dl)	(ref)	(ref)	(ref)	
Prediabetic/ Diabetic (≥126mg/dl)	13.09(6.49-26.39)	0.000	5.92(2.26-15.49)	0.00
Total cholesterol				
Normal (<200mg/dl)	(ref)	(ref)	(ref)	
High (≥200mg/ml)	8.63(4.25-17.5)	0.000	3.24(1.17-8.93)	0.024
TAG				
Normal (<165mg/dl)	(ref)	(ref)	(ref)	
High (≥165mg/ml)	28.2(14.57-54.6)	0.000	20.60(8.84-47.98)	0.00
HDL				
Normal (≥35mg/ml)	(ref)	(ref)	(ref)	
High(<35mg/dl)	5.80(1.95-17.24)	0.002	0.44(0.089-2.19)	0.318
Dermatitis and Dermatoses				
Acanthosis nigricans	7.97(3.29-19.37)	0.00	9.8(3.01-31.91)	0.00
Acrochordon	2.37(1.2- 4.6)	0.012	4.4(1.65-11.77)	0.003
Infections-				
Fungal infection				
Dermatophytosis	18.69(6.6-52.9)	0.000	30.53(8.5-109.38)	0.00

Table 3: Multivariate analysis of case and control

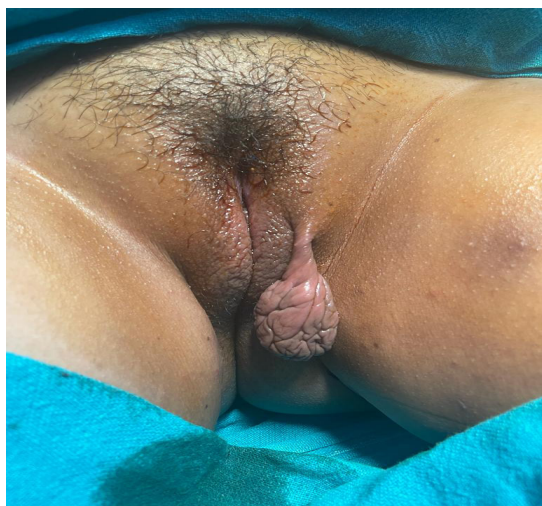


Figure 3: Giant Acrochordon seen in Grade II Obese

Grade I obese, and 26 (2.9%) were Grade II obese. After exclusions, the study included 368 participants: 184 cases (overweight/obese) and 184 controls (normal BMI). Most cases (60.3%) had a BMI of 25–29.9 kg/m² (overweight), followed by 21% in Grade I obesity, 8.7% in Grade II obesity, and none in Grade III. The 184 cases comprised 115 females (62.5%) and 69 males (37.5%), with a male-to-female ratio of 0.6:1. Most patients were aged 40–65 years (44.6%) or 25–39 years (39.7%), followed by 18–24 years (15.76%). Of the cases, 79 (42.9%) had abnormal blood sugar levels, with 27 (13.6%) in the pre-diabetic range and 54 (29.3%) in the diabetic range. Additionally, 123 patients had abnormal lipid profiles, including elevated cholesterol, LDL, or triglycerides. Most common cutaneous manifestations seen were dermatophyte infections (Figure 1), acanthosis

	Overweight n(%)	Obese n(%)	OR	CI	P-value
Dermatitis and Dermatoses					
Acanthosis nigricans	20(18)	19(26)	1.6	0.79-3.26	0.195
Acrochordon	13(11.7)	17(23.3)	2.29	1.036-5.06	0.041
Striae Distensae	2(1.8)	2(2.7)	1.54	0.21-11.14	0.672
Sweat and Sebaceous gland disorder					
Acne	17(15.3)	2(2.7)	0.16	0.035-0.70	0.015
Pigmentary Disorder					
Melasma	11(9.9)	5(6.8)	0.67	0.22-2.01	0.473
Infections- Fungal infection					
Dermatophytosis	29(26.1)	25(34.2)	1.47	0.77-2.8	0.238

Table 4: Univariate analysis of Overweight and Obese for the skin manifestation

Category	Unadjusted Odds Ratio (95% CI)	P value	Adjusted Odds Ratio (95% CI)	P value
Dermatitis and Dermatoses				
Acrochordon	2.29 (1.036-5.06)	0.041	3.73(1.37-0.11)	0.01
Sweat and Sebaceous gland disorder				
Acne	0.16 (0.035-0.70)	0.015	0.07(0.015-0.354)	0.001

Table 5: Multivariate analysis of overweight and obese

nigricans (Figure 2), acrochordon (Figure 3), psoriasis, and acne. As obesity severity increased, the prevalence of both acrochordon and acanthosis nigricans rose, with lesions appearing more frequently and affecting larger areas. (Table 1).

