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Original Research Article

Hirsutism and Association with Body Mass Index in Women and Adolescents of Rivers State University: A Clino-Anthropological Marker for Medical Conditions

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Abstract: ***Objective*:** Hirsutism is characterized by excessive terminal hair growth in a male-like pattern in women and globally affects approximately 5-10% of women within their reproductive age. This research seeks to investigate the association between hirsutism and body mass index (BMI) among women and adolescents in Rivers State University. ***Methodology*:** This research was carried out at Rivers State University (RSU), Port Harcourt, Nigeria. The study population consisted of female students and staff aged 15–40 years. Hirsutism was assessed using the Modified Ferriman–Gallwey (mFG) scoring system. Each of the nine body regions (upper lip, chin, chest, upper abdomen, lower abdomen, upper back, lower back, upper arm, thigh) were examined and assigned a score from 0 to 4. A total mFG score ≥ 8 was used to define clinical hirsutism, with consideration of ethnic-specific cutoffs (e.g., ≥ 9 for African populations). A digital weighing scale, a stadiometer, a meter rule and a digital vernier caliper were used to measure the weight, height, thumb and foot lengths. ***Results*:** The correlation analysis revealed a very weak negative association between BMI and hirsutism severity ($r = –0.013$, $p = 0.791$). This relationship was not statistically significant, indicating that BMI did not have a meaningful linear association with Ferriman–Gallwey Scores in the study population. ***Conclusion*:** In this University-based sample, hirsutism, though common, was not significantly associated with BMI.

Keywords: Adult Females, Adolescent females, BMI, Hirsutism, Rivers State University.

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1.0 INTRODUCTION

Hirsutism is a male-like pattern of hair growth in women, especially those within the reproductive age. It affects approximately 5-10% of females globally and serves as a key clino-anthropological marker for hyperandrogenism-related conditions such as polycystic ovarian syndrome (PCOS), congenital adrenal hyperplasia, and insulin resistance syndromes [1]. This condition imposes significant psychosocial distress and is often linked to underlying metabolic disturbances, including altered androgen metabolism driven by adipose tissue, which converts androgens to estrogens and reduces sex hormone-binding globulin (SHBG) levels, thereby increasing free androgen indices [2].

The prevalence of hirsutism varies across ethnic groups. For instance, studies among African American women report a 10% prevalence based on modified Ferriman-Gallwey (mFG) scores ≥8, with strong associations to PCOS (prevalence ratio: 2.22), severe facial acne (prevalence ratio: 1.90), and irregular menses (prevalence ratio: 1.78) [3]. In Nigeria, similar trends are observed; among Igala adolescents, severe hirsutism (mFG ≥15) was found in 16.8% of females aged 13-19 years, with affected individuals showing higher mean BMI (23.77 kg/m²) compared to those with normal hair growth (23.26 kg/m²), highlighting the role of adiposity in hyperandrogenism [4].

A substantial body of evidence demonstrates a consistent association between elevated body mass index (BMI) and the severity of hirsutism, suggesting that metabolic and anthropometric factors may influence hair growth patterns independent of serum androgen concentrations [1-4]. Prior findings indicate that women with hirsutism tend to present with significantly higher BMI values, and the degree of hair growth often

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intensifies with increasing BMI, a trend attributed to metabolic alterations that extend beyond androgen excess alone [5]. This relationship is further reflected in recent work by Qurtas and Ezzat (2025) [6]. who reported that BMI values ≥30 kg/m² were strongly associated with increased hirsutism severity due to heightened peripheral conversion of androgen precursors in adipose tissue, reinforcing the notion that obesity amplifies androgenic effects despite stable circulating androgen levels. Supporting this view, Hong *et al*., (2024) [7], found no statistically significant differences in serum androgen profiles between hirsute and non-hirsute participants, emphasizing that BMI and insulin-resistant states may contribute to the manifestation and progression of hirsutism through mechanisms independent of direct androgen elevation. Current clinical guidance similarly underscores the importance of evaluating BMI during the assessment of hirsutism, acknowledging that metabolic status constitutes a critical determinant of symptom severity and should be incorporated into routine diagnostic and management frameworks [8]. Some studies have documented significant correlations between higher BMI categories and increased Ferriman–Gallwey scores, demonstrating that excess weight is positively associated with hirsutism severity regardless of age or baseline androgen concentrations [2-5].