On univariate analysis of cases and controls, acanthosis nigricans (p-value=0.00), acrochordons (p-value=0.012), dermatophytosis (p-value=0.00) were statistically significant with a p-value of <0.05 (Table 2), which was found to be statistically significant (p-value <0.05) even on multivariate analysis (Table 3). Cases were sub-classified into overweight and obesity classes I, II, and III. Acanthosis nigricans, acrochordon, and dermatophyte infections were the most common skin manifestations, with frequency increasing alongside obesity severity (Table 2). Univariate and multivariate analyses confirmed acrochordon (p=0.041) and acne (p=0.015) as statistically significant (Table 4, 5).

Discussion

The link between obesity and health issues has been recognized since Hippocrates over 2,500 years ago.¹⁵ This study examined skin manifestations in obese and normal adults at a tertiary hospital in Nepal. Participants aged 18–65 were primarily between 40 and 65 years old, aligning with Boza et al.,⁷ reported peak obesity prevalence at ages 40–49. The mean age differences between cases (39 ± 12.34) and controls (37 ± 12.4) were not significant (p= 0.3548). The male-to-female ratio (0.6:1) matched findings by Chekuri R et al.,⁸ and was not statistically significant (p=0.588).

Higher female prevalence may be linked to appearance concerns¹⁶ and sedentary lifestyles.¹⁷ Most participants were from urban areas, consistent with Chekuri R et al.,⁸ but not statistically significant (p=0.593).

The study found a strong association between obesity and dermatological diseases. The mean BMI was 29.49 ± 3.22 kg/m² in cases and 23.34 ± 0.75 kg/m² in controls. Among the study group, 111 participants (60.3%) were overweight, 57 (30.9%) had Grade I obesity, 16 (8.7%) had Grade II obesity, and none had Grade III obesity. The difference in the history of diabetes mellitus between the groups was substantial (p < 0.05), with 54 cases (29.3%) in the study group. Lipid profile differences were also significant (p < 0.05), with abnormal total cholesterol levels in 61 cases (33.2%) compared to 10 controls (5.4%). Triglyceride levels showed significant differences between groups (p < 0.05). As reported by Boza et al.,⁷ the prevalence of dermatoses increased with BMI; however, unlike Boza et al.,⁷ this study included participants with a BMI of 18.5–24.9 kg/m².

In this study, the most common cutaneous manifestation seen in the overweight and obese was the presence of dermatophytes, which was seen in 54 (29.3%) of the cases compared with the 4 (2.2%) controls, which was significant (p < 0.05). Similarly, Al-Mutairi N et al., reported a 9.6% prevalence of dermatophyte infections in obese individuals, most commonly in Grade II obesity, consistent with these findings.¹³ Acanthosis nigricans was observed in 39 cases (21.2%) and 6 controls (3.3%), showing a significant difference (p < 0.05). Among cases, it affected 20 (18%) of the

overweight and 19 (26%) of the obese, though this difference was not statistically significant ($p = 0.195$). In this study, acrochordons were observed in 30 cases (16.3%) and 14 controls (7.6%), a statistically significant difference ($p < 0.05$). Within the study group, 13 (11.7%) were in the overweight category and 17 (23.3%) in the obese category, also statistically significant ($p < 0.05$). These findings align with studies by Ahsan et al.,³ Boza et al.,⁷ Chekuri et al.,⁸ Nino et al.,⁹ Guida et al.,¹⁰ Arti S et al.,¹² and Asim et al.,¹⁸ which similarly reported a higher prevalence of acrochordons in obese individuals, with variations attributed to differences in age and obesity severity. Studies suggest that acrochordons are associated with diabetes, a risk factor for obesity, rather than directly with obesity itself.¹⁹ However, Jowkar et al.,²⁰ found a link between acrochordons and hyperinsulinemia in non-diabetics. Our results support this, showing an increase in acrochordon frequency with BMI, consistent with studies by Chekuri et al.,⁸ and Guida et al.¹⁰

Acne was observed in 19 cases (10.3%) and 16 controls (8.7%), with no statistical significance ($p = 0.594$). However, the difference between overweight (15.3%) and obese individuals (2.7%) was significant ($p < 0.05$). This aligns with Al-Mutairi et al., who reported a 21.5% prevalence in grade II obesity linked to androgen overproduction.¹³ Melasma was present

in 16 cases (8.7%) but was not statistically significant ($p = 0.306$), reflecting Chekuri R et al.,⁸ 's findings of hyperpigmentation linked to obesity severity.⁸ Telogen effluvium in controls was attributed to COVID-19-related cytokine storms.²¹ Striae distensae and hidradenitis suppurativa were rare, contrasting with Arti S et al.,¹² findings of higher prevalence in obese populations.¹² These results highlight obesity's systemic effects on skin health, with variations across studies and populations.

Conclusion

Obesity is often linked with various skin conditions that can serve as an indicator for excessive weight, which are usually preventable and treatable if proper care is taken. Although the cutaneous manifestations are also seen in non-obese subjects, their incidence and severity are significantly higher in obese individuals. Obese individuals are more likely to experience skin issues like dermatophytes, acanthosis nigricans, and acrochordon, which are often linked to metabolic syndrome and endocrine disorders. The humid climate further increases the risk of infections in these patients. However, the study's single-centre design limits the ability to generalize the findings to the broader population.

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