Correspondingly, population analyses revealed that obese individuals frequently account for a disproportionately high percentage of hirsutism cases. For example, among adult females, nearly half (48.46%) of hirsute participants fell within the obese category (BMI >30 kg/m²), with statistically significant differences in BMI distribution between hirsute and non-hirsute groups ($p < .001$), suggesting that obesity constitutes a modifiable risk factor through mechanisms of peripheral androgen amplification [5]. Similar findings have been observed in polycystic ovarian syndrome (PCOS) cohorts, where women with elevated BMI (≥23 kg/m²) exhibited markedly higher modified Ferriman–Gallwey (mFG) scores—up to 2.96-fold greater than normal-weight counterparts—largely due to reduced sex hormone–binding globulin (SHBG) levels and subsequent increases in free androgen availability [2]. Collectively, these studies indicate that while androgen levels remain central to the etiology of hirsutism, BMI plays a significant and often independent role in determining clinical severity, highlighting the need for integrated metabolic and anthropometric assessment in both research and clinical practice [5].

Adolescent females are particularly susceptible to hirsutism due to obesity-driven androgen excess, which often manifests as early hirsutism alongside menstrual irregularities. In obese adolescent girls, hirsutism prevalence reached 36.5%, associated with low SHBG, elevated free androgen index, and earlier onset of thelarche and menarche, often preceding a formal PCOS diagnosis [9]. These patterns position hirsutism as an early anthropometric indicator of metabolic syndrome in the young, with central obesity amplifying risks for long-term comorbidities such as type 2 diabetes and cardiovascular disease [10].

Therefore, based on population diversity and geographical influences, this study seeks to investigate the association between hirsutism and body mass index (BMI) among women and adolescents at Rivers State University.

2.0 METHODOLOGY

2.1 Materials

1. Modified Ferriman–Gallwey (mFG) scoring chart: to assess hirsutism in nine androgen-sensitive body areas (upper lip, chin, chest, upper abdomen, lower abdomen, upper back, lower back, upper arm, thigh) [11].
2. Digital weighing scale: for measuring weight (kg) to the nearest 0.1 kg.
3. Stadiometer: to measure height (m) with an accuracy of 0.01 m.
4. Digital Vernier caliper: for measuring thumb length precisely.
5. Sliding caliper or measuring meter rule: for foot length measurement from heel to the tip of the longest toe.

2.2 Study Area and Population

This research was carried out at Rivers State University (RSU), Port Harcourt, Nigeria. The study population consisted of female students and staff aged 15–40 years. These participants were drawn from RSU's campuses, hostels, lecture halls, and health centers, ensuring representation across different socioeconomic and age groups.

2.3 Study Design

A cross-sectional, quantitative design was employed to assess the association between hirsutism and body mass index (BMI) among participants. This design allowed for simultaneous measurement of hirsutism severity, BMI, and relevant clinical–anthropological variables.

2.4 Sample Size and Sampling Technique

The minimum sample size was calculated using Taro–Yamane's formula (Yamane, 1967), assuming a population (N) of 30,000 and a margin of error (e) of 0.05. The resulting sample size is approximately 400 ($n \approx 400$).

Convenience sampling was used to recruit participants. The minimum sample size will be calculated as:

$n = N \div (1+N(e)^2)$

Where;

n=Sample size, N=Total population size = Margin of error (expressed as 0.005 for 5%)

The estimated number of students (population size) in Rivers State University is 30,000

N =30,000÷ (30,001(0.05) ²)

n = 30,000÷ (30,001(0.0035))

n = 30,000÷75.0025

n = 399.99

n~400 participants

2.5 Inclusion and Exclusion Criteria

2.5.1 Inclusion Criteria:

i. Biologically female participants aged 15–40 years.
ii. Registered students or employed staff of Rivers State University.
iii. Willingness to provide written informed consent (or parental/guardian consent for adolescents).

2.5.2 Exclusion Criteria:

i. Pregnancy.
ii. Use of hormonal contraceptives or anti-androgenic medications within the past three months.
iii. Known endocrine disorders not related to hyperandrogenism (e.g., neoplastic causes).

2.6 Data Collection Procedures

- **Hirsutism Assessment:** Hirsutism was assessed using the mFG scoring system. Trained researchers inspected each of the nine body regions and assigned a score from 0 to 4, following standardized clinical guidelines. A total mFG score ≥ 8 was used to define clinical hirsutism, with consideration of ethnic-specific cutoffs (e.g., ≥ 9 for African populations). [11, 4]
- **Anthropometric Measurements:** Weight and height were measured to calculate BMI (kg/m²).
- **Thumb Length Measurement:** Thumb length was measured from the metacarpophalangeal crease to the tip, taking the average of two measurements.
- **Foot Length Measurement:** Foot length was measured as the distance from the heel (pternion) to the tip of the longest toe (acropodion), also averaged over two readings.

All measurements were taken by a single trained examiner to reduce inter-observer variability.

2.7 Ethical Considerations

Approval for the study was granted by the Ethics and Research Committee of the Faculty of Basic Medical Sciences, Rivers State University with the ethical number RSU/FBMS/REC/24/241. Participants (or guardians, for adolescents) provided written informed consent before participation. Data were anonymized, and confidentiality was maintained. Participation was voluntary, and participants could withdraw at any time without penalty.

2.8 Data Analysis

Data was analyzed using SPSS (Version 26) software. Descriptive statistics (mean, standard deviation, range) were computed for BMI, mFG score, thumb length, and foot length. Inferential statistics included Pearson correlation to assess the association between BMI and mFG score. Statistical significance was set at $p \leq 0.05$.

3.0 RESULTS

3.1 Descriptive Statistics

Table 1 presents the descriptive statistics for age, weight, height, and body mass index (BMI) among the 400 participants.

Table 1: Descriptive Statistics of the Study Population (N = 400)

Variable	*N*	Mean ± SD
Age (years)	400	21.5 ± 5.9
Weight (kg)	400	64.3 ± 13.6
Height (m)	400	2.08 ± 8.0
BMI (kg/m²)	400	24.5 ± 8.7

Note: Values are presented as mean ± standard deviation (SD).

The mean age of participants was 21.5 years (SD = 5.9), reflecting a predominantly young adult population. The mean weight was 64.3 kg (SD = 13.6), and mean height was 2.08 m (SD = 8.0). The mean BMI was 24.5 kg/m² (SD = 8.7), which falls within the normal BMI range; however, the relatively large standard deviation suggests variation ranging from underweight to obese categories.

3.2 Prevalence of Hirsutism

Table 2 summarizes the distribution of Ferriman–Gallwey Scores (FGS) among participants.

Table 2: Prevalence and Severity of Hirsutism Based on Ferriman–Gallwey Score

FGS Category	Criteria	*F*	%
Normal	< 8	198	49.5
Mild	8–16	141	35.3
Moderate	17–25	51	12.7
Severe	> 25	10	2.5
Total	—	**400**	**100**

Note: FGS = Ferriman–Gallwey Score; *f* = frequency.

Nearly half of the participants (49.5%) had normal hair growth (FGS < 8), while 35.3% had mild hirsutism. Moderate and severe hirsutism accounted for 12.7% and 2.5% of participants, respectively. The prevalence of hirsutism in the study population ranged from 2.5% - 35.3%, indicating that slightly more than half of the women exhibited some level of excessive hair growth.

3.3 Body Mass Index Distribution

Table 3 shows the BMI categories of the participants.

Table 3: Body Mass Index Categories of Participants (N = 400)

BMI Category	Criterion (kg/m²)	*F*	%
Underweight	< 18.5	46	11.5
Normal	18.5–24.9	202	50.5
Overweight	25–29.9	98	24.5
Obese	> 30	54	13.5
Class I	30–34.9	40	10.0
Class II	35–39.9	6	1.5
Class III	> 40	8	2.0
Total	—	**400**	**100**

Note: BMI = body mass index; *f* = frequency.

Half of the participants (50.5%) had a normal BMI, while 24.5% were overweight and 13.5% were classified as obese. Underweight individuals constituted 11.5% of the population. Class I obesity was the most common among the obese subgroup.

3.4 Relationship between BMI and Hirsutism Severity

Table 4 shows the cross-tabulation of BMI categories and FGS-classified hirsutism severity.

Table 4: Distribution of Ferriman–Gallwey Scores Across BMI Categories (N = 400)

BMI Category	Normal	Mild	Moderate	Severe	Total (%)
Underweight	23 (5.8%)	16 (4.0%)	5 (1.25%)	2 (0.5%)	46 (11.5%)
Normal	93 (23.3%)	80 (20.0%)	26 (6.5%)	3 (0.75%)	202 (50.5%)
Overweight	51 (12.8%)	33 (8.3%)	11 (2.75%)	3 (0.75%)	98 (24.5%)
Obese—Class I	23 (5.8%)	8 (2.0%)	8 (2.0%)	1 (0.25%)	40 (10.0%)
Obese—Class II	4 (1.0%)	2 (0.5%)	0 (0%)	0 (0%)	6 (1.5%)
Obese—Class III	4 (1.0%)	2 (0.5%)	1 (0.25%)	1 (0.25%)	8 (2.0%)
Total	**198 (49.5%)**	**141 (35.3%)**	**51 (12.8%)**	**10 (2.5%)**	**400 (100%)**

A comparison of BMI with hirsutism severity shows that mild and moderate hirsutism were most common among women with normal and overweight BMI. Severe hirsutism was rare across all BMI categories.

3.5 Correlation between BMI and Hirsutism

Table 5 shows the Pearson correlation between BMI and Ferriman–Gallwey Score.

Table 5: Pearson Correlation between BMI and Ferriman–Gallwey Score

Variables	Correlation (r)	Significance (p)
BMI × FGS	–0.013	0.791

Note: BMI = body mass index; FGS = Ferriman–Gallwey Score.

The correlation analysis revealed a very weak negative association between BMI and hirsutism severity ($r = –0.013$, $p = 0.791$). This indicates that BMI did not have a meaningful linear association with Ferriman–Gallwey Scores and/or hirsutism in the study population.

4.0 DISCUSSION

The prevalence of hirsutism in this study categorized from mild to severe cases ranges from 2.5% - 35.3%, similar to values reported in several community and clinic-based studies, which often report prevalence estimates ranging widely by population and cut-off used (e.g., ~5%–30% in many unselected female populations) [3-12]. Ethnic background, age distribution, and the modified Ferriman Gallwey cut-off selected strongly influence prevalence estimates. Studies that apply ethnicity-specific thresholds or cluster-based normative cut-offs report substantial variation across groups [13].

Concordant with some recent investigations, our analysis did not demonstrate a statistically significant relationship between BMI and hirsutism severity [7-14]. Some community studies likewise report weak or absent correlations between BMI and mFG scores after adjustment for confounders [3-7]. Whereas others, particularly clinic-based samples enriched for polycystic

ovary syndrome (PCOS) or metabolic disease, report stronger associations [4-16]. The heterogeneity across studies likely reflects differences in sample selection (community vs. clinic), age range, ethnic hair-growth patterns, and the prevalence of PCOS or other hyperandrogenic disorders [16]. The findings from the present study could therefore be influenced from a community-based perspective, with no consideration to ethnicity or other known influencers.

4.1. Possible Explanations for the Lack of Association between BMI and Hirsutism

Several mechanistic and methodological explanations may account for the weak correlation observed in this study. First, adiposity influences androgen biology through multiple pathways (insulin resistance, altered sex hormone–binding globulin, peripheral aromatization), but the net effect on visible terminal hair growth depends on both circulating androgens and hair follicle sensitivity to androgens [17]. Thus, BMI alone may not capture the endocrine milieu that drives hirsutism in all women. Second, ethnicity and genetically-determined follicular sensitivity can modulate the phenotypic expression of hyperandrogenism, more so, populations differ in baseline terminal hair density and in the threshold of mFG that best predicts pathological hyperandrogenism [13-18]. Third, the young age distribution (mean ≈ 21.5 years) could mean that many participants were in a stage where menstrual-endocrine disruption and frank PCOS are not yet fully manifest, reducing the apparent link between obesity and hirsute phenotypes [19]. Finally, convenience sampling within a university setting may select for groups with particular health-seeking behaviours, body-image practices (e.g., hair removal), or contraceptive use patterns that obscure associations [19].

4.2 Clinical and Public-Health Implications

Although BMI and hirsutism were not associated in this sample, the proportion of participants with any degree of hirsutism (2.5% - 35.3%) has clinical and psychosocial importance. Hirsutism can signal underlying endocrine disorders (e.g., PCOS, late-onset congenital adrenal hyperplasia) and is associated with metabolic comorbidities in some populations [16]. Therefore, even in the absence of a clear BMI–hirsutism link in the present study, there is need for targeted screening (menstrual history, biochemical androgen profile, and metabolic risk assessment) for women with moderate–severe hirsutism. However, considering the variability of cut-offs across ethnic groups, the use of context-appropriate mFG thresholds or local normative data is of great need before labelling hirsutism as pathological [18].

4.3 Strengths and Limitations

Strengths of this study include a relatively large sample size (n = 400) and standardized clinical assessment using the mFG system performed by trained examiners. However, important limitations must be acknowledged. The cross-sectional design precludes causal inference about BMI and hirsutism. BMI is a crude indicator of adiposity and does not account for fat distribution or visceral adiposity-parameters more tightly linked to insulin resistance and hyperandrogenism; future work should include waist circumference, waist-to-hip ratio, or direct measures of body composition. Biochemical measures of androgens (total/free testosterone, DHEA-S) and metabolic markers (fasting insulin, glucose) were not obtained; which would clarify endocrine mechanisms and help identify PCOS cases. Ethnicity-specific normative mFG thresholds were not available for the study population except those for the general African population; applying universal cut-offs may over- or under-estimate true pathological hirsutism in this population. Finally, convenience sampling at a single university may limit generalizability to the broader female population.

4.4 Summary of Main Findings

This study examined hirsutism and its association with body mass index (BMI) among 400 female students and staff at Rivers State University. The overall prevalence of hirsutism (mFG ≥ 8) ranged from 2.5% - 35.3%, with 35.3% classified as mild, 12.7% as moderate, and 2.5% as severe. The sample had a mean age of 21.5 ± 5.9 years and mean BMI of 24.5 ± 8.7 kg/m². Pearson's correlation revealed a very weak negative relationship between BMI and Ferriman–Gallwey score ($r = –0.013$, $p = .791$), indicating no meaningful linear association between overall adiposity (as measured by BMI) and clinical hirsutism severity in the study.

5.0 CONCLUSION

In this university-based sample, hirsutism was common, but BMI was not significantly associated with Ferriman-Gallwey scores. These findings suggest that BMI alone may be an insufficient predictor of clinically relevant hirsutism in young Nigerian women and underscore the need for comprehensive endocrine and metabolic assessment where indicated. Local validation of hirsutism thresholds and expanded phenotyping (biochemical and body-composition data) will be essential to determine whether hirsutism can reliably serve as a clino-anthropological marker for underlying medical conditions in this and similar populations.

Authors' Contribution

CDO developed the study concept and design, including preparation of the final manuscript and statistical analysis. CL developed the literature review and prepared the final manuscript. BM designed the full work and final manuscript. HA prepared the study design and methodology and also helped in securing the approval of the study. NPD prepared the final manuscript and aided in the method design. RFD participated in the acquisition of data, as well as data analysis and interpretation of data; 2. FCE handled the data acquisition as well and interpretation of data.

Conflict of Interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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